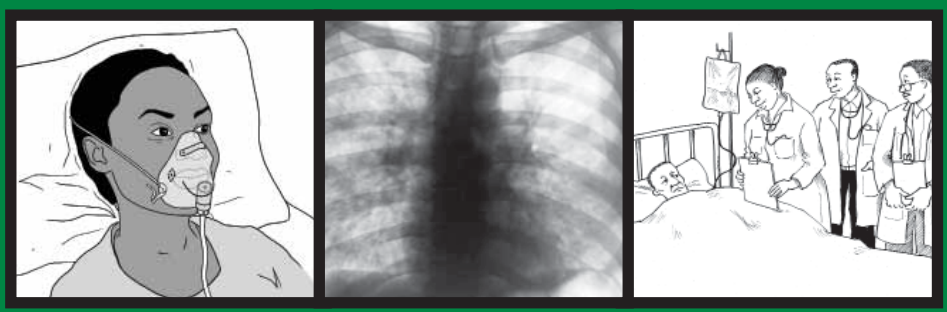
VOLUME 1

IMAI District Clinician Manual:

Hospital Care for Adolescents and Adults



GUIDELINES FOR THE MANAGEMENT OF COMMON ILLNESSES WITH LIMITED RESOURCES

Integrated Management of Adolescent and Adult Illness (IMAI)

World Health Organization

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Integrated Management of Adolescent and Adult Illness (IMAI)

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Foreword

IMAI District Clinician Manual: Hospital Care for Adolescents and Adults

The manual is written for clinicians working at the district hospital (first-level referral care) who diagnose and manage sick adolescents and adults in resource-constrained settings. It aims to support clinical reasoning, and to provide an effective clinical approach and protocols for the management of common and serious or potentially life-threatening conditions at district hospitals. The target audience thus includes doctors, clinical officers, health officers, and senior nurse practitioners. It has been designed to be applicable in both high and low HIV prevalence settings. The manual is divided into two volumes. The first covers emergency triage assessment and treatment, and acute care for a severely ill or acutely injured patient for approximately the first 24 hours of care. This volume also describes the clinical procedures commonly used in emergency and acute care, and gives a summary of the medicines used and the steps necessary for infection control. Volume 2 provides a symptom-based approach to clinical care for acute and subacute conditions (including mental health). It provides short summaries of the management of diseases that affect multiple systems of the body, focusing on communicable diseases. It also includes the chronic or long-term management of HIV, TB, alcohol, and substance use disorders. Future editions may incorporate the chronic management of non-communicable diseases.

The manual was developed to support clinicians in diagnosing and managing adolescent and adult patients at district hospitals with limited essential drugs, laboratory tests, and equipment. It is one component of a broader WHO second-level learning programme. It has been developed through a large collaboration of WHO Departments and their experts from many countries and regions across the world working in expert subgroups. Recommendations in the manual are predominately based on recent WHO evidence-based normative guidelines developed by several Departments and disease control programmes, including WHO HIV/AIDS, Stop TB, Global Malaria Programme, Neglected Tropical Diseases (NTD), Mental Health Gap (mhGAP), the Reproductive Health and Research (RHR) STI and cervical cancer and family planning guidelines, Integrated Management of Emergency and Essential Surgical Care (IMEESC) , Integrated Management of Pregnancy and Childbirth (IMPAC) , Global Influenza Programme (GIP), Global Alert Response (GAR) and others. To put these normative guidelines into operation within an integrated clinical manual supports the implementation of multiple disease-control strategies.

Good clinical care is a component of most effective public health approaches. Simplification and standardization of case detection and first-line treatments support decentralization and expand access to care. Within a district network, the district clinician receives patients in referral who have not responded to first-line treatment or who require hospitalization for severe illness. The ability to provide effective emergency care for severely ill patients, to establish a likely differential diagnosis, to provide appropriate management and then monitor the patient's response to treatment can contribute substantially to the health of the community.

Where current WHO guidelines do not exist, selected national guidelines and evidence-based medicine sources, existing systematic reviews of evidence, and randomised clinical trials were reviewed. These evidence checks and updated

sections of the manual can be accessed on the IMAI second-level EZcollab site. The relevant WHO normative guidelines are listed in footnotes in each Section, including an indication of when these will be revised (when available). The manual will be updated as other WHO guidelines are updated or new WHO guidelines are developed. Within three months of the revision and release of a relevant WHO normative guideline, an updated Section will be posted on the IMAI second-level EZcollab website. Each volume will be reprinted yearly. To request access to this website, or to provide comments or further queries, please send an email to imaimail@who.int. As updates to the manual sections are frequent, readers of the manual are advised to ensure that they are using a current version of the manual. This manual is for country adaptation, to match the national essential medicine list, availability of laboratory tests, and local disease epidemiology. An evolving country Adaptation Guide will be available from the same website.

We thank the large number of people who have given valuable input, comments and feedback on this manual to date.

Drs Sandy Gove, Kirsty McHarry and Eyerusalem Negussie for the IMAI team.

1. Introduction, assumptions, and principles of this manual

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1. Introduction, assumptions, and principles of this manual

1.1 Target audience and assumptions

Human resource assumptions

This manual is aimed at the district clinician who may be a medical officer, clinical officer, or senior nurse, and other senior health workers working at a district hospital in a resource-constrained setting. The manual assumes that many district hospitals in these settings have general multipurpose practitioners, such as a medical or clinical officer, but do not have specialist clinicians, such as an internist, paediatrician, or psychiatrist (although it may be possible to consult with one).

Other assumptions are that these settings have:

- **Limited essential drugs** (see the medicine Section 8 at the end of the manual; this is subject to adaptation based on the national essential drug list).
- **Limited equipment** – no mechanical ventilation except for during surgery (see *Adaptation Guide* for the use of simple ventilators if these are available).
- **Limited laboratory and other investigations** – this manual assumes that there are limited laboratory and other investigations available onsite[1], listed in the Table: Essential laboratory tests at the health centre and district hospital, with additional tests available as "send-out" tests to referral laboratory facilities.

The diagnostic process and treatment protocols in this manual assume that only the minimum essential laboratory tests are available in the district hospital in resource-limited settings. Additional guidance is provided on using results that may be obtained by sending out specimens or sending patients for additional tests elsewhere.

Additional tests that are not usually available at district hospital level are in italics in the text.

1 *Consultation on technical and operational recommendations for clinical laboratory testing harmonization and standardization: Helping to expand sustainable quality testing to improve the care and treatment of people infected with and affected by HIV/AIDS, TB, and malaria.* WHO, 2008. Available at http://www.who.int/diagnostics_laboratory/3by5/Maputo_Meeting_Report_7_7_08.pdf

1.2 Essential laboratory tests at the health centre and district hospital[2]

Table: Essential laboratory tests at the health centre and district hospital

At the health centre Essential laboratory tests	At the district hospital Additional laboratory tests
• Haemoglobin or haematocrit **HIV diagnostics** • Rapid HIV antibody tests (first and second tests) • Infant diagnosis; preparation of dried blood spot (DBS) then send out for virological testing • Blood collection and send-out for CD4 cell absolute count and percentage **TB diagnostics** • Sputum send-out for smear microscopy (or onsite acid fast bacilli (AFB) smear microscopy) • Sputum send-out for culture and drug susceptibility testing **Malaria tests (if in endemic area)** • Peripheral blood smear (PBS) preparation and smear microscopy or • Rapid test to detect and discriminate between *Plasmodium falciparum* and mixed *Plasmodium* species **Other tests** • Rapid syphilis test • Rapid pregnancy test • Urine dipstick for sugar and protein (if available, also for leukocytes and ketones)	• Full blood count with differential • Erythrocyte sedimentation rate (ESR) **HIV diagnostics** • Rapid HIV antibody tests (first, second and third tests) • CD4 absolute count and percentage **TB diagnostics** • Acid fast bacilli smear microscopy • Sputum send-out for culture and drug susceptibility testing • WHO-approved molecular testing such as Xpert MTB/RIF **Other tests** • Serum alanine aminotransferase (ALT) • Serum electrolytes • Amylase • Blood sugar (glucose) • Serum creatinine and blood urea nitrogen (BUN) • Gram stain • Syphilis – rapid plasma reagin (RPR) • Basic microscopy and chemistry for cerebrospinal fluid (CSF), urine, thoracentesis, and paracentesis • Saline and potassium hydroxide (KOH) wet mounts (for bacterial vaginosis (BV) or trichomonas) • Bilirubin determination for neonates • Blood and sputum cultures (may be sent out) • Cryptococcal antigen (CrAg- serum or CSF) or India ink stain of CSF • Lactic acid • Type and cross match for transfusion • Stool microscopy for ova and parasites • Hepatitis B enzyme immunoassay (EIA)

2 *Rapid implementation of Xpert MTB/RIF diagnostic test: Technical and operational «How-to» practical considerations.* WHO, 2011. Available at whqlibdoc.who.int/publications/2011/9789241501569_eng.pdf

Additional investigations that require special equipment

At the health centre	At the district hospital (in addition to health centre equipment)
• Mid upper arm circumference (MUAC) tape • Blood pressure (BP) measurement: BP machine • Auscultation and BP measurement: stethoscope • Respiratory rate: timer	• Oxygen saturation by pulse oximetry (SpO_2) • X-ray: chest, plain film abdomen, cervical spine, and bone films • Ultrasound • ECG • Otoscopy: otoscope • Ophthalmoscopy: ophthalmoscope • Body mass index (BMI) measurement: adult beam scale and height board • Peak flow meter • Snellen eye chart • Colposcopy: colposcope

Additional tests that may be available at regional or central laboratories (as send-out tests)

- *Serum aspartate aminotransferase (AST)*
- *Serum bilirubin*
- *Serum and CSF total protein*
- *CSF glucose*
- *Serum lipids*
- *Sputum AFB culture and drug susceptibility testing*
- *HIV viral load (VL)*
- *Fungal stains*
- *Urine culture*
- *Stool culture*
- *Toxoplasma serology*
- *Cytology (e.g. CSF, cervical)*
- *Silver stain or direct fluorescent antibody (DFA) for Pneumocystis jiroveci pneumonia (PCP) diagnosis*
- *General fungal cultures, including blood*
- *Histology (e.g. cervical, lymph node, skin biopsy)*

Other serological tests, polymerase chain reaction (PCR), other investigations or special cultures may be available at a central laboratory to diagnose brucellosis, dengue, fascioliasis, leishmaniasis, cysticercosis, strongyloidiasis, trypanosomiasis. See Section 11 and the *Adaptation Guide.*

1.3 Other companion WHO manuals

This manual assumes that companion WHO manuals are available. The Quick Check and Emergency Treatment sections are intended to support both emergency medical and surgical care, then to link with additional guidance on obstetrical and other surgical interventions found in these other resources:

Companion clinical manuals:

- IMPAC Managing complications in pregnancy and childbirth (MCPC) (WHO, UNFPA, UNICEF, World Bank 2003)[3]
- Pocket book of hospital care for children (WHO 2005) with new addendum[4]
- Manual on paediatric HIV care and treatment for district hospitals IMCI (WHO 2009)[5]
- Family planning: A global handbook for providers (USAID, John Hopkins, WHO 2011, revised)[6]
- Surgical care at the district hospital (WHO 2003)[7]
- Manual for male circumcision under local anaesthesia (WHO, Jhpiego, and UNAIDS 2008)[8]

Laboratory diagnosis aids: see Section 7 Procedures for list of bench aids.

3 http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9241545879/en/index.html

4 http://whqlibdoc.who.int/publications/2005/9241546700.pdf

5 http://whqlibdoc.who.int/publications/2011/9789241501026_eng.pdf

6 http://www.who.int/reproductivehealth/publications/family_planning/9780978856304/en/index.html

7 http://www.who.int/surgery/publications/en/SCDH.pdf

8 http://www.who.int/hiv/pub/malecircumcision/who_mc_local_anaesthesia.pdf

1.4 District network

Relationship to the first-level guideline modules

Nurses and clinical officers in the outpatient department and at health centre level will be using simpler primary health care guidelines, including:

- IMAI *Acute Care*[9]
- IMAI-IMCI *Chronic HIV Care with ARV Therapy and Prevention*[8]
- IMAI *General Principles of Good Chronic Care*[8]
- IMAI-IMCI *Palliative Care: Symptom Management and End-of-Life Care*[8]
- IMAI-STB *Tuberculosis Care with TB-HIV Co-management*[8]
- IMAI-STB-PIH *Management of MDR-TB: A field guide*[8]
- IMCI *Chart Booklet for High HIV Settings*[10]
- IMPAC *Pregnancy, Childbirth, Postpartum and Newborn Care*[11] (PCPNC)
- IMEESC toolkit (Integrated Management of Emergency and Essential Surgical Care)[12]

The district clinician's role: referral and back-referral

The district clinician should understand these simplified guidelines, and use them to provide primary care for uncomplicated patients on initial presentation, to understand which patients need to be referred for second-level care (based on complications, severe illness or treatment failure), and to supervise and mentor nurse-led clinical teams, both in the hospital outpatient clinic and in health centres.

This manual does not address the programme management responsibilities of the district management team (for HIV, TB, maternal and child health, and other programmes). This team provides supportive supervision and important assistance to the health centre, including supplies, laboratory support, hiring health workers, transport, and training. Also, this manual does not address the management and logistical requirements to manage a district hospital.

9 IMAI/IMCI heath centre/primary care guideline modules available at http://www.who.int/hiv/pub/imai/primary/en/index.html

10 http://www.who.int/child_adolescent_health/documents/9789241597388/en/

11 http://www.who.int/making_pregnancy_safer/documents/924159084x/en/

12 IMEESC toolkit that can be accessed at http://www.who.int/surgery/publications/imeesc/en/index.html

1.5 Scope of the manual

Age 10 and up

The manual addresses adolescents from 10 years of age and adults through old age and death. Children under 10 years are addressed in the *Pocket book of hospital care for children.*[13]

Addresses people living with HIV (PLHIV) and all acutely ill adolescents and adults

The manual was developed to improve acute and chronic care both for PLHIV and others. HIV-infected patients, both immunocompetent and immunocompromised, may have multiple diseases or pathogens involving several systems at once. PLHIV are also at increased risk of drug toxicities and interactions. Common diseases that occur in HIV-negative people are also common in PLHIV. HIV infection does not protect against these. Therefore, the full differential diagnosis for presenting symptoms needs to be considered, and is covered in this manual. As a result, the manual is applicable to all acutely ill adolescents and adults.

In addition, the diagnosis of HIV places a huge burden on the psychosocial and economic stability of the patient and the patient's family. The most sustainable and effective approach is, in partnership with the patient, to enrol PLHIV in chronic care. The strength of a district network can be measured by the quality of chronic care delivered in the district. The role of the district clinician includes supporting primary health care wherever chronic care is delivered, both at health centres and in the outpatient clinic of the district hospital. Long-term care of TB, chronic HIV care, and substance use are included in Volume 2 with plans to add the chronic care of other diseases in the future.

Several symbols appear throughout the manual

HIV-related conditions or special considerations in managing HIV-positive people. Some diseases marked with the red ribbon may also occur in HIV-negative people, but less commonly.

Special considerations in managing pregnant, postpartum, and breastfeeding women.

Notifiable diseases. These are communicable diseases that need to be reported to national authorities as their presence has a broader significance to the public. These are usually uncommon or even rare, but are included in the differential diagnosis tables because of the importance of early recognition and of the need to report dangerous pathogens and diseases targeted for elimination. See Section 21.

Surgery may be needed – call for help.

13 http://www.who.int/child_adolescent_health/documents/9241546700/en/

The manual has the following sections:

Volume 1

Section 1 Introduction, assumptions and principles of this manual
Section 2 Quick Check and emergency treatments
Section 3 Approach to severely ill patients (acutely ill patients with a life-threatening condition)
Section 4 Trauma: approach to acutely injured patients
Section 5 Response to laboratory investigations
Section 6 Infection prevention and control
Section 7 Procedures
Section 8 Medicines and therapies

Volume 2

Section 9 HIV diagnosis
Section 10 Acute (and subacute) care: organized by the main symptoms. Provides the differential diagnosis and specific (often empirical) treatment recommendations.
Section 11 Multisystem communicable diseases, renal problems, and HIV-related cancers (in alphabetical order)
Section 12 General principles of good chronic care
Section 13 Chronic HIV care with ART and prevention at second level
Section 14 PMTCT, HIV care and treatment during pregnancy, and family planning
Section 15 Long-term care of TB, including MDR-TB
Section 16 Management of alcohol use disorders
Section 17 Other substance use
Section 18 Geriatric care
Section 19 Prevention in adolescents and adults
Section 20 Palliative care
Section 21 Patient monitoring, recording, and reporting of notifiable diseases

Consult Section 8 for the formulation, dosage, adverse effects, contraindications, and cautions when administering or prescribing medicines.

How palliative care is integrated within the manual

It is important that the clinical team addresses both the specific treatment of the cause of an illness and also the symptoms during both acute and chronic care. In the section on acute care by main symptoms (Section 10), specific management is summarized and symptom management either summarized or cross-referenced to Section 20. Section 20 on palliative care addresses both the management of pain and other symptoms, as well as end-of-life care.

Health workers should be aware of a patient's quality of life concerns and respect their wishes regarding end-of-life care. Often such discussions are particularly difficult in an emergency setting. For patients with end-stage diseases, "advance directives" should be discussed with the patient and family when the patient's status is stable. For patients who have a diagnosis of a terminal illness, relief of symptoms should be the priority.

1.6 Clinical reasoning

This process involves the health worker being confident in their knowledge and skills, as well as knowing their limitations, and delivering the best care possible to the patient within the constraints of available diagnostic and therapeutic capacity and resources.

First, in every patient, triage for severe conditions and conditions that could potentially deteriorate quickly using the Quick Check (Section 2). Immediately provide emergency treatment and perform emergency laboratory investigations.

Thereafter, obtain more information about the presenting complaints and consider the signs and symptoms. Be sure to think again of serious or potentially life-threatening conditions associated with each symptom. Establish the possibility of such a condition, and keep it near the top of the list until safely excluded. Rapidly do relevant laboratory and other investigations for serious conditions. Initiate early investigations for serious conditions for which relevant tests are available at the health facility.

Next, ascertain the likely cause of each presenting symptom. Use the relevant differential diagnosis tables. This involves a process of weighing up the likelihood of one diagnosis over other possible diagnoses by gathering available evidence – history, physical examination, and further investigations. Consider:

- patient demographics – age, sex, pregnancy status
- risk factors – environmental factors and any others particular to the patient
- important negative findings – remember to actively look to exclude these
- combinations of signs and symptoms associated with a particular disease
- any history of prior intervention for the current condition.

Identify all diagnoses (more than one may be present). Plan treatment and consolidate a combined treatment plan, addressing the several problems an acutely ill patient may have. If there are many unexplained symptoms over time, consider the possibility of a mental health problem (see Section 10.11).

Clinical reasoning and medical uncertainty

Health workers in resource-limited settings frequently need to make clinical decisions with incomplete diagnostic support from radiology or the laboratory. The processes of clinical reasoning used, and the knowledge possessed to support decision-making, are critical determinants of the quality of clinical practice.

Clinical mentoring and supportive supervision are very important for good clinical decisions and for improving clinical practice over time. In areas with high levels of diagnostic and therapeutic capacity, poor decision-making wastes resources; a large proportion of interventions may be unnecessary while a large number of useful interventions may not be provided.

The **content** of clinical guidelines (such as lists of signs and symptoms, and treatment of common diseases) is very important. However, the **process** of clinical decision-making is somewhat distinct from these. Reaching an **evidence-based clinical decision** involves making a systematic health assessment of a patient based on history and physical examination, and linking this with information in the patient's medical records. Complete and accurate medical records on patients will enable the health worker to make better informed decisions.

Each diagnostic process begins with uncertainty but draws upon contextualized and case-specific knowledge, as well as increasingly on biomedical informatics and support tools. Clinicians transform the information or evidence available to them into a decision with consequent action, based on knowledge, the environmental, socioeconomic, and epidemiological context and the accumulated data on the specific case.

Clinical decision-making is centred on a **differential diagnosis** (abbreviated DDx throughout the manual). Initially, this should be broad, followed by progressive elimination of possibilities without sufficient evidence. This process of elimination includes both seeking evidence that supports a particular diagnosis and evidence to exclude a possibility. However, solely listing the conditions that could potentially account for the presenting symptoms in a patient is insufficient, especially in PLHIV. It is important to consider other serious diseases or co-morbidities that may be present. Consideration needs to be given to the possibility of disseminated disease affecting multiple organ systems, and diseases with diverse symptomatology (see Section 11). Appropriate context needs to be established by considering the patient's risk factors, as well as any unmet prevention needs.

The frequency and severity of a disease may influence how diseases within the differential diagnosis table are ranked, and the order in which they are investigated. Differential diagnosis (DDx) tables should be considered in the local context of diseases, both those that are endemic and epidemic in an area. Determining the immunological status of an HIV-infected patient may be useful for ranking the likelihood of a particular infectious agent. Additional or repeated physical examinations, laboratory tests, and other investigations, consultation with clinical mentors, and consideration of the local disease epidemiology, can assist in ruling in or out a diagnosis. It may be important to initiate early investigations for serious conditions for which relevant tests are available at the health facility (see Section 5.1).

If it is not possible to confirm a diagnosis at the facility, consider referral or the empirical treatment of common or life-threatening conditions, depending on local guidelines. As for all investigations and therapy, assessment of the risks is required, and of the benefit and cost of investigations versus empirical treatment. At regular intervals, it is necessary to revise an initial diagnosis and reassess clinical progress, particularly whether or not a patient is improving within the expected time frame.

Establishing clinical diagnosis using different differential diagnosis tables

1. Use the differential diagnosis tables to establish links between clinical features and possible underlying diagnoses.
2. Prioritize the list of possible diagnoses from the table based on the conditions most likely to exist in the setting or to be life threatening.
3. Request and perform specific diagnostic tests (such as lumbar puncture, skin scrapings, fine needle aspiration) in order to support or refute diagnoses from the initial differential list.
4. Identify patients who need hospitalization.
5. Determine whether clinical findings or diagnostic test results support a condition from the initial differential diagnosis list.
    a. If yes, treat accordingly.
        i. If treatment was successful, follow the patient as indicated.
        ii. If treatment was unsuccessful, re-evaluate the patient, modify the differential diagnosis, and return to step 1.
    b. If no, re-evaluate the patient, modify the differential diagnosis, and return to step 1.
6. If the diagnosis is uncertain:
    a. Consider initiating empirical therapy for serious or life-threatening conditions.
    b. Consider initiating empirical therapy for non-severe conditions when a diagnosis is likely and treatment is accessible and likely to be effective.

Improved clinical decision-making comes with experience and knowledge of local patterns of disease. For less experienced staff, supportive supervision and clinical mentoring are important in building confidence.

Avoiding errors in clinical reasoning

The following principles are often cited to guide the clinical reasoning process.

- Try to think of a single disease that accounts for most or all of the clinical findings ("Occam's razor"). This principle does not always apply in the elderly and in immunocompromised patients (e.g. patients with advanced HIV infection), where there may be more than one pathological process occurring at the same time, in the same or in different organs.
- Even if a clinical presentation looks similar to or is "representative of" a particular illness, this does not prove that the cause is due to that illness. Common diseases sometimes have uncommon presentations, and uncommon diseases can sometimes resemble those that are very common.
- An uncommon presentation of a common disease is generally more likely than a typical presentation of an uncommon disease. (Consider "Sutton's Law," named after a famous bank robber who explained that he robbed banks because "that's where the money is". This suggests that a clinician consider common causes in the local region for a patient's symptoms before considering uncommon causes.)
- Consider what could kill a patient quickly, even if the diagnosis may be uncommon (this counterbalances Sutton's Law).
- Plan the initial empirical or syndromic treatment so as to cover the most common causes and the most serious (life-threatening) possible causes.
- Avoid premature closure of the diagnostic process. Start with a broad differential diagnosis so as not to prematurely eliminate possibilities without sufficient evidence.
- Do not be overconfident. Seek reasons why decisions may be wrong and consider alternative hypotheses. Ask questions that would disprove, as well as prove the current hypothesis.
- Conditions recently seen can be over-diagnosed, especially those that were particularly dramatic, or in which a mistake was made that needs to be avoided in the future.
- Avoid "illusory correlation". This means that just because two findings occur together, it does not necessarily mean that one caused the other.
- Know what you do not know. If you have a knowledge gap, admit it and seek the missing information, e.g. from a book, from your colleagues and co-workers, a clinical mentor, from a warm-line (a phone consultation service that calls users back within a short period of time with relevant information and assistance), or from reputable internet sites.

2 Quick Check and emergency treatments

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2. Quick Check and emergency treatments for adolescents and adults

The assessment in the Quick Check should be performed for all patients on arrival at the facility. The **ABC** emergency signs (**A**irway, **B**reathing, **C**irculation, Consciousness, Convulsions) are a special set of emergency signs that are checked rapidly and frequently.

Triage is the process of rapidly screening patients soon after arrival in hospital to identify:

- patients with **emergency** signs, who require immediate emergency treatment;
- patients with **priority** signs, who should be given priority and placed at the front of the queue so that they can be assessed and treated without delay;
- **non-urgent** patients, who have neither emergency nor priority signs and can wait in the queue.

This section should guide the entire hospital team. The Quick Check should be used both for the **immediate, first assessment** on arrival in hospital and to **reassess** sick patients in hospital, or waiting in the emergency department.

The 4 columns of the Quick Check on pages 17–23 (and on the Quick Check wallchart) are used as follows:

1. The assessment of **emergency signs** (left column in the Quick Check) should be done by any hospital staff, even the gatekeeper. Emergency signs are circled in red on the Quick Check chart. If any emergency signs are present, call for help!
2. The **first line emergency treatments** (second column) should be given immediately by the nurse or other clinician receiving the patient.
3. If there has been **trauma**, they should also follow the guidelines in the third, trauma column.
4. The fourth, right-hand column summarizes **further urgent medical treatments**. This directs the district clinician to continue with other management of the severely ill patient (see Section 3). It also cross-references the *IMPAC MCPC*[1] (*Management of complications in pregnancy and childbirth*) and the IMEESC, which are trauma guidelines applicable to all ages.[2]

Use the IMCI ETAT for Children Less than 5 Years of Age (rather than these guidelines). The version for young children can be found in the *Pocket Book of Hospital Care for Children* http://www.who.int/child_adolescent_health/documents/9241546700/en/index.html

Several parts of this Section have been adapted from *Surgical Care at the District Hospital*.[1] For additional information on assessment and definitive surgical treatment and inpatient hospital care of the trauma patient, see this manual and the IMEESC toolkit which can be accessed at http://www.who.int/surgery/publications/imeesc/en/index.html

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1 *IMPAC Managing Complications in Pregnancy and Childbirth*. WHO, 2003. http://www.who.int/making_pregnancy_safer/documents/9241545879/en/index.html

2 *Surgical Care at the District Hospital*. WHO, 2003. http://www.who.int/surgery/publications/en/SCDH.pdf

In addition, use the treatment guidelines in the *IMPAC MCPC*[1] (*Managing Complications in Pregnancy and Childbirth*) and *PCPNC*[3] (*Pregnancy Childbirth Postnatal and Newborn Care*) when managing women of childbearing age who may be pregnant (referred to on pages 19–24, 50).

Use infection control precautions during triage, Quick Check and emergency treatments

- Standard precautions should be followed for all patients.
- Add droplet, contact, airborne and special precautions for aerosol-generating procedures as appropriate (see Section 6).

Abbreviations:

AVPU	Alert, Voice, Pain, Unresponsive l = litres
oxygen 5 litres	5 litres/minute
Hb	haemoglobin
LR	lactated ringers
NS	normal saline (0.9%) RR = respiratory rate
SBP 90	ystolic blood pressure 90 mm Hg
SpO_2 90	oxygen saturation 90%

3 *IMPAC Pregnancy, childbirth, postpartum and newborn care – A guide for essential practice*. WHO, 2006. http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/924159084X/en/

Quick Check for adolescents and adults

EMERGENCY SIGNS
All staff should be able to assess these signs. If any sign is present, patient is severely ill. Call for help. Clinical staff should immediately give emergency treatment(s).

FIRST LINE EMERGENCY TREATMENT
If any emergency sign is present, nurse and others on clinical team should give the treatments, call for help, and establish IV access. After the Quick Check, test blood for glucose, malaria RDT, haemoglobin. Make sure a full set of vital signs and pulse oximetry are obtained from all patients with emergency signs and these findings are acted on.

First assess: Airway and breathing

Do not move neck if cervical spine injury possible – immobilize spine (see p. 29).

- **Appears obstructed**
  or
- **Central cyanosis**
  or
- **Severe respiratory distress**

Check for obstruction (noisy breathing), wheezing, choking, not able to speak

If obstructed airway:

- **If foreign body aspiration, treat choking patient** (see p. 27).
- **If suspect anaphylaxis, give 1:1000 epinephrine (adrenaline) IM – 0.5 ml if 50 kg or above, 0.4 ml if 40 kg, 0.3 if 30 kg** (see p. 28).

For all patients:

- **Manage airway** (see p. 30).
- **Give oxygen 5 litres** (see p.34).
- **If inadequate breathing, assist ventilation with bag valve mask** (see p. 31).
- **Help patient assume position of comfort.**
- **If wheezing, give salbutamol** (see p. 37).

THEN ASSESS: CIRCULATION

Use this chart for rapid triage assessment, then emergency treatments. Assess pregnancy status of women of childbearing age to appropriately manage and refer.

If trauma also

CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS

If head or neck trauma, manage airway and immobilize spine (see p. 44–45).

Look for
- Respiratory distress
- Trachea deviated
- Decreased breath sounds
- Low SBP

Treat tension pneumothorax with emergency needle decompression (see p. 46).

- Give oxygen 5 litres (see p. 34–36).
- If wound to chest wall which sucks air in when patient breathes in —> treat sucking chest wound (see p. 46).
- Treat pain (Section 20).
- If chest trauma, call for help for possible surgical intervention.

Use **standard precautions** for all patients.
Use **droplet precautions** if acute respiratory infection of concern.
Add **aerosol precautions** if airway management or intubation.
See Section 6.

Finish remainder of Quick Check then:
- **Count pulse, RR; measure SBP, SpO_2**
- **Titrate oxygen to SpO_2 90**
- **Give antibiotics if fever and RR >30 (see Section 3.2)**
- **Give antiviral if suspect influenza**
- **Insert IV and start fluids at 1 ml/kg/hour**

If...	Then...
Severely ill patient with difficult breathing: Consider silent chest with bronchospasm	See Section 3.2.
If moderate – severe wheeze continues	Give salbutamol (another dose) and ipratropium (see p.37). See Section 3.2 for other causes wheezing.
Pinpoint pupils and suspect organophosphate intoxication	Give atropine. See Section 3.8.
Pinpoint pupils and suspect opioid intoxication and RR <10 or SpO_2 <90	Assist ventilation and give naloxone. See p. 22 and Section 3.6.
Suspect other poisoning or snakebite	See Sections 3.8 and 3.9.
Suspect inhalation burn	See Sections 3.2 and 3.10.

First assess: Circulation (shock or heavy bleeding)

Do not move neck if cervical spine injury possible – immobilize spine (see p. 44).

- **Weak or fast pulse**
  or
- **Capillary refill longer than three seconds**
  or
- **Heavy bleeding from any site**
  or
- **Severe trauma**

Check SBP, pulse

Is she pregnant?

If SBP <90 mmHg or pulse >110 per minute or heavy bleeding:

- **Give oxygen** 5 litres if respiratory distress or SpO_2 <90.
- **Insert IV, give 1 litre bolus** crystalloid (LR or NS) then reassess (see give fluids rapidly, see p. 39).
- **Keep warm** (cover).
- **If in second half pregnancy, place on her side (preferably on the left), not on back.**

- **If anaphylaxis, give 1:1000 epinephrine (adrenaline) IM –** 0.5 ml if 50 kg or above, 0.4 ml if 40 kg, 0.3 if 30 kg (see p. 28).

THEN ASSESS: CONSCIOUSNESS/CONVULSING

If trauma also

CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS

If trauma and patient in shock (SBP <90, pulse >110) or suspect significant internal or external bleeding.

- Give oxygen 5 litres if SpO_2 <90 or respiratory distress.
- Give rapid IV fluids (see p. 39).
- Keep warm.
- Urgently send blood for type and cross match.

If external bleeding:

- Apply pressure immediately to stop bleeding (see p. 47).

If suspect internal bleeding:

Uncontrolled, noncompressible haemorrhage (abdomen, chest, pelvis or around long bone fractures) requires emergency surgical intervention.

- If possible femur fracture – splint (see Section 4).
- If possible pelvic fracture – apply pelvic binder (see p. 47).
- Call for help and plan emergency surgical intervention (see Section 4).
- If patient remains in shock after 2 litres of IV fluids – transfuse (see Section 4).

Decide on type of shock and treat accordingly (see Section 3.1).

If...	Then...
Fever, consider septic shock and malaria	Give empirical antibiotics (see p. 42), antimalarial and glucose (if blood glucose is low or unknown). Send blood culture if feasible before starting antibiotics. See Section 3.1.
Suspect heart failure, cardiogenic shock or severe anaemia	Be cautious with giving fluids. See Section 3.2.
Diarrhoea	Classify dehydration. If severe, give rapid fluids for shock and follow Fluid Plan C. See Sections 3.1.2 and 10.7.
Vaginal bleeding	Assess pregnancy status and amount of bleeding and treat. See p. 50–52.
Large nosebleed	See p. 49.
Vomiting blood	See p. 48.

Alltered level consciousness/convulsing

Do not move neck if cervical spine injury.

- **Altered level consciousness**
  or
- **Convulsing**

Is she pregnant?

For all:

- Protect from fall or injury.
- Manage airway and assist into recovery position (see p.29).
- Give oxygen 5 litres.
- Call for help but do not leave patient alone.
- Give glucose (if blood glucose is low or unknown) (see p. 41).
- Check (then monitor and record) level of consciousness on AVPU scale.

If convulsing:

- Give diazepam IV or rectally (see p. 41).
- If convulsing in second half of pregnancy or post-partum up to one week, give magnesium sulfate rather than diazepam (see p. 57).[4]

Then check SBP, pulse, RR, temperature.

If convulsions continue after 10 minutes:

- Continue to monitor airway, breathing, circulation.
- Recheck glucose.
- Give second dose diazepam (unless pregnant/post-partum).
- Consult district clinician to start phenytoin (see Section 3.5).

4 *WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia*. WHO, 2011. Available at http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548335/en/index.html

If trauma also

CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS

Check for signs of serious head and spine trauma:

- **Immobilize spine** (see p. 44).
- **Give oxygen 5 litres.**
- **Log-roll patient when moving.**
- **Expose patient fully.**
- **Look/feel for deformity of skull.**
- **Look for:**
  - pupils not equal or not reactive to light
  - blood/fluid from ear or nose
  - associated traumatic injuries (spine, chest,pelvis) (see Section 4)
- **Call for help from district clinician/surgeon.**

If...	Then...
Altered consciousness	See Section 3.4.
Convulsions	See Section 3.5.
Fever	Give empirical antibiotics (see p. 42) Give antimalarials if in a malaria endemic area (see Section 11.25).
Pinpoint pupils and suspect organophosphate intoxication	Give atropine. See Section 3.8.
Pinpoint pupils and suspect opioid intoxication and RR <10 or SpO_2 <90	Assist ventilation and give naloxone. See p. 31 and Section 3.6.
Alcohol intoxication or withdrawal	See Section 3.7.
Poisoning	See Section 3.8.
Snakebite	See Section 3.9.

Pain from life-threatening cause

Often:
- Not able to walk
- Sweating
- Guarding against pain/abnormal position
- Very silent or moaning

If these present then checkSBP, pulse, RR, temperature and look for:

- **Severe abdominal pain**
  and
- **Abdomen hard on palpation**

Is she pregnant?

- Nothing by mouth (NPO)
- IV fluids
- Give oxygen if respiratory distress or SpO_2 <90
- Empirical antibiotics IV/IM (see p. 42)
- Treat pain
- Suspect surgical abdomen – call for help (see Section 4); send blood for type and cross match

If early pregnancy possible, consider ectopic and check rapid pregnancy test. If late pregnancy, consider abruption or ruptured uterus (see *IMPAC MCPC* guidelines[2]).

- **Severe headache**
  or
- **Stiff neck**
  or
- **Trauma to head/ neck**

Is she pregnant?

If current/recent pregnancy, elevated BP and headache, consider severe pre-eclampsia; dipstick urine for protein (see *IMPAC MCPC*[2]). Give magnesium sulfate if diastolic >110 mmHg with proteinuria (see p. 57).

If severe headache with stiff neck and fever, consider meningitis:
- Give IV antibiotics (call clinician to do LP first if can do within 15 minutes).
- Give IV or IM antimalarials if in malaria endemic area.

- **New onset chest pain**

If crushing, retrosternal pain (and cardiovascular risk factors)* and no history of trauma, suspect acute myocardial infarction:
- Give aspirin (300 mg, chewed).
- Give oxygen if SpO_2 <90 or respiratory distress.
- Insert IV – if no signs of shock, give fluids slowly at a keep-open rate.
- Give morphine for pain (see Section 20).
- Do ECG. Call district clinician for help.

- **Major burn**

- Manage airway.
- Consider inhalational burn.
- Give oxygen if SpO_2 <90 or respiratory distress.
- Insert IV; give fluids rapidly.
- Treat pain.
- Apply clean sterile bandages – see Section 3.10.

- **Snake-bite**

- Give oxygen if SpO_2 <90 or respiratory distress.
- Insert IV; give fluids rapidly (see p. 39).
- Treat pain (see Section 20).
- See Section 3.9 for antivenom guidelines.

* For country adaptation.

After the Quick Check, test blood for glucose and haemoglobin, do malaria microscopy (if not immediately available, a malaria RDT can be performed while waiting for the result of the blood slide). Make sure all patients with positive emergency signs have full set of vital signs and pulse oximetry and that these are acted on.

If trauma also

Do not move neck if cervical spine injury.

If trauma with abdominal pain:

- Consider possible spleen or liver injury.
- If penetrating injuries to abdomen or distended or painful abdomen:
  - Check Hb.
  - Send type and cross match.
  - Consider diagnostic peritoneal lavage or ultrasound to check for internal bleeding.

If trauma with neck pain or possible cervical spine injury:

DO NOT MOVE NECK —> immobilize the neck (see p. 44).

- If severe headache, manage as possible head injury (see p. 44).

If trauma with chest pain:

- Palpate chest for rib fractures.
  - If present, consider pneumothorax (see p. 46).

CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS

If...	Then...
Trauma	See Section 4.
Pregnant with abdominal pain or severe headache with elevated BP	Decide if severe pre-eclampsia. See *IMPAC MCPC* guidelines.
Severe headache	See Section 10.10b.
Suspect acute myocardial infarction	Follow national guidelines. See Section 3.3 for DDx.
Major burn	See Section 3.10.
Snakebite	See Section 3.9.

Priority signs and symptoms

After screening for emergency signs, screen all patients for priority signs.

Priority signs for infection control: if cough or other signs of respiratory illness, apply source control (use of tissues, handkerchiefs or medical masks) on the patient in the waiting room when coughing or sneezing, and perform hand hygiene. If possible, accommodate patient at least 1 meter away from other patients or in a room, and evaluate as soon as possible – see Section 6.

Priority signs for urgent care – these patients should not wait in queue:

- Any respiratory distress/complaint of difficulty breathing
- Violent behaviour toward self or others or very agitated
- Very pale
- Very weak/ill
- Recent fainting
- Bleeding:
  - Large haemoptysis
  - GI bleeding (vomiting or in stools)
  - External bleeding
- Fractures or dislocations
- Burns
- Bites from rabid animal
- Frequent diarrhoea >5 times per day
- Visual changes
- New loss of function (possible stroke)
- Rape/abuse (maintain a high index of suspicion)
- New extensive rash with peeling and mucous membrane involvement (Stevens-Johnson)
- Acute pain, cough or dyspnea, priapism, or fever in patient with sickle-cell disease

Check SBP, pulse and temperature

- If any respiratory distress/complaint of difficulty breathing – measure SpO_2; give oxygen 5 litres if SpO_2 <90 (see Sections 3.2 and 10.6).
- If wheezing, give salbutamol (see p.38 and Section 3.2.4).
- If violent behaviour or very agitated, protect, calm, and sedate the patient as appropriate (see p. 59). Check glucose and SpO_2 and consider causes (see Section 3.4).

Initiate interim management if clinician is not available:

- Measure haemoglobin if any bleeding, pale, weak, fainting, abdominal pain.
- If melena or vomiting blood, manage as on p. 48 and admit.
- If large haemoptysis (see p. 48).
- If visible deformity, assess and treat possible fractures/dislocations (see Section 4).
- Manage burns (see Section 3.10).
- If suspect rape or abuse (see Section 4).
- If painful vasoocclusive crisis from sickle-cell disease – control pain, hydrate and give oxygen if SpO_2 <90 (see Section 10.18).

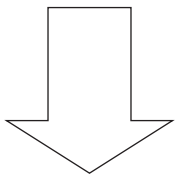
The patient needs clinical evaluation and should not wait in queue. **Repeat Quick Check if in line more than 20 minutes.**

In all cases of trauma, consider:

- Was **alcohol** a contributor? If yes, counsel on harmful alcohol use.
- Was **drug use** a contributor? If yes, counsel and arrange for treatment.
- Was this a **suicide attempt?** If possible, ask the patient, were you trying to harm yourself? (See p. 61 and Section 10.11.)
- Was **abuse** or **sexual violence** involved? (See Section 4.4.)
- Was **interpersonal violence** a contributor? Is there a risk of further violence in retaliation? If yes, get help to interrupt this and prevent further violence.

If no emergency signs and
no priority signs,

NON-URGENT



- **Patient can wait in queue**
- **Provide routine care and use the appropriate sections**
- **Repeat Quick Check if condition changes**

How to help the choking patient

Suspect foreign body obstruction if respiratory distress occurs suddenly while eating, patient is clutching their throat, or when there is silent coughing, cyanosis, stridor or noisy breathing.

IN THE CONSCIOUS PATIENT

If patient is able to speak or cough

- Encourage patient to cough, and observe carefully until obstruction is removed.

If the patient is not able to speak or cough

- Tell patient that you are going to help him or her.
- Deliver five abdominal thrusts (if patient is pregnant give chest thrusts):
  - Go behind patient.
  - Have patient standing if possible.
  - Form a fist with one hand and place hand just below the breastbone.
  - Place the other hand over the fist.
  - Pull in and up quickly, using hard thrusts, this will force air into the patient's lungs and help to remove the obstruction.
- If still obstruction, give five back blows.
- Repeat abdominal thrusts then back blows until patient speaks or coughs or patient becomes unconscious.

Abominal thrusts

If patient is pregnant, give chest thrusts

IN THE UNCONSCIOUS PATIENT

- Lie patient on hard surface, open airway, and give two breaths via bag valve mask (BVM), if available.
- If you can see foreign body in mouth, manually remove it (if laryngoscope available may use to look for foreign body).
- Deliver five abdominal thrusts.

How to give epinephrine

- **For anaphylaxis: give 1:1000 epinephrine (adrenaline) IM.** 0.5 ml if 50 kg or above, 0.4 ml if 40 kg, 0.3 ml if 30 kg.
- Give IM in anterior lateral thigh.
- Repeat in **five minutes if no response.**
- See Section 3.1.3 for further management.

Emergency treatments

How to manage the airway

After only a few minutes, a patient without oxygen can sustain brain damage and die. Most patients can be managed with oxygen and simple manoeuvres, and it is rare for a patient to require advanced airway management and intubation.

STEP 1

ASSESS AIRWAY

- Talk to the patient. If the patient is speaking clearly the airway is open.
- Look/listen for signs of airway obstruction.
  - snoring or gurgling.
  - stridor or noisy breathing.
- Foreign body or vomit in mouth.

STEP 2

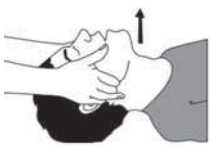
IF AIRWAY OBSTRUCTED, OPEN AIRWAY AND CLEAR OBSTRUCTION AS FOLLOWS:
IF NO OBSTRUCTION, GO TO STEP 4

No trauma

- Position patient on firm surface.
- Tilt the head.
- Lift the chin.
- Remove foreign body if visible.
- Clear secretions.
- If unconscious, place in recovery position (see p.42).

Trauma

- Stabilize cervical spine – do not lift head.
- Place fingers behind both sides of mandible and lift up (jaw thrust).
- Remove foreign body if visible.
- Clear secretions with suction.



If SEVERE head or neck trauma
Patients with severe head or neck trauma often have significant associated injuries to airway and cervical spine. When caring for these patients, also:

- give oxygen 5 litres.
- place oral airway.

A definitive airway including intubation or surgical cricothyroidotomy may be required.

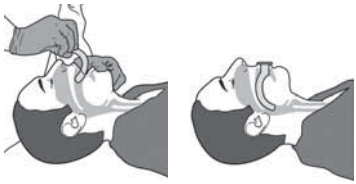
STEP 3

IF AIRWAY OBSTRUCTED BY TONGUE, INSERT AIRWAY DEVICE TO KEEP AIRWAY OPEN, AND THEN GO TO STEP 4.
IF AIRWAY IS NO LONGER OBSTRUCTED, GO TO STEP 4.

INSERT AIRWAY

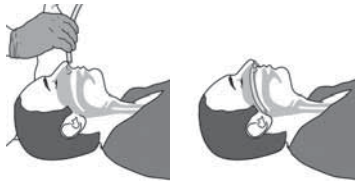
Oropharyngeal airway

- Use if patient is unconscious.
- Use appropriate size (measure from front of ear to corner of mouth).
- Slide airway over tongue.
- Give oxygen after placing airway device.
- If patient resists, gags, or vomits remove immediately.



Nasopharyngeal airway

- Better tolerated if patient is semi-conscious.
- Pass well-lubricated airway into one nostril directed posterior towards the throat.
- Give oxygen after placing airway device.



STEP 4

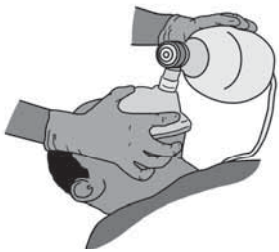
ASSESS VENTILATION

- If ventilation is inadequate, or patient is cyanotic or unconscious with respiratory distress, then assist breathing via bag valve mask ventilation (go to STEP 5).
- If ventilation is adequate, give oxygen and titrate flow (see p. 33–34).

STEP 5 **ASSIST VENTILATION WITH BAG VALVE MASK**

- Attach the bag valve mask (BVM) to highest available flow oxygen.
- Place mask over patient's mouth and nose (if two people: one person squeezes bag and other holds mask on patient's face).
- Create a seal so that air does not leak out.
- If the patient is breathing on their own, deliver breaths during inspiration. Do not attempt to deliver a breath as the patient exhales.
- Squeeze bag to give one breath every 6 seconds.
- If unable to effectively ventilate, reconsider possibility of foreign body obstruction or air leak. Insert oral or nasal airway device if not already in place (see STEP 3).

One person



Two people

How to bag patient

- Hold the bag in one hand and depress a two-litre bag to about 1/3 of its volume.
- After each breath allow the patient to completely exhale before giving another breath.
- Watch the chest rising and falling evenly with each breath.
- Avoid over-aggressive bagging, as it will result in damage to lungs.

STEP 6 | **ASSESS NEED FOR ADVANCED AIRWAY MANAGEMENT**

Some patients with easily reversible conditions may quickly improve and be able to ventilate on their own after emergency treatments are given.

Others may need continued assistance with ventilation or intubation to protect airway. Look for signs:

- Is SpO_2 < 90, cyanosis or severe respiratory distress on high flow oxygen therapy?
- Is there impending airway failure (e.g. inhalation injury, angioedema)?
- Are these basic airway manoeuvres (Steps 1 to 5) failing to maintain or protect airway?
- Is prolonged ventilation likely needed (e.g. suspect continued failure from drug overdose, snakebite)?

If yes, call for help from district clinician and see advanced airway management (see p. 62).

How to give oxygen

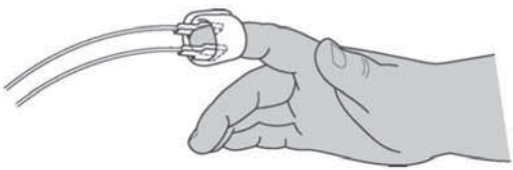
SET UP OXYGEN EQUIPMENT

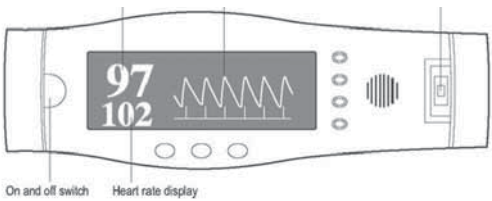
Either a concentrator with cylinder back-up or a cylinder may be used.

- If concentrator, make sure to plug into power source.
- Firmly connect the non-crush oxygen delivery tube to the tubing adaptor at the oxygen outlet of the concentrator or cylinder.
- Fully open the cylinder by turning the key wheel anti-clockwise.
- Turn the knob on the flow controller to adjust the flow based on the flowmeter reading (check manufacture directions for reading).
- Check that oxygen is coming out either by holding the end close to your hand and feeling the air flow or holding prongs under water.

USING A PULSE OXIMETER TO MONITOR SpO_2

- Turn on the pulse oximeter.
- Attach the oximeter probe to the finger or toe.
- Wait until there is a consistent pulse signal (this may take 20–30 seconds).
- Record the SpO_2 on a monitoring chart.
- If titrating oxygen down, recheck SpO_2 within 15 minutes and record on the monitoring chart.
- If problems with the reading or inconsistent with clinical state, remove nail polish.





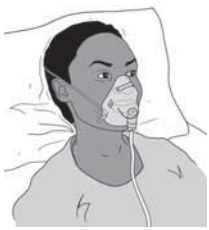
HOW TO DELIVER INCREASING OXYGEN

Place prongs inside the nostril.
Hook tubing behind ears.
Flow rates higher than 5 litres will dry mucous membranes.

- Start **oxygen at 5 litres/minute**
- Use nasal prongs
- Assess response

▼

- **If increasing respiratory distress or SpO_2 <90**

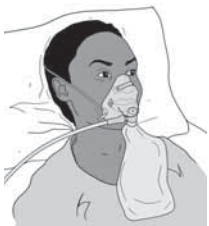


Secure mask firmly on face over nose and mouth.
Pull strap over head.

- Use face mask
- **Increase oxygen to 6–10 litres/minute**
- Assess response

▼

- **If increasing respiratory distress or SpO_2 <90**



Make sure bag is full to deliver highest oxygen concentration.
An empty bag is dangerous.

- Use face mask with reservoir
- Increase oxygen to 10–15 litres/minute
- Make sure bag inflates
- Call for help from district clinician
- Assess response

▼

- **If increasing respiratory distress or SpO_2 <90**
  or
- **If not improving with BVM on high flow oxygen**
  AND
- **Patient has an easily reversible condition (e.g. drug overdose, snakebite) and manual ventilation (bagging –** p. 31**) possible**
  or
- **Transfer to a hospital with available invasive mechanical ventilator possible. See Referral and transfer of severely ill patients,** p. 70.

- Call for help from district clinician for possible tracheal intubation – see advanced airway management, p. 32.
- **Start manual ventilation (bagging) with high flow oxygen –** see p. 31.

RESPOND TO DROP IN SPO_2 OR INCREASING RESPIRATORY RATE ON OXYGEN

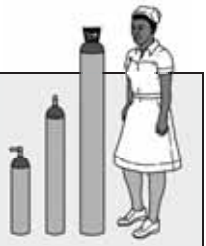
- Deliver increasing oxygen. See previous page.
- Check to make sure oxygen supply and all equipment is working properly:
  - check that the cylinder still has sufficient oxygen.
  - check that oxygen is flowing out of the prongs or face mask – hold the end close to your hand and you will feel the airflow.
  - check that there are no leaks in the connections or oxygen tubing.
- Exclude pneumothorax, pleural effusion, heart failure, poisoning.
- If wheezing, give salbutamol.
- Check that antibiotics and antimalarials have been given.
- If PLHIV consider PCP – give cotrimoxazole and steroids (see Section 10.6).
- Consider TB; check AFB smear.

DECREASE OXYGEN IF PATIENT IS STABILIZING OR IMPROVING

Decrease oxygen flow by 1–2 litres/min.

- Observe the patient for at least 2–3 minutes.
- If patient does not tolerate less oxygen, then do not titrate oxygen flow until the patient is more stable.
- If patient does tolerate less oxygen, then recheck the patient in 15 minutes and measure SpO_2.
- If patient is in increased respiratory distress or SpO_2 <90, then increase oxygen flow to previous flow rate.
- If patient remains stable and SpO_2 >90, continue to titrate oxygen down as tolerated.

Recheck clinical status and SpO_2 on patients after 1 hour for delayed hypoxia or respiratory distress.



LITRES IN FULL O_2 TANK

BY HEIGHT OF TANK/CYLINDER LETTER

Rate of oxygen administration:
Top row: How long will a tank of this size last.
Bottom row: How many tanks required for 24 hours of oxygen administration.

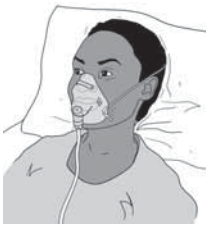
Rate of oxygen administration for one patient	O_2 tank C 170 litres 14 inches	O_2 tank D 340 litres 18 inches	O_2 tank E 680 litres 31 inches	O_2 tank F 1360 litres 34 inches	O_2 tank G 3400 litres 49 inches	O_2 tank J 6800 litres 57 inches
2 litres/min	1 hr 25 min	2 hr 50 min	5 hr 40 min	11 hr 20 min	28 hr 20 min	56 hr
	16 tanks	8 ½ tanks	4 tanks	2 ½ tanks	1 tank	½ tank
5 litres/min	34 min	1 hr 8 min	2 hr 16 min	4 hr 30 min	11 hr 20 min	23 hr
	48 tanks	21 tanks	10 tanks	5 tanks	2 tanks	1 tank
8 litres/min	21 min	42 min	1 hr 24 min	2 hr 50 min	7 hr	14 hr
	72 tanks	34 tanks	17 tanks	8 tanks	4 tanks	2 tanks
10 litres/min	17 min	34 min	1 hr 8 min	2 hr 16 min	5 hr 40 min	11 hr
	96 tanks	42 tanks	21 tanks	10 tanks	4 tanks	2.2 tanks

If wheezing – how to give sequential bronchodilators

Also see Section 3.2.4

GIVE SALBUTAMOL FOR MODERATE–SEVERE WHEEZING

Signs of severity: breathless at rest or with talking; speaking in incomplete phrases, single words or not at all; confused, sleepy or agitated; or SpO_2 <90 on room air. See Section 3.2.4 to consider other causes of wheezing.



- **Call for help** from district clinician.
- **By nebulizer:** for patient more than 20 kg: place 5 mg salbutamol in 5 ml sterile saline in nebulizer driven by oxygen. Treat until liquid almost all used up.
- **By metered dose inhaler:** prime space with 5 puffs, then give 2 puffs via spacer every 2 minutes.

Assess response → **If incomplete or poor response – signs of severity continue**

Give salbutamol by nebulizer, every 10–20 minutes, or if poor response, continuously.

- Add **ipratropium** by metered dose inhaler (**2 puffs**) in spacer or by nebulizer.
- Then continue salbutamol.

Assess response → **If incomplete or poor response – signs of severity continue**

Give salbutamol continuously by nebulizer.

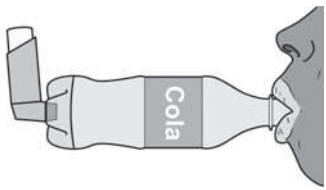
- For **life-threatening** wheezing give **2 g of magnesium sulfate** IV over 20 minutes or IM. See Section 3.2.4.

GIVE SALBUTAMOL FOR MILD WHEEZING

By metered dose inhaler: 100 mcg/puff; 200 puffs/inhaler

- Use spacer with inhaler if patient is able to coordinate breathing, if not use mask.
- 2 puffs every 20 minutes x 3 times then 2 puffs every 3 to 6 hours.
- See Section 10.6.

HOW TO MAKE SPACER FROM PLASTIC BOTTLE



- Use a clean plastic 300–500 ml bottle (wash with detergent and rinse well).
- Clean monthly and prime with 5 puffs after each cleaning, before using for treatment.
- Remove the inhaler cap and trace the shape of the opening of the inhaler on the base of the bottle, directly opposite the mouth of the bottle.
- Cut an opening into the base of the bottle exactly (or slightly smaller) than the size traced with a heated paperclip. An alternative is to make a slit in the side of the bottle and place the puffer through the hole.
- Insert the inhaler into the spacer to check the size.
- For severe attacks or if the patient cannot cooperate, cut off at the neck and use as a mask.

How to insert IV and give fluids rapidly

- If heavy bleeding or shock, insert two large bore cannulae – at least 16 or 18 gauge.
- Attach LR or NS. Give one litre as rapidly with infusion wide open.
- Assess response of pulse, SBP and signs of perfusion (urine output, mental status).
- If still in shock and no evidence of fluid overload, give another bolus.
- If still in shock after 2 litres and suspect ongoing blood loss, start blood transfusion and search again for source of bleeding.
- If still in shock after 2 litres, call for help from district clinician and see Section 3.1.
- Insert urinary catheter (see Sections 7.3.2 and 7.3.6), and monitor hourly urine output. A urine output of at least 30 ml/hour suggests adequate hydration.

See Sections 3.1 (Shock) and 4 (Trauma) for further information on fluid management.

If not able to insert peripheral IV, use alternative:

- Call for more experienced help, consider:
  - External jugular vein cannulation.
  - Femoral vein cannulation (or internal jugular or subclavian vein cannulation, if trained).
  - Venous cut-down – see 7.3.10.

How to give naloxone

Important: naloxone effect lasts only 40 minutes.

Is IV inserted?

If IV

- Give naloxone 100 mcg IV – repeat dose until patient RR >10/minute.
- Response is usually within 30 seconds.

May be repeated.

If no IV

- Give naloxone 400 mcg IM or subcutaneous 800 mcg – repeat 2 minutes later, if necessary.

Second, decide whether opioid was short-acting (heroin) or long-acting (methadone).

If short-acting

- Advise to wait two hours. If they go, do not stop them.

If long-acting

- If inadequate ventilation assist with BVM using high- flow oxygen.
- Call for help from district clinician – see advanced airway management p. 62.
- If patient responded to naloxone:
  - Give naloxone IV infusion – 0.4 mg/hour (for approximately 12 hours).
  - Try to keep patient until 12 hours after last dose.
  - Monitor closely: SBP, RR, SpO_2 with alarm (if possible).

Note: death can occur if the infusion is interrupted or the patient discharges themselves.

- Explain to family or companion beforehand why giving naloxone is necessary. Counsel accompanying person that naloxone wears off quickly and patient could become unconscious again.
- Realize that on awakening, the patient may be angry and combative and could injure self or others.
- If patient fails to wake up after several doses, rule out other causes of unconsciousness (see Section 3.4 or severe respiratory depression (see Section 3.2).
- Explain to patient not to inject again for 12 hours, or overdose might be fatal.

How to give glucose

If symptoms of hypoglycaemia or if glucose low (<3 mmol/l (54 mg/dl)):

- Give IV glucose:
  - make sure IV is running well.
  - for adolescent or adult, give D50 25 to 50 ml or, if D10 available, give 125 to 250 ml rapidly (D50 is the same as dextrose 50% and glucose 50%).
- If no IV glucose is available, give sugar water by mouth (if conscious) or nasogastric tube.
  - dissolve four level teaspoons of sugar (20 grams) in a 200 ml cup of clean water.
- Repeat if necessary.

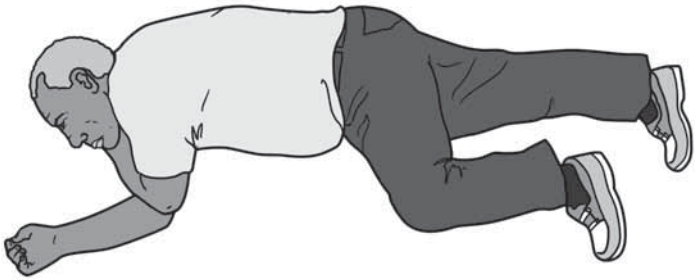
How to give diazepam IV or rectally

- **Maximum total IV** diazepam **dose: 30 mg**
- Do not give further diazepam if breathing less than 16 breaths per minute. If respiratory arrest develops, ventilate with bag valve mask (see p. 31).
- **Consider all causes if convulsions continue – see Section 3.5.**

Typical dose for 50 kg adult	**IV** (10 mg/2 ml solution)	**RECTALLY** (10mg/2 ml solution)
Initial dose	2 ml (10 mg)	4 ml (20 mg)
Second dose after 10 minutes	1 ml (5 mg)	2 ml (10 mg)

- If convulsions continue, administer IV antiepileptic drug such as phenytoin (see Section 3.5).
- Give phenytoin 15–18 mg/kg IV in normal saline over 1 hour.
- Monitor pulse and respiratory rate.

How to put patient in recovery position



How to give empirical IV/IM antibiotics for emergency management

- **Give ceftriaxone 1 gm IV or IM (2 gm if suspect meningitis).**
- **If ceftriaxone not available, give:**
  - ampicillin*† 2 gm IV or IM, **and**
  - gentamicin 240 mg IV or IM
- For open fractures or wounds, an alternative is a first generation cephalosporin or cloxacillin.

* If ampicillin is not available, give benzylpenicillin 3 million units.
† If patient has penicillin allergy, see Section 8.4 for alternatives.

How to give emergency antimalarial treatment if *falciparum* malaria is possible[5]

Preferred treatment is artesunate IV. Use artesunate or artemether rather than quinine, if available. Give artesunate IV in patients in shock, if possible (except for pregnant women in first trimester – give quinine).

ALWAYS GIVE GLUCOSE WITH QUININE

	ARTESUNATE IV or IM		ARTEMETHER IM		QUININE IM or IV			
	IV or IM 2.4 mg/kg on admission then at 12 hr and 24 hr then once daily. For each dose, freshly mix 60 mg anhydrous aretesunic acid ampoule with 1 ml of 5% sodium bicarbonate solution		Initial loading dose: 3.2 mg/kg	Subsequent doses 1.6 mg/kg each day until able to take oral medication	Initial dose: 20 mg/kg IM (divide dose equally in 2 and give 1 in each anterior thigh) or IV by rate-controlled infusion not exceeding 5 mg salt/ kg body weight/hour		Subsequent doses 10 mg/ kg every 8 hours	
Weight	**For IV,** further dilute with 5 ml of 5% dextrose (for 10 mg/ml)	**For IM,** further dilute with 2 ml of 5% dextrose (for 20 mg/ml)	80 mg/ml (in 1 ml ampoules)	80 mg/ml (in 1 ml ampoules)	150 mg/ml (in 2 ml ampoules)	300 mg/ml (in 2 ml ampoules)	150 mg/ml (in 2 ml ampoules)	300 mg/ml (in 2 ml ampoules)
30 kg	7.2 ml	3.6 ml	1.2 ml	0.6 ml	4.0 ml	2.0 ml	2.0 ml	0.5 ml
40 kg	9.6 ml	4.8 ml	1.6 ml	0.8 ml	5.4 ml	2.6 ml	2.6 ml	0.7 ml
50 kg	12.0 ml	6.0 ml	2.0 ml	1.0 ml	6.6 ml	3.3 ml	3.3 ml	0.8 ml
60 kg	14.4 ml	7.2 ml	2.4 ml	1.2 ml	8.0 ml	4.0 ml	4.0 ml	1.0 ml
70 kg	16.8 ml	8.4 ml	2.8 ml	1.4 ml	9.3 ml	4.7 ml	4.7 ml	1.2 ml
80 kg	19.2 ml	9.6 ml	3.2 ml	1.6 ml	10.6 ml	5.3 ml	5.3 ml	1.3 ml
90 kg	21.6 ml	10.8 ml	3.6 ml	1.8 ml	12.0 ml	6.0 ml	6.0 ml	1.5 ml

- If giving quinine by IV, infuse slowly over 4 hours.
- If giving large IM dose, divide between 2 thighs.
- Give at least 24 hours of parenteral artesunate, artemether or quinine. Start oral as soon as tolerated and complete full course (see Section 11.25).

How to give emergency antiviral treatment[6]

	Oseltamivir	
Weight	Usual dose	Severe disease or severely immunosuppressed
24–40 kg	60 mg twice daily	60 mg twice daily for 10 days
>40 kg	75 mg twice daily	150 mg twice daily for 10 days

5 *Guidelines for the treatment of malaria – 2nd edition. WHO, 2010.* Chapter: 8. Treatment of severe *P. falciparum* malaria. http://www.who.int/malaria/publications/atoz/9789241547925/en/index.html

6 The oseltamivir recommendations are based on the published *WHO Guidelines for Pharmacological Management of Pandemic Influenza A(H1N1) 2009 and other Influenza Viruses* Revised February 2010. http://www.who.int/csr/resources/publications/swineflu/h1n1_guidelines_pharmaceutical_mngt.pdf

How to immobilize spine UNTIL CLEARANCE: NO SPINE INJURY

Every patient with a suspected spinal injury should be immobilized until spine can be cleared clinically or with X-ray. It is important to document all examination findings.

Who to immobilize:

- every unconscious trauma patient.
- every conscious trauma patient with head, face, neck injury.
- every trauma patient with posterior neck pain or cervical spine tenderness, and/or neurological signs.

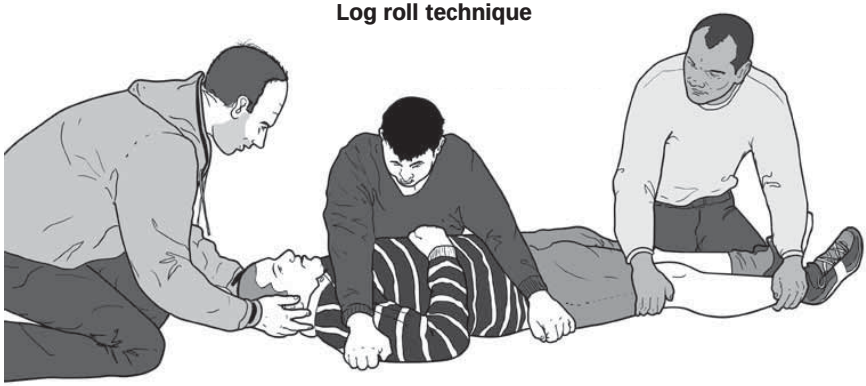
How to immobilize cervical spine:

- apply cervical collar or stabilize the neck with locally available material.
- keep the patient lying on a flat surface.
- prevent the neck from moving with locally available materials (towel rolls, newspaper, sandbags, or bags of IV fluids) or cervical collar if available.
- if patient vomits, turn whole patient on their side, keeping head in line with the body.
- keep someone with patient at all times to watch the airway.

How to immobilize thoracic and lumbar spine:

- keep patient on a flat surface.
- if need to move patient use log roll technique.

Log roll technique



How to determine whether cervical spine is clear and collar can be removed:

To clear clinically, patient must be conscious, cooperative, not intoxicated and able to concentrate on exam (no other major injuries). If patient is conscious, check for:

- posterior neck pain at rest.
- tenderness with palpation of posterior cervical spine.
- sensory or motor deficit.

If patient has none of these symptoms ask them to move neck.

If no pain or neurological signs on active range of motion, spine is clear.

If patient cannot be cleared clinically, patient should remain immobilized until their cervical spine is cleared by X-ray. Three X-ray views are needed to clear the cervical spine (lateral, AP, open mouth odontoid). The most important view is the lateral X-ray. An adequate lateral X-ray must view to C7/T1.

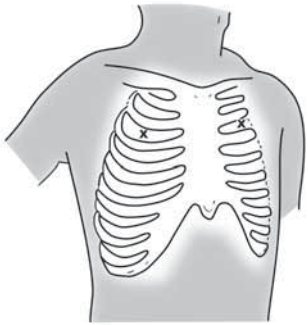
If patient is unconscious, then they must have their cervical spine immobilized until it is cleared by X-ray.

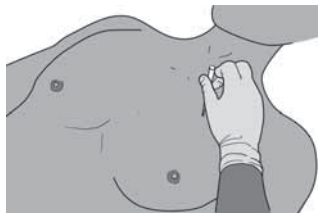
How to manage serious head injury

- Monitor airway. Watch for vomiting and aspiration.
- Keep head of bed elevated 30° while maintaining spinal precautions.
- Log roll patient when moving.
- If concern for open skull fracture, give IV antibiotics (e.g. ceftriaxone).
- No food or drink by mouth.
- Give maintenance intravenous fluids.
- Monitor and record:
  - AVPU scale
  - fluid input and output
  - thorough neurologic exam
- If possible, **urgent referral** to a higher level of care (see p. 71). If not possible, continue supportive care.

How to manage tension pneumothorax or massive haemothorax

- Treat tension pneumothorax with emergency needle decompression:
  - insert large bore (#14) cannula along the upper edge of third rib through second intercostal space in mid-clavicular line
  - if tension pneumothorax, there will be a rush of expelled air.





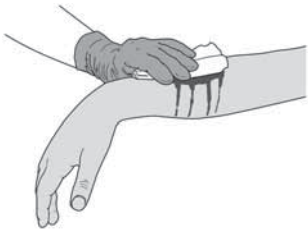
- Give high flow oxygen.
- Call for help from district clinician and see Section 7.3.1.
- Chest tube should be placed as soon as possible following needle decompression (even if no rush of air) or for suspected haemothorax
- Give IV antibiotics

How to treat sucking chest wound

Chest wall wound which sucks air in when patient breaths in (vacuum effect):

- Give high flow oxygen.
- Cover with petroleum gauze.
- Tape three sides of the dressing, leaving one side untaped to act as flap valve.
- Definitive treatment is to insert chest tube (never insert chest tube through wound).
- Debride wound and consider closure.
- Give IV antibiotics.

How to apply pressure to stop bleeding



- Apply firm, direct compression.
- Reinforce dressings to apply more pressure.

ONLY IF all other bleeding control measures have failed AND haemorrhage is life-threatening, consider using tourniquet technique until control by surgery or for transport only.

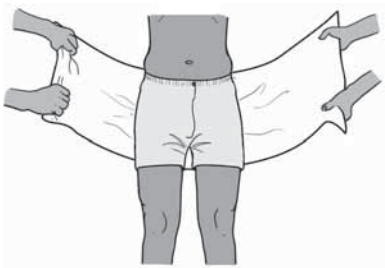
Tourniquet technique:

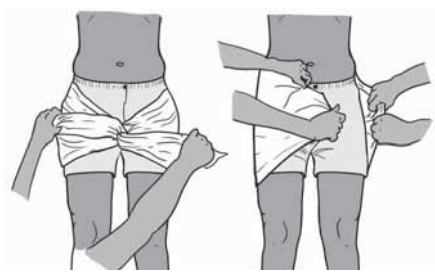
- If available, use pneumatic tourniquet (like BP cuff) over padded skin, inflate until bleeding stops.
- If not, use elastic band or piece of cloth or belt (the wider, the better), over padded skin.
- Apply as close to wound as possible.
- Apply enough pressure to make distal pulses disappear and reassess bleeding. If stopped, dress the wound and proceed with surgery or transfer urgently. If not, increase tourniquet pressure until major bleeding (arterial "pumper") ceases.
- Release for 10 minutes every 2 hours, while applying forceful direct pressure over the wound. Do not reapply unless evidence of continued active bleeding.
- Never leave a tourniquet on for more than 4 hours.
- Make sure tourniquet is clearly visible.

How to apply pelvic binder

To pull displaced bones together to tamponade bleeding.

- Place bed sheet under the pelvis.
- Pull over the great trochanters/iliac wings – cross over anteriorly.
- Pull tight and tie.





How to manage heavy upper gastrointestinal bleeding

Call for help.

- Insert IV and give fluids rapidly (see p. 39).
- Send blood specimen for type and cross match then transfuse as needed.
- Repeat Quick Check and monitor pulse, SBP and haemoglobin.
- Insert nasogastric tube to decompress – do not lavage (see Section 7.3.8).
- If endoscope and trained provider: locate site and cauterize.
- Give proton pump inhibitor in high dose (e.g. omeprazole 80 mg).
- Check whole blood clotting time.

How to manage large haemoptysis

- Manage airway.
- Send blood for type and cross match then transfuse as needed.
- Consider antibiotics.
- Monitor Quick Check and haemoglobin (see Section 10.6).
- Check chest X-ray. If unilateral process, place affected side down.

How to manage large nose bleed (epistaxis)

1. **Pressure.** Have the patient gently blow their nose to remove all clots.
   - Ask patient to open mouth, then pinch both nostrils tightly between your fingers and thumb.
   - Hold continuous pressure. Bleeding usually stops within 10 minutes.

2. **Consider cautery** (i.e. silver nitrate) **only if you can clearly identify a bleeding site.**

If bleeding continues

3. **Pack the anterior nares** – bleeding side. First pack the side that appears to be the main source of bleeding. Use petroleum ribbon gauze (if not available, soak gauze 1 mg of epinephrine diluted in 200 ml saline).

4. **Pack both sides.**

If bleeding continues after both side packed

5. **Use a urinary catheter to stop the bleeding from posterior nasopharynx:**
   - Lubricate the catheter, and pass it through the nose until the tip is visible at the oropharynx.
   - Inflate the balloon with 5–10 ml of water.
   - Gently pull the catheter forward until the balloon is held in the posterior part of the nose.
   - While holding catheter in place, pack the anterior nares with petroleum or saline soaked gauze.
   - Tape or tie in place.
   - Deflate the foley catheter after 24 hours, and if bleeding does not recur remove it.
   - Admit any patient with posterior packing for observation and airway monitoring.

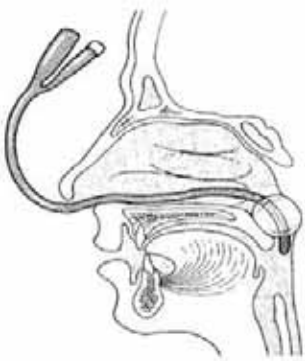
For all patients: monitor airway, breathing and circulation (follow Quick Check).

Manage in comfortable sitting position with head forward.

If patient unstable: insert IV, give LR or NS fluid bolus, and send blood for Hb, type and cross-match.

If patient extremely anxious, consider low dose diazepam.

For all patients with nasal packing, give antibiotics to prevent toxic shock syndrome.



Vaginal bleeding in pregnant woman or woman of childbearing age[2,7]

- **Assess pregnancy status.**
- **Assess amount of bleeding.**

EARLY PREGNANCY (uterus NOT above umbilicus; may not be aware of pregnancy) or NOT PREGNANT

Heavy bleeding: *pad or cloth soaked in <5 minutes. Decide if pregnant.*

- Insert an IV line.
- Give fluids rapidly.
- Give 0.2 mg ergometrine IM.
- Repeat 0.2 mg ergometrine IM or IV if bleeding continues.
- If suspect possible complicated abortion, give appropriate IM or IV antibiotics; see *IMPAC MCPC.*[2]
- If pregnant, see *IMPAC MCPC.*[2]
- If not pregnant, consider fibroids, anovulatory bleeding, malignancy, sexual trauma (see Section 10.15).
- Call for help and admit to hospital.

Light bleeding

Examine woman:

- Consider ectopic pregnancy (see Section 10.15 and *IMPAC MCPC*[2]).
- If pregnancy not likely, see Section 10.15.

LATE PREGNANCY (uterus above umbilicus)

ANT BLEEDING IS DANGEROUS!

DURING LABOUR Before delivery of baby

BLEEDING MORE THAN 100 ML SINCE LABOUR BEGAN IS DANGEROUS!

DO NOT do vaginal examination, but:

- Insert an IV line
- Give fluids rapidly if heavy bleeding or shock
- Call for help and admit to hospital

Call for help from district clinician.

See *IMPAC MCPC.*[2] This may be placenta praevia, abruptio placenta, ruptured uterus.

7 *WHO guidelines for the management of postpartum haemorrhage and retained placenta.* WHO, 2009. http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241598514/en/index.html

POSTPARTUM[2] (BABY IS BORN) bleeding heavy?

Heavy bleeding:
- *Pad or cloth soaked in<5 minutes*
- *Constant trickling of blood*
- *Bleeding >250 ml or delivered outside hospital and still bleeding*

- Call for extra help.
- Massage uterus until it is hard. Give oxytocin 10 IU IM.
- Insert IV line and give IV fluids with 20 IU oxytocin/litre at 60 drops/minute.
- Empty bladder, catheterize if necessary.
- Check and record SBP and pulse every 15 minutes and treat.
- Check and ask if placenta is delivered (continue to follow flowchart).

District clinician management: see *IMPAC MCPC.*[1] This may be uterine atony, retained placenta, ruptured uterus, vaginal or cervical tear.

Check and ask if placenta is delivered.

Placenta NOT delivered

When uterus is hard, deliver placenta by controlled cord traction:
- If unsuccessful and bleeding continues.
- If bleeding continues, remove placenta manually (see p. 55) and check placenta.
- Give appropriate IM/IV antibiotics.
- If unable to remove placenta, call for help. Continue IV fluids with 20 IU of oxytocin at 30 drops/minute.

Placenta delivered

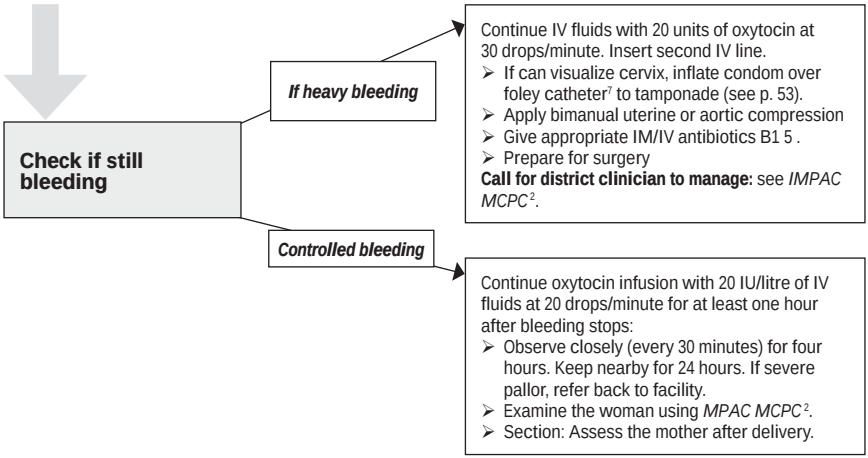
If placenta is complete:
- Massage uterus to express any clots.
- If uterus remains soft, give ergometrine 0.2 mg IV (DO NOT give ergometrine if pre-eclampsia, eclampsia or known hypertension).
- Continue IV fluids with 20 IU oxytocin/litre at 30 drops/minute.
- Continue massaging uterus until it is hard.
- If bleeding does not respond, give misoprostol[7] (see p. 56).

If placenta is incomplete (or not available for inspection):
- Remove placental fragments (see I*MPAC MCPC*[2]).
- Give appropriate IM/IV antibiotics.
- If cannot remove, call urgently for help from district clinician.

Check for perineal and lower vaginal tears

If present

Examine the tear and determine the degree. controlled cord traction:
- If third or fourth degree tear (involving rectum or anus), get district clinician to repair.
- For other tears: apply pressure over the tear with a sterile pad or gauze and put legs together.
- Check after five minutes, if bleeding persists repair tear.



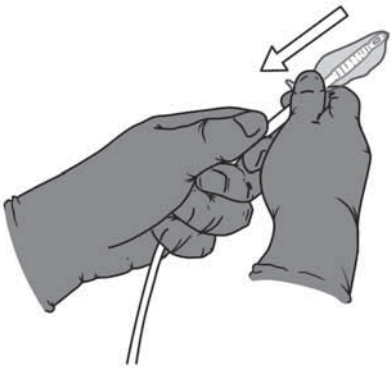
How to massage uterus and expel clots

If heavy postpartum bleeding persists after placenta is delivered, or uterus is not well contracted (is soft):

- Place cupped palm on uterine fundus and feel for state of contraction.
- Massage fundus in a circular motion with cupped palm until uterus is well contracted.
- When well contracted, place fingers behind fundus and push down in one swift action to expel clots.
- Collect blood in a container placed close to the vulva. Measure or estimate blood loss, and record.

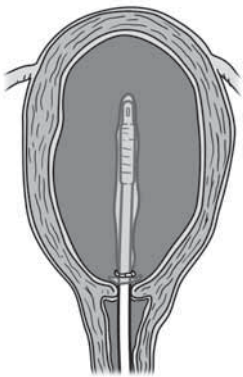
How to inflate condom over foley catheter[7] to tamponade uterine bleeding

If trained and keeping all equipment sterile:



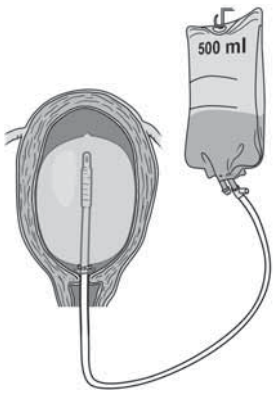
Insert sterile foley catheter up to 3–5 cm below the bulb into a condom.

Tie the condom tightly around the stem of the catheter using sterile gauze ties.



Using a sterile speculum and sponge holding forceps, insert catheter with the condom attached well into the uterine cavity.

Clamp the catheter and leave the end inside the vagina.



Connect a bag of sterile fluid to the end of the catheter (ensuring a tight fit) and allow the fluid to run in and fill the catheter.

Make arrangements for further treatment as appropriate.

How to apply bimanual uterine compression

If heavy postpartum bleeding persists despite uterine massage, oxytocin/ergometrine/misoprostol[7] treatment and removal of placenta:

- Wear sterile or clean gloves.
- Introduce the right hand into the vagina, clenched fist, with the back of the hand directed posteriorly and the knuckles in the anterior fornix.
- Place the other hand on the abdomen behind the uterus and squeeze the uterus firmly between the two hands.
- Continue compression until bleeding stops (no bleeding if the compression is released).
- If bleeding persists, apply aortic compression and transport woman to hospital.

How to apply aortic compression

If heavy postpartum bleeding persists despite uterine massage, oxytocin/ergometrine/misoprostol[6] treatment and removal of placenta:

- Feel for femoral pulse.
- Apply pressure above the umbilicus to stop bleeding. Apply sufficient pressure until femoral pulse is not felt.
- After finding correct site, show assistant or relative how to apply pressure, if necessary.
- Continue pressure until bleeding stops. If bleeding persists, keep applying pressure while preparing for surgery or transporting woman to a referral hospital.

How to give oxytocin

If heavy postpartum bleeding:

MAXIMUM DOSE: Not more that 3 litres of IV fluids containing oxytocin

Initial dose	Continuing dose
IM: 10 IU	**IM:** repeat 10 IU after 20 minutes if heavy bleeding persists
IV infusion: 20 IU in 1 litre at 60 drops/min	**IV infusion:** 20 IU in 1 litre at 30 drops/min

How to manually remove the placenta if postpartum bleeding[2]

- If placenta not delivered 30 minutes after delivery of the baby with bleeding,

OR

- If heavy vaginal bleeding continues despite massage and oxytocin and placenta cannot be delivered by controlled cord traction, or if placenta is incomplete and bleeding continues.

Preparation:

- Explain to the woman the need for manual removal of the placenta and obtain her consent.
- Insert an IV line. If bleeding, give fluids rapidly. If not bleeding, give fluids slowly.
- Assist woman to get onto her back.
- Give diazepam (10 mg IV) or ketamine sedation (see p. 58) if not comatose.
- Clean vulva and perineal area.
- Ensure the bladder is empty. Catheterize if necessary.
- Wash hands and forearms well and put on long sterile gloves (and an apron or gown if available).

How to manually remove placenta:

- With the left hand, hold the umbilical cord with the clamp. Then pull the cord gently until it is horizontal.
- Insert right hand into the vagina and up into the uterus.
- Leave the cord and hold the fundus with the left hand in order to support the fundus of the uterus and to provide counter-traction during removal.
- Move the fingers of the right hand sideways until edge of the placenta is located.
- Detach the placenta from the implantation site by keeping the fingers tightly together and using the edge of the hand to gradually make a space between the placenta and the uterine wall.
- Withdraw the right hand from the uterus gradually, bringing the placenta with it.
- Explore the inside of the uterine cavity to ensure all placental tissue has been removed.
- With the left hand, provide counter-traction to the fundus through the abdomen by pushing it in the opposite direction of the hand that is being withdrawn. This prevents inversion of the uterus.
- Examine the uterine surface of the placenta to ensure that lobes and membranes are complete. If anyplacental lobe or tissue fragments are missing, explore again the uterine cavity to remove them.

If hours or days have passed since delivery, or if the placenta is retained due to constriction ring or closed cervix, it may not be possible to put the hand into the uterus. DO NOT persist. Get help; admit or refer.

If the placenta does not separate from the uterine surface by gentle sideways movement of the fingertips at the line of cleavage, suspect placenta accreta.

DO NOT persist in efforts to remove placenta. Get help; admit or refer.

After manual removal of the placenta

- Repeat oxytocin 10 IU IM/IV.
- Massage the fundus of the uterus to encourage a tonic uterine contraction.
- Give ampicillin 2 g IV/IM.
- If fever >38.5°C, foul-smelling lochia or history of rupture of membranes for 18 or more hours, also give gentamicin 80 mg IM.
- If bleeding stops:
  - give fluids slowly for at least 1 hour after removal of placenta.
- If heavy bleeding continues:
  - give ergometrine 0.2 mg IM
  - give 20 IU oxytocin in each litre of IV fluids and infuse rapidly
  - admit to hospital and call for surgical help (see *IMPAC MCPC*[2]).
- During transportation, feel continuously whether uterus is well contracted (hard and round). If not, massage and repeat oxytocin 10 IU IM/IV.
- Provide bimanual or aortic compression if severe bleeding before and during transport to surgery.

How to give misoprostol[7] for postpartum bleeding if noresponse to oxytocin plus ergometrine

- Give misoprostol 800 mcg sublingually.

How to give magnesium sulfate

For severe pre-eclampsia and eclampsia:[4]

Give IV and IM combined dose (loading dose):

- Insert IV line and give fluids slowly (NS or LR) 1 litre in 6–8 hours (3 ml/minute)
- Give 4 g of magnesium sulfate (20 ml of 20% solution) IV slowly over 20 minutes (woman may feel warm during injection)

AND

- Give 10 g of magnesium sulfate IM: give 5 g (10 ml of 50% solution) IM deep in upper outer quadrant of each buttock with 1 ml of 2% lidocaine in the same syringe.

If unable to give IV, give IM only (loading dose):

- Give 10 g of magnesium sulfate IM: give 5 g (10 ml of 50% solution) IM deep in upper outer quadrant of each buttock with 1 ml of 2% lidocaine in the same syringe.

If convulsions recur:

- After 15 minutes, give an additional 2 g of magnesium sulfate (10 ml of 20% solution) IV over 20 minutes.
- If convulsions still continue, give diazepam.

If referral delayed for long, or the woman is in late labour, continue treatment:

- Give 5 g of 50% magnesium sulfate solution IM with 1 ml of 2% lidocaine every four hours in alternate

Monitor:

- Monitor urine output: collect urine and measure the quantity.
- Before giving the next dose of magnesium sulfate, ensure:
  - knee jerk is present.
  - urine output >100 ml/4 hours.
  - RR >16/minute.
- DO NOT give the next dose if any of these signs:
  - knee jerk absent.
  - urine output <100 ml/4 hours.
  - RR <16/minute.
- Record findings and drugs given.

Important considerations in caring for a woman with eclampsia or pre-eclampsia

- Do not leave the woman on her own.
  - help her into the left side position and protect her from fall and injury.
- Give IV magnesium sulfate slowly, over 20 minutes. Rapid injection can cause respiratory failure or death.
  - if respiratory depression (RR less than 16/minute) occurs after magnesium sulfate: DO NOT give any more magnesium sulfate.
- Give the antidote: calcium gluconate 1 g IV (10 ml of 10% solution) over 10 minutes.
- DO NOT give intravenous fluids rapidly.
- DO NOT give intravenously 50% magnesium sulfate without diluting it to 20%.
- Consider caesarian section unless delivery is imminent.
- If delivery imminent, manage as in childbirth and accompany the woman during transport.
  - Keep her in the left side position.
  - If a convulsion occurs during transport, give magnesium sulfate and protect her from fall and injury.

How to give ketamine for a procedure

- Prepare: place IV; set up monitoring equipment, suction, oxygen and mask, oral or nasal airway, and BVM at bedside.
- Pretreat to prevent emergence reaction (agitation or hallucination) before administering ketamine.
  - give midazolam 0.05 mg/kg IV over 2 minutes just prior to giving ketamine; OR
  - alternative, give diazepam 0.05–0.1 mg/kg IV (requires longer observation following sedation): OR
  - alternative, treat ketamine emergence reaction with midazolam or diazepam only if hallucinations or agitation are observed.
- Sedate:
  - give ketamine 1–2 mg/kg IV over 2 minutes.
  - repeat 0.5 mg/kg IV every 10 minutes as needed.
  - alternative to IV: give 4 mg/kg IM.
- Monitor:
  - check BP, pulse, RR, and SpO_2 every 2 minutes.
  - watch for secretions, laryngospasm, and emergence reactions.

How to manage the violent or very agitated patient

Calm and protect

- Protect patient from harming him/herself, you or others.
- Ensure that you are in a quiet area where there is no audience.
- Use space to protect yourself.
- Get help from colleagues, security, and family members who can help mediate the situation and calm the patient down for the safety of staff and the patient.
- Approach in calm and confident manner.
  - Speak in a calm and reassuring way.
  - **Be non-confrontational, non-judgemental, and deflect criticism.**
- Keep your own emotions in check. Do not let yourself be affected by verbal abuse or threats.
- Be aware of potential weapons and remove unsafe objects.
- **Consider differential diagnosis:**
  - Check blood glucose and give glucose if low (see p. 41).
  - Check vital signs including temperature.
  - Check SpO_2 and give oxygen if < 90.
  - Use the delirium differential diagnosis to consider medical causes including poisoning and substance use (see Section 3.4).
  - Decide what is the likely cause of the aggression and agitation.

Sedate – as appropriate

If suspect agitation is due to ingestion of substances (i.e. alcohol or other sedative withdrawal or stimulant intoxication):

- Give diazepam 10–20 mg orally – repeat as necessary (see Sections 3.6 and 3.7).

If suspect agitation is due to psychotic disorder, mania, or other psychiatric disorders, consider the use of haloperidol to alleviate the agitation:

- **For most patients:**
  - Give haloperidol 2 mg IM or orally every hour up to 5 doses (max dose = 10 mg).
- **For elderly patients and those with complicating medical illness, including delirium and dementia:**
  - Give haloperidol 0.5–1 mg orally or IM every hour up to 3 doses (max dose = 3 mg).
- For the most uncontrollable patients at risk to themselves and others:
  - Seek immediate assistance from security staff or police. Ensure the safety of staff.
  - If sedation is required give haloperidol 5 mg IM, repeating in 15–30 minutes if necessary (seek specialist advice before using more than 15 mg).

Avoid sedatives (diazepam) unless there is a clear diagnosis of alcohol withdrawal or stimulant intoxication.

If suspect agitation is due to poisoning with organophosphates or chloroquine

- Give diazepam rather than haloperidol (see Section 3.8).

See Sections 3.6, 3.7, and 10.11 Mental health.

High doses of diazepam can cause problems with respiratory depression. Monitor for signs of respiratory depression for up to 4 hours. High dose of haloperidol can cause dystonic reactions. If acute, treat with biperiden (see Section 8.4).

Once the patient is beginning to calm down, wait to see the full effect of any sedative medication before giving any further sedative medication. When the person is no longer acutely agitated, see mental health Section 10.11 for appropriate management.

- If patient remains agitated despite the above interventions:
  - Reconsider possible causes including pain.
  - Recheck SpO_2 and glucose.
  - Seek assistance and advice.

How to manage the suicidal/self-harm patient

- **Evaluate whether the person has attempted a medically serious act of self-harm or suicide:**
  - Ask the patient or accompanying friends or family about self harm attempt or recent poisoning.
  - Look for signs of poisoning or intoxication or signs of self injury.
  - Medically treat as necessary.
  - Ensure that the person is closely monitored to prevent further self harm.
  - Do not leave the patient alone or unsupervised.

- **Evaluate whether there is an imminent risk of self-harm or suicide:**
  - Ask the patient about current thoughts or plans to commit suicide or self harm and about access to means to follow through on those thoughts or plans.
  - Look for signs of emotional distress, hopelessness, agitation, uncommunicative behaviour, social isolation.

- **If risk is imminent:**
  - Remove access to means of self harm.
  - Create a secure and supportive environment, ensure that the person is not left alone.
  - Attend to emotional distress and mental state, solve problems and explore reasons and ways to stay alive.
  - Assess for presence of a mental health disorder and treat as indicated.
  - Consult mental health specialist if available.

- **If risk is not imminent but there is a recent history of thoughts of suicide or self harm:**
  - Remove, or advise removal, of access to means of self harm.
  - Attend to emotional distress and mental state, problem solve and explore reasons and ways to stay alive.
  - Offer and activate psychosocial support.
  - Assess for a presence of a mental health disorder and treat as indicated.
  - Consult mental health specialist if available.

In all cases, assess the patient for mental health, neurological, drug use disorders, chronic pain and/or emotional symptoms that require clinical management.

See Section 10.11 mental health for more on managing the suicidal patient and for managing mental health disorders.

Advanced airway management: for district clinicians with training

INDICATIONS FOR TRACHEAL INTUBATION

Tracheal intubation is an advanced airway procedure and should only be attempted if one understands the indications for intubation, is skilled in the technique, and can provide post-intubation care. If you are not skilled with intubation, manage airway in other ways. **All intubations are potentially difficult,** and a patient should only be intubated *if the basic airway interventions* (oxygen, head positioning, oral airways, bag valve mask ventilation) are inadequate.

Before attempting intubation ask these questions:

1. Does the patient have an indication for intubation?
   - Failure to maintain or protect airway (risk of aspiration).
   - Failure to oxygenate or ventilate.
   - Impending airway obstruction (e.g. inhalation injury, angioedema).
2. Is the intubation equipment in working order?
   - Laryngoscope with working light.
   - Appropriate endotracheal tube size.
   - Use 6.0–7.0 tube in females, and 7.0–8.0 tube in males.
   - Oxygen source.
   - Bag valve mask.
   - Suction.
3. Is there a post-intubation plan?
   - Is an invasive mechanical ventilator available? If answer is **NO**, then **only** consider intubation for the following conditions:
     - If you suspect the patient has a rapidly reversible condition and will only require short-term intubation (e.g. snake bite, overdose) and manual ventilation possible.
     - If you suspect the patient may need longer intubation and transfer is possible to a hospital with an available invasive mechanical ventilator.
   - Are sedative drugs available?
   - Patients often must be sedated during and after intubation. Medications for intubation and sedation should **only** be administered by clinicians trained to intubate who understand their appropriate use and indication.

If the answer to any of these questions is NO**, then do not attempt intubation and continue basic airway interventions and bag valve mask ventilation with high flow oxygen. Call for more senior clinician.**

HOW TO PERFORM TRACHEAL INTUBATION

Tracheal intubation should take no more than 30 seconds.

Procedure:

- Give high flow oxygen via BVM or face mask with reservoir before the procedure.
- Position patient in sniffing position (place pillow under neck if no trauma).
- Give sedation if required (if not comatose) – midazolam 0.2 mg/kg IV or ketamine 1.5 mg/kg IV.*
- Open the patient's mouth by separating the lips and pulling on the upper jaw with the index finger.
- Hold a laryngoscope in the left hand, insert it into the mouth of the patient with the blade directed to the right tonsil. Once the right tonsil is reached, sweep laryngoscope to the midline, keeping the tongue on the left to bring the epiglottis into view.
- Advance the laryngoscope blade until the angle between the base of the tongue and the epiglottis is reached.
- Next, lift laryngoscope up and away from you at a 45 degree angle to bring the vocal cords into view. An assistant should press downward and upward on the larynx to help bring the vocal cords in view.
- Take the endotracheal tube in the right hand and insert it into the mouth. Insert the tube through the cords to the point that the cuff rests just below the cords.
- Inflate the cuff to provide a minimal leak when the bag is squeezed.
- Attach tube to bag connected to high flow oxygen.
- If successful, start post – intubation care (see p. 66–67).
- If you are unable to intubate in 30 seconds, perform BVM ventilation with high flow oxygen.
- If unable to intubate and unable to ventilate, go to failed airway algorithm (see p. 65).

*Skilled clinicians may also add a muscle relaxant such as succinylcholine to facilitate intubation.

HOW TO CONFIRM ENDOTRACHEAL TUBE (ETT) PLACEMENT

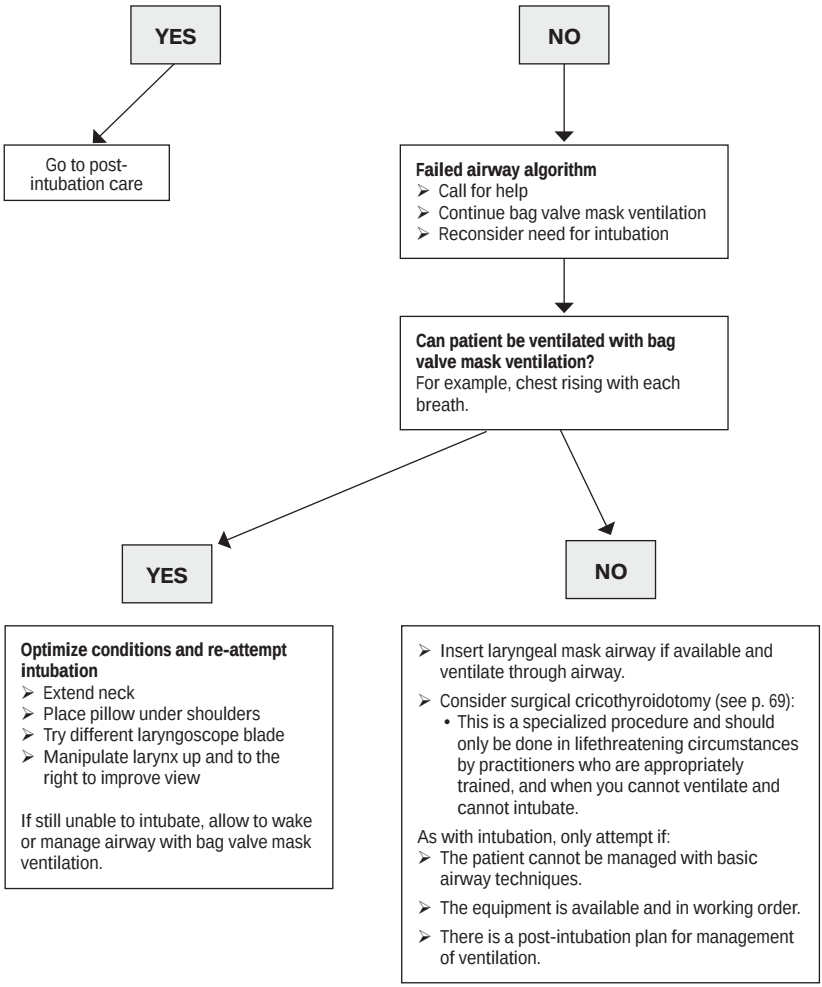
- Give breaths through ETT using manual ventilation with high flow oxygen.
- Look for condensation in ETT.
- Look for chest rise.
- Listen over both lung fields and stomach for breath sounds.
- If breath sounds are heard over stomach, and not in lung fields, assume oesophageal intubation and immediately remove tube.
- Give 6–8 breaths via BVM ventilation with high flow oxygen or until re-oxygenated. Re-attempt intubation.
- If breath sounds are louder on the right than the left or the left chest not expanding with ventilation consider right mainstem bronchus intubation. Pull ETT out in very small increments (1–2 cm) and listen again – until breath sounds are equal on both sides.
- Secure ETT in place (cloth, tape, ribbon gauze).
- Continue with manual ventilation, see post-intubation care p. 66–67.

Ten tests of correct tube placement: if in doubt, take it out!

Test	Result	Significance	Reliability
Look with laryngoscope	Tube between cords	Correct tracheal intubation	Certain
Listen/feel	Breathing through tube	Correct tracheal intubation	Certain
Tap sternum	Puff of air from the tracheal tube	Correct tracheal intubation	Certain
Inflate with self-inflating bag	Chest rises and falls	Correct tracheal intubation	Probable
Inflate with self-inflating bag	Gurgling noises	Oesophageal intubation	REMOVE TUBE
Pass catheter down tube	Patient coughs (if not paralysed)	Correct tracheal intubation	Probable
Look	Patient remains pink after intubation	Correct tracheal intubation	Probable
Look	Patient becomes cyanosed after intubation	Oesophageal intubation very likely	REMOVE TUBE
Listen with stethoscope	Air entry at apices, axillae and bases	Correct tracheal intubation	Probable
Listen with stethoscope	Air entry over stomach	Oesophageal intubation very likely	REMOVE TUBE

WAS INTUBATION SUCCESSFUL?

Was intubation successful?



POST-INTUBATION CARE

■ How to ventilate the intubated patient

Make sure to check all of the following when initiating manual ventilation

- Check bag is connected to high flow oxygen source and to ETT correctly.
- Check that ETT is properly positioned and secured in place and that cuff is inflated.
- Make sure you have looked for and treated pneumothorax, flail chest, and sucking chest wounds.
- If available, check suction equipment still functioning.
- If patient is biting on the tube, insert an oral airway or bite block.
- Perform manual ventilation, see next page.

■ **How to sedate the intubated patient**

- Sedate patient with intravenous medication based on local availability (such as midazolam.
- 0.02–0.1 mg/kg/hour).
- Most patients will require sedation following intubation to treat anxiety or agitation.
- Assessing anxiety and agitation can be challenging so use a standardized sedation scale, if possible.
- After sedative medication is given, the patient will need to be reassessed at least every 30 minutes to determine if sedation is adequate.
- Signs that patient requires more sedation:
  - patient is biting down on the ETT.
  - patient is trying to pull ETT out.
  - increased resistance is felt in the bag when trying to ventilate the patient.
  - SBP and/or heart rate elevated.
  - *(if patient is on ventilator, high peak pressures are registered).*

POST-INTUBATION CARE

■ If patient becomes blue, cyanotic or hypoxic

- ➢ Confirm placement of ETT (see p. 64).
- ➢ Check ETT cuff is inflated.
- ➢ Confirm that oxygen source is working.
- ➢ Suction secretions.
- ➢ Sedate patient if not adequately sedated.
- ➢ If wheezing, give salbutamol (see p. 17).
- ➢ Look for signs of tension pneumothorax – trachea deviated to the side, decreased breath sounds, neck veins distended or crepitus and treat if suspected (see p. 46).
- ➢ Look for signs of pulmonary oedema, treat if suspected (see Section 3.2.5).
- ➢ *If patient is on ventilator, disconnect patient from ventilator and manually bag patient until patient improves*.
- ➢ If patient remains hypoxic and suspect ETT not in correct position then remove ETT and ventilate via bag valve mask.

■ **Intubated patients require close monitoring**

- ➢ Reassess frequently, at least every 30 minutes: do Quick Check, measure vital signs, SpO_2.
- ➢ *If available place patient on continuous pulse oximeter monitoring.*
- ➢ Place nasogastric tube (orogastric tube if head trauma suspected; see Section 17.5.1).
- ➢ Use soft hand restraints.
- ➢ Record all your observations.

MANUAL VENTILATION (BAGGING) – HOW TO PREPARE THE HEALTH WORKER, FAMILY OR OTHER CAREGIVERS

Overaggressive bagging can cause serious harm to a patient's lungs and also death.

It is critical that the health worker or family understands the proper technique, need for continuous bagging and when to call for help.

Demonstrate how to bag, then watch them do it

- Hold the bag in one hand and depress a 2-litre bag to about 1/3 of its volume.
- Give one breath over about one second.
- Give about 10 breaths/minute.
- Make sure that after each breath, the patient completely exhales before giving another breath.
- Watch to make sure that the chest is rising and falling evenly with each breath. The patient's stomach should not be expanding with each breath. If you are not sure if you are getting a good breath, ask for help from the nurse or doctor.
- If the patient is breathing on their own, deliver breaths when the patient is inhaling. Do not attempt to deliver a breath as the patient exhales.
- It should be easy to compress the bag and you should feel minimal resistance. If you feel resistance ask for help from the nurse or doctor.

When to call for help

- If you see the patient vomiting call for help:
  - stop ventilating the patient for a short period of time while you suction or manually remove all vomit out of the patient's mouth and the tube.
  - if there is no concern for a spinal injury, turn the patient's head to the side to get as much vomit out as possible.
  - resume ventilation when the vomiting has stopped and as much vomit as possible has been removed from the airway.
- If you must take a break, make sure that someone takes over for you and the patient is always being ventilated.
- Call immediately for help if:
  - the patient is turning blue or cyanotic.
  - the patient is waking up and biting on the tube, or trying to pull the tube out of his or her mouth.
  - it becomes hard to compress the bag or you feel increased resistance
  - the patient is vomiting.
  - you hear gurgling noise when you give a breath or the tube is filling with secretions.
  - the patient's stomach seems to be filling with air or is expanding.
  - when you touch the patient's skin it feels like it is full of air and "crackles" under your fingers.
  - the patient's trachea (a hard structure located under the skin in the middle of the neck) seems to move to one side.
  - if the patient's oxygen level falls below 90% (only for patients monitored with a pulse oximeter).
  - you must take a break, and there is no one to relieve you.

IF LIFE THREATENING UPPER AIRWAY OBSTRUCTION AND UNABLE TO VENTILATE, HOW TO PERFORM CRICOTHYROIDOTOMY

Surgical cricothyroidotomy should be performed in any patient where intubation has been attempted twice and failed and/or the patient cannot be ventilated.

Technique:

1. Hyperextend the neck (unless known or suspected C-spine injury), making the patient comfortable (Figure 1).
2. Clean the area and infiltrate with local anaesthetic.
3. Incise through the skin vertically with a 1.5 cm cut and use blunt dissection to ensure that you can see the membrane between the thyroid and cricoid.
4. With a #22 or #23 scalpel blade, stab through the membrane into the hollow trachea (Figure 2).
5. Rotate the blade 90°, insert a curved artery forceps alongside the blade, remove the blade and open the forceps side to side, widening the space between the thyroid and cricoid cartilages (Figure 3).
6. Pass a thin introducer or a nasogastric tube into the trachea if very small access (Figure 4).
7. Run a 4–6 endotracheal tube over the introducer and pass it into the trachea (Figure 5).

Figure 1

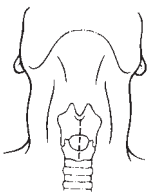


Figure 2

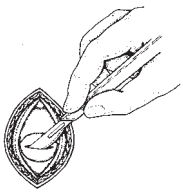


Figure 3

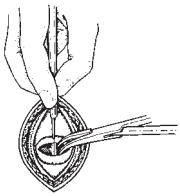


Figure 4

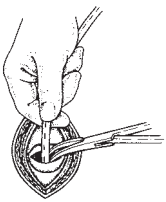
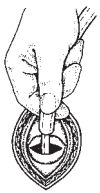


Figure 5



8. Remove the introducer, if used.
   - ➢ This tube can stay in place for up to 3 days.
   - ➢ This procedure should be performed by an experienced person, with prior knowledge of the anatomy and medical condition of the patient.

This procedure should not be undertaken lightly, as wrong placement, bleeding and delay can cause death.

How to refer the severely ill patient to a higher level of care

Severely ill patients may require referral to a higher level of care for access to personnel, diagnostic testing, equipment or specialty services not available at the district hospital. Patients should only be transported if the receiving hospital has the necessary and appropriate resources to care for the patient and is in agreement.

Transport is a very hazardous time for a severely ill patient. In many settings, transport may occur over long distances and is of a significant cost to the family.

A standard approach to referral in your hospital will help ensure appropriate referrals and minimize patient harm.

- Communicate with the receiving hospital. Make a clear agreement that the receiving hospital has the necessary and available resources to care for your patient and will admit the patient for this care.
- Prepare a written report that includes the following: vital signs, including those on admission, a brief physical examination, treatments given (e.g. IV fluids, blood transfusion, medications, antimicrobials) and all laboratory and radiographic results. Send this with the patient.
- Decide what accompanying caregiver is necessary.
- Keep patient comfortable. Treat patient anxiety and pain. Cover patient and keep warm.

How to transport the severely ill patient

Transporting a severely ill patient can be in hospital or inter-hospital. Patient should usually be stabilized before being transported.

- Transport requires that resources can be released, including staff to accompany the patient.
- Complications range in severity from minor to potentially life threatening and may be related to clinical, equipment or organizational issues.
- If indicated: secure airway, immobilize cervical spine, apply manual pressure or pressure dressing to active bleeding, secure IV access, stabilize any injuries that may become life-threatening during transport (e.g. pelvic fracture, pneumothorax).
- Use a checklist (see below) to ensure safety and that key supplies, considerations and communication have been taken care of before setting out.

Transfer checklist

- Airway and NG tube.
- Breathing and adequate SpO_2.
- Circulation, monitoring and IV.
- Disability/cervical collar/head injury care.
- Exposed, examined and equipment sorted out and secure.
- Family informed.
- Final considerations:
  - Ask for notes and X-rays and other results.
  - Bed confirmed at receiving hospital.
  - Continuity of care assured? Communication equipment.
  - Drugs and spare? Documentation, including patient history.
  - Everything secure? Enough drugs? Enough oxygen? Enough fuel? Enough IV fluids?
- Health worker accompanying patient-prepared?

Emergency trolley

Health worker protection
Gloves
Mask (surgical and N95)
Eye protection
Gown
Sharps box
Alcohol based cleansers

Supplies/equipment (in child and adult sizes)

Suction catheter
Nasal prongs
Oxygen mask
Oxygen mask with reservoir bag
Oxygen mask with nebulizer attachment
Oxygen tubing
Bag valve mask-hung on side of cart
Oral airway
Nasal airway
Pulse oximeter with probes
Tongue depressor
Laryngoscope
Magill forceps
Spacer

Angiocatheters – 14, 16 and 18 gauge
Intravenous tubing
Syringes
Needles
Intraosseus
Alcohol wipe or equivalent antiseptic for skin
Tourniquet
Tubes for blood draw
Sterile pads and gauze
Bandage
Suture
Tape
Lubricant

Medication

Epinephrine (adrenaline) IV
Atropine IV
Naloxone IV
Salbutamol MDI with spacer
Salbutamol ampoules
Hydrocortisone IV, oral
Furosemide IV, oral
Ipratropium MDI
LR or NS fluids

Emergency antibiotics
Emergency antimalarials
Oseltamavir
Glucose (dextrose D50)
Paracetamol
Aspirin
Morphine or equivalent*
Diazepam IV/PR*
Magnesium sulfate IV
Haloperidol
Ergometrine IM
Oxytocin IV

For VAGINAL BLEEDING – see *IMPAC MCPC*[2]

*Lock box.

3. Approach to the severely ill patient (after the Quick Check)

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3. Approach to the severely ill patient (after the Quick Check)

3.0 General principles for caring for the severely ill patient

In this section:
- Rapid assessment and immediate management
- Monitor – record – respond
- Give oxygen
- Nursing care for severely ill patients
- Involving the family in caring for severely ill patients
- Limiting therapy and palliative care
- Nutrition
- Considerations when caring for the pregnant patient with severe illness

Patients with critical illness need careful assessment, timely interventions to correct physiological abnormalities, and close monitoring of responses to interventions. The mortality of severely ill patients is high, and health workers should be mindful of the limits to intervention and the need to preserve dignity and comfort in this difficult situation. This Section addresses severe illness from medical causes. Section 4 addresses trauma.

Rapid assessment and immediate management

Severely ill patients require a rapid assessment of their problem and immediate interventions to correct abnormalities that are identified. The Quick Check should be used both for all patients presenting to hospital and also for severely ill patients who deteriorate after admission. The ABC section of the Quick Check – assessment of airway, breathing, circulation and altered level of consciousness or convulsions – should be used repeatedly in assessing severely ill patients.

Initial management of the severely ill patient
Fix the physiology first. Focus on correcting physiological abnormalities to stabilize the patient and prevent organ damage.
- Rapid breathing or shortness of breath should prompt an assessment of the patient's airway, administration of oxygen, listening to the chest for wheezing with administration of salbutamol as required, and an assessment for fluid overload.
- A fast pulse or low blood pressure should prompt securing intravenous access, administration of a bolus of intravenous fluid, and assessment of causes that may be reversible, such as anaphylaxis, bleeding, or sepsis.

Next, assess and treat the underlying cause. For example, give antibiotics for septic shock, pneumonia, or meningitis. For more detailed assessment and management guidelines, see the Sections on shock (3.1), respiratory distress (3.2), coma, convulsions, and altered mental status (3.4). If the diagnosis is not known, treatments can be started for multiple causes, such as antibiotics for bacterial infection together with antimalarials, while results from ongoing assessment and other tests are pending.

Monitor – record – respond

Close monitoring of critically ill patients is vitally important. Systems should be set up to enable this monitoring. Where possible, severely ill patients should be cared for in a common area close to the nursing station. Nurses should measure vital signs frequently (hourly or even more frequently, depending on acuity), and have specific instructions on criteria for action.

During the first 6 hours, monitor the following initially every 30 minutes, and then every 60 minutes once the patient is stable.

- SBP (normal – systolic >90)
- respiratory rate (normal 12 to 16; use Section 3.2 if >25, Section 10.6 if 20 to 25)
- SpO_2 (normal: >95%, give oxygen if <90%)
- mental status (AVPU scale – alert, responding to voice, responding to pain, unresponsive)
- heart rate (normal 60–100).

Monitor the following every 6 hours.

- temperature (normal 36°–38°C)
- urine output (normal >30 ml/hour) – record the quantity if feasible; if not, record whether the patient urinated during this time period.
- physical examination of the respiratory and cardiovascular systems

In addition, monitor and record treatments as they are given, including medications (antimicrobials, bronchodilators), oxygen flow rate and IV fluid type, volume and flow rate. More specific guidance on monitoring and appropriate responses is given in each Section.

The monitoring process should proceed iteratively; for example, immediately after delivering a bolus of IV fluid check to see if the blood pressure has risen and the pulse has fallen. A failure to respond or only a transient response should prompt an equipment check to see if there is a problem (e.g. IV line extravasation or blockage), reassessment of the diagnosis, administration of another fluid bolus while monitoring the response, and calling for help from a senior clinician.

Similarly, administration of oxygen to a breathless and hypoxaemic patient should result in an immediate rise in SpO_2. Failure to correct hypoxaemia with oxygen should prompt a check of technical factors (e.g. check to make sure oxygen supply is working properly) and alternative diagnoses (e.g. severe asthma). If fluid overload has been treated with intravenous furosemide, there should be an improvement in shortness of breath and respiratory rate within an hour, associated with increased urine output.

A monitoring form for the severely ill patient is in Section 3.11. Once physiological abnormalities have been corrected, patients still require monitoring as problems are likely to recur, but probably less frequently.

Give oxygen (see Quick Check pages 33–35)

Oxygen should be started immediately for all severely ill patients who have signs of severe respiratory distress or SpO_2 <90. Most patients will respond to oxygen with improvement in their respiratory distress or SpO_2 within a few minutes. However, some patients will continue to have severe respiratory distress or SpO_2 < 90 while on oxygen. For these patients, use a systematic approach to increase oxygen therapy as described in the Quick Check – How to deliver increasing oxygen, page 34. In addition, be systematic in assessing for technical problems and considering alternate causes of respiratory distress as described in the Quick Check – Respond to drop in SpO_2 or increasing respiratory rate on oxygen, page 35. Once patient stabilizes or begins to improve, gradually decrease oxygen therapy with close monitoring as described in the Quick Check – Decrease oxygen if patient is stabilizing or improving, page 35.

Consider the following when giving oxygen.

- Giving oxygen alone will not relieve an upper airway obstruction or inadequate ventilation (see Quick Check – How to manage the airway, pages 29–32).
- In patients who are obtunded, placement of an oral or nasal airway can help keep the airway open so that oxygen can be delivered more effectively.
- Once oxygen has been given, treat the underlying cause(s) of hypoxaemia, such as severe pneumonia or acute lung injury (see Section 3.2.3), severe bronchospasm (see Sections 3.2.4 and 10.6), or acute pulmonary oedema or fluid overload (see Section 3.2.5).

Nursing care for severely ill patients

- Pain control – give analgesia as indicated.
- Temperature control – ensure the patient does not get cold or too hot.
- Check IV cannula each day and replace if local signs of inflammation or infection. Remove IV when no longer required for fluid management. Change to oral antibiotics and fluids as soon as possible.
- Consider the possible spread of infections to other patients; integrate infection prevention and control strategies (see Section 6) into treatment planning and delivery of care.
- Give special care for the mouth, nose and eyes when patients receive high flow oxygen therapy to prevent irritated or dry mucous membranes, pressure sores behind ears or on the side of the nose, and skin intolerance to mask or nasal prongs.
- Pressure care – rotate patient position to prevent development of pressure ulcers.
- Comfort care – be attentive to a comfortable position, patient hygiene, respect of the basic needs of the patient and their safety and privacy.
- Ensure observation and monitoring with immediate response and rapid notification of the district clinician when clinical changes are occurring.
- Record observations, procedures performed, procedures planned, and changes in condition.
- Ensure continuity of care – keep patient's chart current to facilitate communication with other team members, and other shifts.

- Inform patient and family members about the care, how the ward operates, and what behaviour and support is expected.

Involving families in caring for severely ill patients

In some hospitals with limited staff and where families are accustomed to caring for their loved ones while in hospital, families can be trained to carry out simple care and monitoring tasks.

These tasks may include feeding and washing the patient and rotating the patient from side to side to avoid pressure sores. In some cases, patient attendants may be trained to notify staff when there has been a change in clinical status or when intravenous fluids bags are empty, and in more advanced tasks, such as manual ventilation.

Limiting therapy and palliative care

Many patients with critical illness will die; it is an essential professional duty to maintain their comfort and dignity and support the family through this period. It may become evident that treatments are futile, and be appropriate to discontinue active treatments and concentrate on providing comfort (see Section 20). When possible, this decision should be made by a senior clinician after discussion with the family.

Nutrition

Once the patient has stabilized, or after 1 to 2 days, pay attention to nutrition. Two groups of patients may not be able to take food orally:

- those who have a gastrointestinal disorder or after gastrointestinal surgery (e.g. ileus, pancreatitis);
- those who cannot safely swallow due to a risk of aspiration (e.g. alteration in mental status, severe shortness of breath, or ongoing vomiting).

All other patients should be provided with food to eat. Most patients lose their appetite when unwell, and may find soft foods (e.g. mashed vegetables, soups) and oral fluids (e.g. oral rehydration solution) easier to tolerate. Small frequent meals are often tolerated better. A return of appetite is a good early sign of recovery.

Patients who cannot swallow safely may benefit from feeding via nasograstric tube. This may include pureed foods (sufficiently thin so as not to block the nasogastric tube). In severely unwell patients, a small amount should be started initially (e.g. 20–40 ml/hour), and the nasogastric aspirates monitored periodically to check for absorption. The rate of feeding can be increased as tolerated.

Considerations when caring for the pregnant patient with severe illness

- Treat the pregnant patient with the most effective treatment available.
- Place the pregnant patient with shock or severe respiratory distress on their side (preferably the left) to improve uteroplacental blood flow.
- When there is a choice of effective drug therapy, choose the drug that is safest in pregnancy.
- Monitor the fetus (e.g. fetal heart rate) frequently, according to local practice.

Clinical decision-making in severely ill patients

In an emergency situation, simultaneous assessment and treatment are required and need to be directed at reversing any life-threatening conditions. The initial assessment has already been completed by any hospital staff member within minutes, using the Quick Check.

The district clinician now needs to assess the patient (take a brief history and examine) and give additional urgent treatments.

Make a list of possible diseases that may account for the patient's symptoms and signs (the differential diagnosis). Other factors, including environmental exposures, travel history, socioeconomic status, vaccination, other chronic diseases, and local patterns of disease, all have an impact on the differential diagnosis. In particular, the immunological status and use of antiretroviral therapy in PLHIV changes the differential diagnosis considerably. The list should initially be broad; additional evidence may support or eliminate possibilities from the list. It should be based on the most likely diagnoses, but should include less likely but more serious diseases. Investigations and initial treatment in a severely ill patient should be directed towards the most serious, treatable disease.

Additional pieces of information, such as changes in symptoms and physical examination findings on repeat examinations, response to initial emergency treatments, results of investigations, knowledge of other causes of disease, and the opinion of other more senior clinicians, can help make a diagnosis more likely. It should be noted that few investigations are completely accurate; they may not always be positive when a disease is present (not completely sensitive) or not always indicate the correct disease when positive (not completely specific).

Diagnosis and management of severely ill patients often is difficult, and it is important to be systematic in approach. Use the principles of clinical reasoning presented in Section 1.
This Section provides guidance on emergency diagnoses and initial treatments, but it may also be necessary to consult Sections 10 and 11, which contain more details on the differential diagnosis and management of specific diseases. Remember that patients may present with more than one symptom and more than one disease process, and that multiple differential diagnosis tables may need to be consulted for the same patient. The differential diagnosis tables are not exhaustive, but should cover most common and serious conditions.

What is the problem (or problems)?

3.1 Severely ill patient with shock

In this section:

3.1.0 Approach to the patient with shock

Shock is a decrease in blood pressure resulting in poor perfusion and inadequate oxygenation of vital organs (e.g. low urine output, altered level of consciousness). Shock is not a final diagnosis. It is important to establish the underlying cause since this determination affects definitive treatment and supportive care.

General signs of shock common to all causes

- low BP (SBP <90)
- fast pulse
- pallor or cold extremities
- decreased capillary refill
- dizziness or inability to stand
- decreased urine output (<30 ml/hour)
- difficulty breathing
- impaired consciousness, lethargy, agitation, confusion.

Note: Assessment of pulse and BP should be taken in the context of the patient's pre-morbid state, pregnancy, age, and medication. Some pregnant women, patients with chronic illness, and others may normally have a SBP <90 mmHg and have normal mental status, capillary refill, and urine output; they do not have shock.

For clinical purposes there are five main categories of shock

Type of shock	In favour
Haemorrhagic	• Trauma • Bleeding – external or internal • Pregnancy complications
Hypovolaemia	• History of diarrhoea and vomiting • Dehydration • Burns • Pancreatitis
Septic	• Temperature dysregulation • Infective symptoms • Sepsis can present as "warm shock" (bounding pulse, warm hands) or "cold shock" (vasoconstriction, cold extremities)
Anaphylactic	• Very sudden onset angioedema and wheezing • Urticaria • New medication or known allergy
Cardiogenic	• Older patient • Known cardiac history • Chest pain and difficult breathing, sweaty

Less common categories and their causes

- **Obstructive shock** occurs when the blood flow into or out of the heart is physically blocked and the heart cannot pump normally due to such conditions as tension pneumothorax, pericardial tamponade, or massive pulmonary embolus.
- **Endocrine shock** occurs when one of the body's hormone systems is not functioning correctly. Often, the problem will be triggered by a stressful event, such as infection or trauma.
- **Neurogenic shock** occurs when the patient suffers severe spinal cord injury.

History

- Predominant symptoms – do they suggest localization to a particular body system, e.g. lungs or heart?
- History of any preceding illness or medication use – diarrhoea and vomiting, abdominal pain, fevers?
- Speed of onset – if there is a sudden onset, were there any obvious precipitants (e.g. possible exposure to allergen or poison)?
- Recent trauma?
- Pre-existing disease – HIV, cardiac disease, endocrine problems?
- Current or recent pregnancy?
- History of surgery?

Examination

Do a focused examination to identify likely causes. Check:

- vital signs
- signs of anaphylaxis – rash, stridor, wheeze
- signs of sepsis – fever, local signs of infection
- signs of bleeding – visible bleeding, rigid abdomen (internal), vomiting blood, vaginal bleeding
- signs of cardiac disease – distended neck veins, cardiac murmur.

DDx: Shock

Diagnosis	In favour
Anaphylaxis	• Swollen neck or tongue • Wheeze and stridor • Urticaria or red rash • Angioedema • Exposure to food or medicine just prior to attack
Cardiogenic	
Arrhythmias	• Very fast or very slow pulse • Irregular pulse
Cardiomyopathy	• History of HIV, peripartum, recent viral infection, hypertension • Displaced maximum cardiac impulse, extra heart sounds
Myocardial infarction	• Known ischaemic heart disease • Heavy or tight or crushing chest pain associated with nausea or sweating or radiating into arm or neck • Risk factors (smoking, age over 50, hypertension, diabetes)
Pericardial effusion or tamponade see pericardial effusion or tamponade in Section 3.1.4 on cardiogenic shock	• Risk factors (TB, HIV, malignancy) • Sharp sternal pain, worse lying flat • Quiet heart sounds • Distended neck veins
Valve disease	• History of rheumatic fever or heart disease • Murmur
Haemorrhagic	
Trauma with visible bleeding	• History of blunt or penetrating trauma • Visible bleeding
Trauma with internal bleeding (spleen, liver, femur or pelvic fractures)	• History of blunt or penetrating trauma • Major trauma and long bone fractures • Localized pain • Abdominal pain, tenderness, distension
Gastrointestinal bleeding (peptic ulcer, bleeding varices)	• Vomiting blood or melena • History of peptic ulcer disease • History of cirrhosis • Abdominal pain and tenderness

Ruptured ectopic pregnancy	• Pallor • Vaginal bleeding – mild (usually follows abdominal pain and missed period) • Pelvic or adnexal tenderness • May have mass • Positive pregnancy test (may be too early to detect pregnancy clinically)
Incomplete or septic abortion	• Heavy bleeding • Dilated cervix • Cramping or lower abdominal pain • Expulsion of products of conception • If septic abortion, purulent cervical discharge or foul-smelling vaginal discharge
Abruptio placentae	• Late stages of pregnancy • Abdominal pain • Uterus tender and tense • May occur after relatively minor trauma • May have fetal distress or fetal death
Placenta previa	• Late pregnancy • Fetal presenting part above the pelvis • May be precipitated by intercourse
Postpartum haemorrhage (PPH) see Quick Check page 51	• Recent childbirth and uterus not contracted (bleeding, usually immediately after childbirth) • Placenta may not be completely expelled • Secondary PPH also can occur from retained products • Consider traumatic PPH
Uterine rupture	• Severe abdominal pain (may decrease after rupture) • Bleeding may be vaginal or intra-abdominal • Abdominal distension, free fluid • Decreased or absent fetal movements, fetal distress, absent fetal heart sounds • Prior caesarean section, prolonged labour, or induction of labour
Ruptured abdominal aortic aneurysm	• Sudden, severe onset abdominal pain radiating to the back • Pulsatile abdominal mass • Peritonitis • Asymmetry (left to right) of femoral or distal leg pulses
Hypovolaemic	
Severe dehydration due to diarrhoea	• Profuse watery diarrhoea • Known outbreak or travel to area with cholera
Severe dengue	• Known recent cases of dengue, endemic area • Fever, headache, petechiae
Haemorrhagic fevers see Section 11.46	• Contact with known outbreak or endemic area • Fever, headache, dizziness • Bruising, bleeding from gastrointestinal or respiratory tracts
Poisoning see Section 3.8	• History of exposure • Organophosphate (pinpoint pupils, salivation, bradycardia, incontinence, anxiety, coma)
Burns see Section 3.10	• Severe burns

Pancreatitis	• Abdominal pain radiating to the back (duration more than 6 hours) • Vomiting • Known biliary stones (gallstones) or heavy alcohol use • Use of didanosine
Septic	
Septic shock	• Fever (temperature more than 38°C) or hypothermia (less than 36°C) • Warm extremities, bounding pulses (often not present) or weak, thready pulse and cold extremities when hypovolaemic from fluid shifts • Signs of infection: headache or neck stiffness (meningitis), severe rash, severe abdominal pain (peritonitis), cough or difficult breathing (pneumonia), painful urination or blood in the urine (pyelonephritis)
Obstructive	
Tamponade see pericardial effusion or tamponade in Section 3.1.4 on cardiogenic shock	• Risk factors (TB, HIV, malignancy) • Sharp sternal pain, worse lying flat • Quiet heart sounds, distended neck veins
Pulmonary emboli	• Sudden-onset shortness of breath, difficult breathing, pleuritic chest pain • Unilateral leg swelling • Haemoptysis • Tachycardia • Risk factor (long travel, prolonged sitting, recent surgery, recent long bone fracture, malignancy, sickle-cell disease)
Tension pneumothorax	• Sudden-onset shortness of breath, difficult breathing, pleuritic chest pain • History of trauma or chronic lung disease (e.g. emphysema) • Increased resonance on affected side of chest • Decreased breath sounds on side of pneumothorax • Deviated trachea away from pneumothorax
Endocrine	
Hypoadrenalism (Addisonian crisis)	• Fatigue, dizziness • Vomiting • Sudden cessation of long-standing steroid medications (or herbal remedies • containing steroids) • Recent precipitant – infection, surgery • Adrenal TB (fever, night sweats, loss of weight) • Hypoglycaemia • Hyponatraemia, hyperkalaemia
Neurogenic	
Acute spinal cord injury	• Acute trauma to the cervical or upper thoracic spine with paraplegia or quadriplegia • Slow pulse • Loss of muscle tone and reflexes during acute phase of the injury

General principles of managing patients with shock

- Give oxygen (see Quick Check pages 33–35).
- Give IV fluid rapidly (see Quick Check page 39 and specific fluid recommendations by type of shock in the sections which follow).
- Treat underlying cause.
- Consider vasopressors if SBP <90 and signs of inadequate perfusion after fluid resuscitation
- Monitor – record – respond (see Section 3.0).

Monitor – record – respond

In addition to the other clinical parameters that should be monitored in all severely ill patients, as described in Section 3.0, for patients in shock pay particular attention to the signs of perfusion and signs of fluid overload to help guide ongoing management.

- signs of inadequate perfusion
  - decreased urine output
  - altered mental status.
- signs of fluid overload:
  - worsening crackles (rales) on auscultation
  - dyspnoea
  - elevated JVP
  - peripheral oedema.

Management of specific types of shock

3.1.1 Manage haemorrhagic shock (see Quick Check page 19 and Section 4)

Haemorrhagic shock results from rapid loss of blood. A patient usually first will develop tachycardia and tachypnoea (compensated shock) and may not become hypotensive (uncompensated shock) until the condition is immediately life-threatening. Even with a SBP >90, suspect a patient is in haemorrhagic shock if there is bleeding or if there was a traumatic injury, and if there are signs of poor perfusion (e.g. cool, clammy, or mottled extremities, delayed capillary refill, sweaty, pallor, fast respiratory rate, confusion, restlessness).

Do not be falsely reassured that a patient with a normal blood pressure is stable if the patient has clinical signs of shock. In particular, young and previously healthy trauma patients will present in compensated shock, as they are able to maintain a normal blood pressure until they have lost up to 25% of their circulating blood volume. They will often appear very anxious and complain of thirst. It is essential to recognize and treat patients in compensated shock early to avoid increased morbidity and mortality.

Call for help from surgical consultant or senior clinician

- Manage airway (see Quick Check pages 29–32)
- Give oxygen for respiratory distress or SpO2 <90 (see Quick Check pages 33–35)

Identify source of bleeding

Common causes include trauma and postpartum haemorrhage. Patients may present with an obvious source of external bleeding (postpartum haemorrhage or laceration) or with less obvious internal bleeding (abdominal trauma, ruptured ectopic pregnancy). Pain may be referred to the shoulder or back when a patient has free fluid in the abdomen from haemorrhage.

Table: Examine the patient to identify the source and signs of bleeding

Source	Signs
Nose and mouth	Epistaxis (nose bleed), haematemesis (vomiting blood)
Lung	Decreased breath sounds suggests haemothorax
Abdominal	Distended, tense, tender abdomen suggests haemoperitoneum
Musculoskeletal	Long bone and pelvic fractures
Rectal	Melena, bright red blood suggest lower gastrointestinal bleed or massive upper gastrointestinal bleed
Vaginal (do not do vaginal exam in late pregnancy)	(See Quick Check pages 50–52)

Urgent investigations

- Hb and type and cross-match
- pregnancy in all women of childbearing age
- abdominal and pelvic ultrasound (may help to rapidly identify free fluid in the abdomen from abdominal trauma or ruptured ectopic pregnancy but usually cannot identify the source of bleeding; see Section 7.2.21).

Stop ongoing blood loss

- Apply direct pressure to stop obvious bleeding (see Quick Check page 47).
- Splint long bone or pelvic fracture (see Section 4.5.2 and Quick Check page 47).
- Place chest tube if suspect haemothorax (see Section 7.3.1 and Quick Check page 46).
- If vaginal bleeding,1 see Quick Check pages 50–52.
- When indicated, arrange for immediate definitive care to stop the bleeding, either in operating theatre (e.g. to stop haemoperitoneum from liver laceration) or with endoscopy (e.g. to stop upper gastrointestinal bleed from ulcer or varices) (see Quick Check page 48).

1 *Guidelines for the management of postpartum haemorrhage and retained placenta.* WHO (2009). Geneva, Switzerland. Available at http://whqlibdoc.who.int/publications/2009/9789241598514_eng.pdf 2

Restore circulating blood volume

For complete information on blood transfusion, see *The Clinical Use of Blood Handbook.*[2]

- During Quick Check (see page 29) the patient with shock was given 1–2 litres of LR or NS rapidly IV.
- Check that 2 large-bore (14 or 16 gauge) IVs are in place.
- If the patient continues to be in shock (SBP <90) or has signs of poor perfusion, give an additional 1–2 litres LR or NS fluid rapidly.
- If the patient fails to improve after 2 litres of IV fluids or there is only a transient improvement, give rapid safe blood transfusion (see Section 4) while arranging definitive care (if blood not immediately available, continue fluids while waiting).
- Place Foley catheter and monitor urine output.
- Keep the patient warm. This is very important to slow down the bleeding (for normal clotting factor function).

3.1.2 Manage hypovolaemic shock

Patients with shock from severe dehydration (e.g. cholera) will present with other clinical signs of severe dehydration, such as lethargy, depressed consciousness, sunken eyes, or skin pinch that goes back very slowly. Most patients with cholera can be rehydrated with oral rehydration salts (ORS), but those who have developed shock and are weak need intravenous hydration if they are not able to drink or able to drink only very little.

Treat patients with severe dehydration and shock from diarrhoeal disease according to Fluid Plan C guidelines (see Section 10.7).

- The preferred method of fluid resuscitation is by IV.
- During the first 30 minutes give 30 ml/kg LR or NS bolus. If still in shock, repeat bolus. (This includes the 1 litre bolus recommended in Quick Check for shock on page 29). Over next 2½ hours give 70 ml/kg.
- As in other causes of shock, monitor the patient every 30 minutes and titrate fluids according to response. If the patient remains in shock, give fluids at increased rates.
- Start ORS (about 5 ml/kg/hr) as soon as the patient can drink safely.

Note: If placement of IV is difficult or delayed, call for help from senior clinician to obtain alternate IV (see Quick Check page 29). While waiting, place a nasogastric tube for rehydration and give ORS 20 ml/kg/hr for 6 hours (total 120 ml/kg/hr). If there is vomiting or increasing abdominal distension, decrease the rate.

Other causes of hypovolaemic shock include extensive burns (a result of large insensible losses from burn areas) and severe dengue (a result of generalized leaking from vessels). For detailed guidance, see Section 3.10 for burns management, Section 3.1.5 for septic shock, and Section 11.9 for dengue.

2 *The clinical use of blood handbook*. WHO, 2002. Geneva, Switzerland. Guidelines are currently in revision. Available at http://www.who.int/bloodsafety/clinical_use/en/

3.1.3 Manage anaphylactic shock

- Give epinephrine (adrenaline) 0.5 ml 1:1000 IM (see Quick Check page 17) – 0.5 ml if 50 kg or above, 0.4 ml if 40 kg, 0.3 ml if 30 kg. May repeat every 5 minutes several times if no or incomplete response (patient remains in shock).
- Patients with recurring or persistent shock may require an epinephrine infusion (see the vasopressor table below for the dose).
- Give fluids rapidly.
- Manage airway. Give oxygen for respiratory distress or if SpO_2 <90 (see Quick Check pages 33–35).
- Give hydrocortisone IV 200 mg or prednisolone 50 mg orally.
- Additional management
  - Give antihistamine for itching and rash as available, e.g. chlorphenamine 10–20 mg IV over 1 minute (may be repeated), *promethazine 25 mg orally, or diphenhydramine* 25 mg orally. (These drugs may cause drowsiness.)
  - Other antihistamines or a H2-antagonist (e.g. *ranitidine*) may provide additional benefit.

3.1.4 Manage cardiogenic shock

- Help the patient assume a comfortable position.
- Give oxygen for respiratory distress or if SpO_2 <90 (see Quick Check pages 33–35).
- If there is evidence of pericardial tamponade, the patient will need urgent drainage (refer to pericardiocentesis in Section 7.2.12).
- Do an urgent ECG or use a cardiac monitor.
  - Assess for ST segment elevation or depression suggestive of myocardial infarction and treat appropriately.
  - Treat any serious arrhythmia.
- If there is no clinical evidence of fluid overload, give fluids cautiously (250–500 ml).
- If there is clinical evidence of fluid overload, consider vasopressors. See table on next page.

Table: How to administer peripheral vasopressors (in cardiogenic or septic shock)

Mechanism: Vasopressors work by vasoconstriction and increasing the contractility of the heart. Commonly available vasopressor medications include epinephrine (adrenaline) and dopamine.

Side-effects: There are many serious side-effects, notably tissue necrosis if the IV infiltrates, arrhythmias, and ischaemia to organs (skin, gut, kidneys). To minimize these risks, use the minimum dose possible to maintain the blood pressure (target SBP 90) and discontinue as soon the patient improves. Patients who are on a vasopressor infusion will commonly develop tachycardia. The extremities may become cool or cyanotic due to peripheral vasoconstriction.

Delivery: Vasopressors must be given carefully by intravenous infusion and are preferably given via a central venous catheter. However, central venous catheters should be placed only by a doctor who is skilled in the correct technique and at a hospital where this type of IV access is used frequently and personnel are familiar with its care. Central venous catheters are associated with significant risks, notably pneumothorax, arterial puncture, and blood infection. See other guidelines and the Adaptation Guide for instructions on using a central venous catheter. If central venous access is not possible, it is acceptable to deliver vasopressor medications through a peripheral line with appropriate precautions.

- Use the **largest vein possible** to deliver a high flow rate.
- Always dilute the medication and give by infusion at a **strictly controlled rate.**
- Use a metal gate-clamp in the IV rather than the integral roller device, which can become loose.
- Do not use the blood pressure cuff on the same arm through which the medication is infusing.
- Inspect the infusion site regularly to detect any extravasation of the medication into the tissues.

Stop the infusion if:

- the drip has infiltrated the tissues (e.g. severe pain and swelling at infusion site)
- the patient develops an arrhythmia (irregular pulse or dangerous tachycardia).

How to administer and titrate vasopressors

1. Does the patient have adequate perfusion?
First, check if vasopressors are indicated. If a patient remains in shock and has clinical signs of poor perfusion (low BP, low urine output, altered level of consciousness) after IV fluid resuscitation, consider the use of vasopressor medications to temporarily support the circulation. Some pregnant women, patients with chronic illness, and others may normally have a SBP <90 mmHg but be awake and alert, with normal mental status, normal capillary refill, and normal urine output. These patients may not need vasopressors to support blood pressure since they have no clinical signs of poor perfusion.

2. Choose a vasopressor and prepare the drip for infusion
In most settings the choice of vasopressor is determined by what is available. Become familiar with the dosing and administration of the locally available vasopressor to optimize patient safety and prevent medication errors. For most conditions leading to shock, there is no clear benefit of one vasopressor over the other. In cases of severe malaria, dopamine is preferred. The infusion should be dosed based on the patient's weight. If the patient cannot be weighed, estimate if the patient is small (50 kg), average (60 kg), large (70 kg). Use the table below to calculate the correct dose. Have a colleague double-check that you are administering the correct medication in the correct dose and to the correct site.

3. Monitor the patient and titrate
Frequent monitoring is required, as changes in pulse and blood pressure can occur very quickly. This may mean reducing or increasing the infusion rate within minutes of starting it. Continuous monitoring is preferred, but it is not available in many district hospitals. For the initial administration, start at the lowest rate and monitor pulse every minute and blood pressure every 2 to 5 minutes. If the SBP is still <90 mm Hg, increase the infusion rate. If the SBP is >90 mm Hg, decrease the infusion rate to the minimum dose necessary to maintain the blood pressure and adequate perfusion. For epinephrine, titrate the dose in 0.05 mcg/kg/minute increments. For dopamine, titrate the dose in 2 mcg/kg/minute increments.

If the IV site infiltrates, stop the infusion and start an infusion in a new IV site, preferably in the opposite arm. Monitor the skin. Keep the limb elevated. Patients whose IV line infiltrated while receiving vasopressors may develop skin necrosis and may require surgical debridement several days following the incident.

4. When to stop vasopressors
Vasopressors are intended for short-term use only, to allow other treatments to take effect. Continue to support the patient with intravenous fluids and blood as needed while the patient is on vasopressors. As the patient's clinical condition improves, titrate the vasopressors down. Discontinue the vasopressor infusion as soon as the patient can maintain an adequate blood pressure, and continue to monitor frequently.

How to give vasopressor by peripheral infusion

Vasopressor		**Peripheral epinephrine infusion**		**Peripheral dopamine infusion (preferred for shock in severe malaria)**		
Commonly available concentrations		1 amp = 1 mg epinephrine (adrenaline) in 1 ml*		1 amp = 200 mg dopamine in 5 ml*		
Target infusion concentration		10 micrograms per ml		1000 micrograms per ml		
Mixing procedure to create target infusion concentration		Use 2 amps in 200 ml normal saline** OR 10 amps in 1000 ml normal saline**		Use 1 amp dopamine in 200 ml normal saline** OR 5 amps dopamine in 1000 ml normal saline**		
		Epinephrine		**Dopamine**		
Dose rate***		0.05 mcg/ kg/ minute	0.2 mcg/kg/minute for very hypotensive	10 mcg/ kg/ minute	15 mcg/ kg/ minute	20 mcg/ kg/ minute
		Infusion rate (ml/hour)**				
Patient weight (kg)	**50 kg**	15 ml/hour	60 ml/hour	30 ml/hour	45 ml/hour	60 ml/hour
	60 kg	18 ml/hour	72 ml/hour	36 ml/hour	54 ml/hour	72 ml/hour
	70 kg	21 ml/hour	84 ml/hour	42 ml/hour	63 ml/hour	84 ml/hour

* 1 milligram (mg) is equal to 1000 micrograms (mcg).
** Read ampoule label **3 times** to confirm concentration before mixing.
*** Desired dose rate is weight-based.
**** Infusion rate is commonly presented per hour. Infusion rate = desired dose rate or concentration of the infusion.

3.1.5 Manage septic shock

CLINICAL DIAGNOSIS of severe sepsis or septic shock

Suspected infection plus
Hypotension (systolic blood pressure <90 mmHg) plus
One or more of the following:
- pulse >100 per minute
- respiratory rate >24 breaths per minute
- abnormal temperature (<36°C or >38°C).

Use the flowchart on the following pages for specific guidance on the management of septic shock and severe respiratory distress from suspected pneumonia or acute lung injury. It is arranged by hours, starting from patient arrival, and uses a systematic approach, for the recognition of problems, giving oxygen and fluids, and how to monitor, record, and respond to findings, for both septic shock and

severe respiratory distress without shock (described in detail in Section 3.2.4). These basic recommendations apply to many etiologies of septic shock. Below is more detailed information about these basic interventions. The Table, Modified management of septic shock associated with certain infections, below, gives treatment modifications for specific causes of septic shock.

Give fluids rapidly

- After the initial 1000 ml LR or NS bolus (see Quick Check), continue LR or NS at 20 ml/kg/hour, not to exceed a maximum of 60 ml/kg in the first 2 hours (including the initial bolus).
- Monitor SBP and clinical signs of perfusion (urine output, mental status).
- Consider adding vasopressors if SBP remains <90 and signs of poor perfusion continue after fluid resuscitation (estimated 60 ml/kg) even within first 2 hours.
- At 2–6 hours, if SBP remains below 90 and signs of poor perfusion continue, continue fluids at 5–10 ml/kg/hour.
- At 2–6 hours, if SBP rises above 90, continue fluids at 2 ml/kg/hour. However, if the pulse is still high and there are other signs of poor perfusion, patient may still be volume-depleted and need more fluids.
- Watch carefully for signs of fluid overload (increased JVP, increasing crackles or rales on auscultation). If present, decrease the rate of fluid administration.

In a pregnant woman with shock, it is particularly important not to delay initiation of vasopressors if fluid resuscitation is failing, to improve perfusion and to maintain fetus perfusion.

Give empirical IV antimicrobials within the first hour. This is crucially important (see Quick Check page 43)

- **Antibiotics:** Urgently administer broad spectrum antibiotics by IV. Take blood cultures before antibiotics, but do not delay treatment.
  - Choice of antibiotics depends on presence of signs of local infection, local patterns of disease, and availability of antibiotics.
  - If community-acquired pneumonia is suspected, refer to your national or institutional guidelines. Common choices include: ceftriaxone (1 gram daily IV) or ampicillin 2 grams every 4 hours plus gentamicin 1.5 mg/kg IV every 8 hours, plus either a macrolide or a respiratory fluoroquinolone.
  - If TB is suspected (see below) or if treating a pregnant patient, limit fluoroquinolone use if there are alternative antibiotics available.
- **Antimalarials:** Malaria should be suspected both in areas with malaria transmission and in travellers returning from malarious areas (see Quick Check page 43 and Section 11.25). Start antimalarials immediately and then test for malaria by microscopy as soon as possible (if not immediately available, a malaria RDT can be performed while waiting for the result of the blood slide).
- **Antivirals:** if suspect influenza, give antiviral. See Quick Check page 43 and Section 11.17.[3]

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3 *Guidelines for pharmacological management of pandemic (H1N1) 2009 influenza and other influenza viruses.* WHO, 2010. Available at http://www.who.int/csr/resources/publications/swineflu/h1n1_use_antivirals_20090820/en/index.html

Consider TB especially in PLHIV (see Section 15): Patients with HIV-related pulmonary and extrapulmonary TB are at high risk of rapid clinical deterioration and death.[4]

Perform all appropriate TB investigations (see Section 15) and recommend HIV testing. If available, promptly obtain nationally or WHO-approved molecular testing, e.g. Xpert MTB/RIF, per national guideline recommendations. Otherwise, send sputum for AFB smear and obtain a chest X-ray; if smear negative or suspected MDR/TB send sputum for culture. Perform clinical (and further diagnostic) assessment for extrapulmonary TB (see Section 15).

Consider early empirical antituberculous treatment in critically ill PLHIV if, based on suggestive radiograph or clinical judgment, there is high suspicion for disseminated TB-causing shock.

Consider disseminated TB especially if there is malnutrition and weight loss. In some PLHIV with septic shock, this may mean simultaneous treatment for TB and bacterial infection. Consult with senior clinician.

Identify the source of infection

- Use other sections of this manual organized by main signs or symptoms to identify the source of infection.
- Identifying the source of infection should not delay delivery of supportive treatments and empirical antibiotics.
- Try to make a microbiological or anatomical diagnosis. Initial laboratory examinations may include:
  - urine dipstick or microscopy for leukocytes (see Section 7.2.16)
  - malaria test
  - AFB smear and culture of sputum
  - chest X-ray
  - Gram stain
  - blood culture.
- If a specific diagnosis is made (e.g. pneumonia, dengue shock syndrome), use established principles for treating those conditions.

Other initial laboratory investigations include

- Glucose – hypoglycaemia is a manifestation of severe sepsis.
- BUN and creatinine – acute kidney injury is also a manifestation of severe sepsis.
- Hb or Hct
- electrolytes.

The flowcharts on the following pages describe specific management by hours after arrival for recognition of problems, oxygen and fluid administration, and how to monitor, record, and respond to findings for both septic shock and severe respiratory distress without shock (described in detail in Section 3.2.4). These two clinical pathways have similar interventions but different fluid recommendations. These basic recommendations apply to many etiologies of septic shock, with some differences, as summarized in the following table.

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4 *Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents. Recommendations for HIV-prevalent and resource-constrained settings.* WHO, 2007. Available at http://whqlibdoc.who.int/hq/2007/WHO_HTM_TB_2007.379_eng.pdf

Table: Modified management of septic shock associated with certain infections	
Suspected etiology	**Modifications or additions to septic shock guidelines**
Dengue[5] see Section 11.9	• For dengue patients in shock, fluids differ from the general recommendations for septic shock. Fluid management rate for dengue is lower, at 20 ml/kg in the first hour (including the initial bolus), with careful monitoring; then 20 ml/kg in the next hour. This would total 40 ml/kg over the first 2 hours, rather than the 60 ml/kg in the first 2 hours for other patients with septic shock. • Haematocrit should be monitored frequently. • Watch carefully for signs of fluid overload. If fluid overload develops, see Sections 3.2.5 and 11.9. Note that severe dengue with shock can manifest either as compensated shock (SBP maintained but signs of poor perfusion) or as uncompensated shock (SBP low). Fluid therapy (amount and rate) depends on which type of shock (see Section 11.9).
Severe malaria see Section 11.25[6]	• Give antimalarials. • Severe malaria often is associated with bacteraemic sepsis (in particular Gram-negative bacteria). Give broad-spectrum antibiotics (ampicillin plus gentamicin, or ceftriaxone). • Fluids, other supportive care are the same. Follow flowchart on following pages. • Watch carefully for signs of pulmonary oedema and volume overload (cough, fast respiratory rate, shortness of breath, hypoxaemia, increased JVP, rales on auscultation). • In the calculation of 60 ml/kg total in the first 2 hours, include the fluids used to administer antimalarials. • If pulmonary oedema develops, see Section 3.2.5. Stop fluids and use vasopressors to support circulation (dopamine is preferred).
Tuberculosis see Section 15	• Give antituberculous medications early if patient has TB or high suspicion for TB in severely ill patient. Call for help in this decision from senior clinician. • Fluids, other supportive care are the same. Follow flowchart on following pages.
Severe pneumonia see Sections 3.2.3 and 10.6	• Antibiotics may differ depending on suspected etiology; see Section 3.2.3. • Influenza -specific antiviral if suspect influenza. • If empyaema, drain. • Fluids, other supportive care are the same. Follow flowchart on following pages.
Suspect amnionitis during pregnancy see *IMPAC MCPC*[7]	• Add metronidazole to ampicillin and gentamicin. • Fetal monitoring; consider delivery. • Keep patient on left side. • Fluids, other supportive care are the same. Follow flowchart on following pages.

5 *Dengue guidelines for diagnosis, treatment, prevention and control – New edition.* WHO, 2009. Chapter 2: Clinical management and delivery of clinical services. Available at http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf

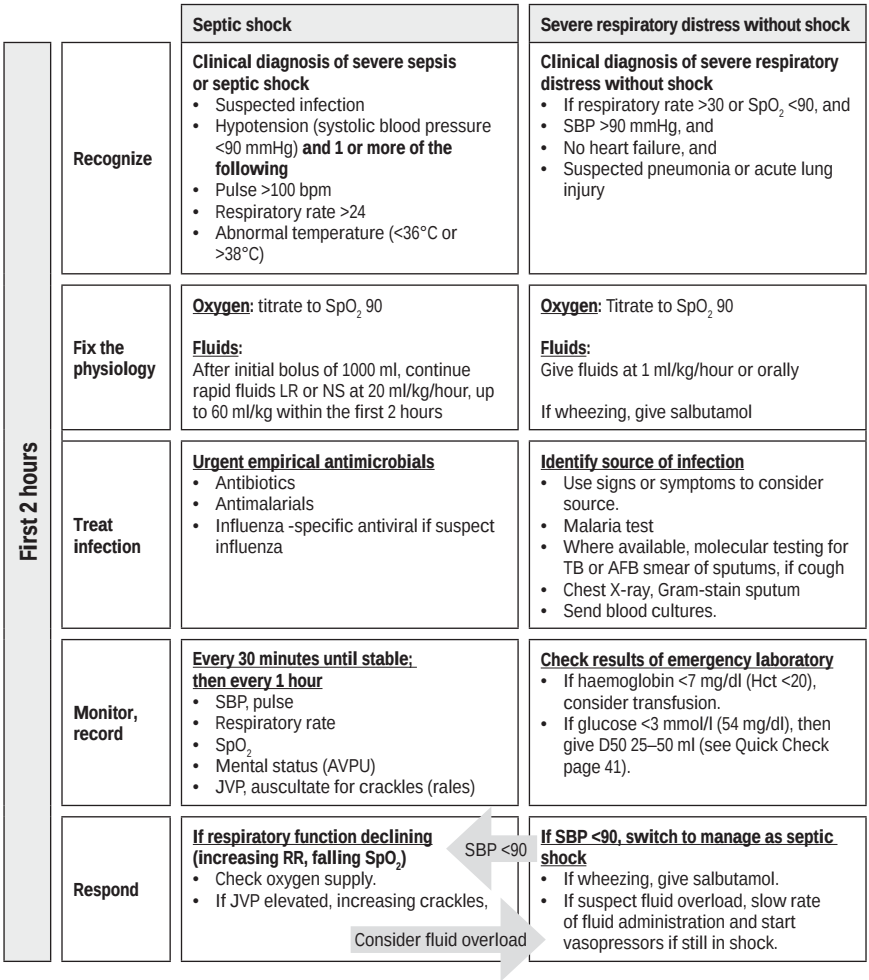
6 *Guidelines for the treatment of malaria, 2nd edition.* WHO, 2010. Chapter 8: Treatment of severe P. falciparum malaria. Available at http://whqlibdoc.who.int/publications/2010/9789241547925_eng.pdf

Suspected etiology	Modifications or additions to septic shock guidelines
Postpartum sepsis or septic abortion see Section 10.15 and *IMPAC MCPC*[7]	• Add metronidazole (or clindamycin) to ceftriaxone, or give ampicillin plus gentamicin. • Evacuate uterus if there are retained products. • Fluids, other supportive care are the same. Follow flowchart on following pages.
PID[8], pelvic or tubo-ovarian abscess see Section 10.15 and *IMPAC MCPC*[7]	• Give ceftriaxone plus doxycycline; OR clindamycin plus gentamicin. • May need urgent surgery if suspect ruptured tubo-ovarian abscess. • Fluids, other supportive care are the same. Follow flowchart on following pages.
Pancreatitis, peritonitis, surgical abdomen or abscess, cholangitis, ruptured appendicitis, etc. see Section 10.7	• Call for help from surgical consultant to possibly drain abscess or perform other surgical interventions as needed. • Fluids, other supportive care are the same. Follow flowchart on following pages.
Viral haemorrhagic fever see Section 11.46	• IV ribavirin may be effective against arenaviridae (the South American haemorrhagic fevers and Lassa fever) and bunyaviridae (Crimean-Congo haemorrhagic fever, hantaviruses); consult with national programme and experts on its use. • See 6.13 for infection control. • Fluids, other supportive care are the same. Follow flowchart on following pages.

7 *Managing complications in pregnancy and childbirth: a guide for midwives and doctors.* WHO, 2003. Available at: http://www.who.int/making_pregnancy_safer/publications/archived_publications/mcpc.pdf

8 *Guidelines for the management of sexually transmitted infections.* WHO, 2003. Updated 2011 version currently in print. Available at http://www.who.int/hiv/pub/sti/en/STIGuidelines2003.pdf

Flowchart: Management of septic shock and severe respiratory distress without shock



		Septic shock	Severe respiratory distress without shock
2–6 hours	**Recognize**	**Reconsider diagnosis if no change in SBP following fluid boluses.** **Establish source of infection**	**If poor response, reconsider** pneumothorax, pleural effusion, heart failure, poisoning, TB, and PCP associated with HIV.
	Fix the physiology	**Oxygen:** titrate to SpO_2 90 **Fluids:** • If SBP >90, continue fluids at 2 ml/kg/hour. • If SBP <90 at 2 hours or later, start vasopressors and continue fluids at 5–10 ml/kg/hour.	**Oxygen:** Titrate to SpO_2 90 **Fluids:** Give fluids at 1 ml/kg/hour or orally If wheezing, give salbutamol
	Treat infection	**Drain surgical infection if required.**	**Consider source of infection.** **Review results of investigations.**
	Monitor, Record	**Every 30 minutes until stable; then every 1 hour** • SBP, pulse • Respiratory rate • SpO_2 • Mental status (AVPU) • JVP, auscultate for crackles (rales)	**Every 6 hours** • Temperature • Urine output • Repeat glucose and Hb if initial values abnormal.
	Respond	**If respiratory function declining (increasing RR, falling SpO_2)** • Check oxygen supply. • If JVP elevated, increasing crackles,	SBP <90 **If SBP <90, switch to manage as septic shock and give 1000 ml IV.** **If respiratory function declining (increasing breathlessness, increasing RR, or SpO_2 <90)** • Check oxygen supply and increase flow rate if possible. • If wheezing, give salbutamol. • Check that antimicrobials have been given. Consider broader antimicrobial cover. • Consider other diagnoses or infections; see above. • If signs of fluid overload, SBP >100, and shock resolved, stop IV fluids, give furosemide 20 mg IV, and raise head of bed.
			Consider fluid overload

6–24 hours

	Septic shock	Severe respiratory distress without shock
Recognize	**Reconsider diagnosis if no change in SBP following fluid boluses.** **Establish source of infection.** **Consider surgical cause: is drainage required?**	**If poor response, reconsider** • pneumothorax • pleural effusion • heart failure • poisoning • TB • PCP associated with HIV
Fix the physiology	**Oxygen:** titrate to SpO_2 90 **Fluids:** • When SBP >90, continue fluids at 2 ml/kg/hour. If on vasopressors, reduce rate. • If SBP <90, continue or increase vasopressors and continue LR or NS at 2 ml/kg/hour.	**Oxygen:** Titrate to SpO_2 90 **Fluids:** • Continue at 1 ml/kg/hour or orally. • If wheezing, give salbutamol.
Treat infection	**Continue empirical antimicrobials – next dose** • Antibiotics • Antimalarials (if malaria tests are positive) • Antiviral if suspect influenza	
Monitor, Record	**Every hour if SBP <90 or on vasopressors; otherwise every 2 hours** • SBP, pulse • Respiratory rate • SpO_2 • Mental status (AVPU) • JVP, auscultate for crackles (rales)	**Every 6 hours** • Temperature • Urine output • Repeat glucose and Hb if initial values abnormal.
Respond	**Respond to changes as indicated for 2–6 hours on previous page.**	

Post-resuscitation

	Septic shock	Severe respiratory distress without shock
Recognize	**Perform full reassessment.** **Review available diagnostic data and treat underlying diagnosis.** Evidence of a primary cardiac or pulmonary process? Switch to its specific management.	**If poor response, reconsider** • pneumothorax • pleural effusion • heart failure • poisoning • TB • PCP associated with HIV
Fix the physiology	**Oxygen:** Titrate to SpO_2 90 and discontinue when 90 on room air. **Fluids:** Reduce to maintenance maximum 2 ml/kg/hour and switch to oral when patient is able to take.	**Oxygen:** Titrate to SpO_2 90 and discontinue when 90 on room air. **Fluids:** oral when able to take If wheezing, give salbutamol.
Treat infection	**Continue antimicrobials – switch to oral dose** • Antibiotics • Antimalarials (give IV antimalarials for at least 24 hours total before switching to oral) • Antiviral if suspect influenza	
Nutrition	**Procedures to follow once the patient has stabilized, or after 1–2 days** • Due to risk of aspiration, do not give food orally if patient cannot safely swallow, (due to, e.g. altered mental status, severe shortness of breath, or severely ill with ongoing vomiting). • All other patients should be provided with food. Most patients lose their appetite when ill and may find soft foods and fluids easier to tolerate. Small frequent meals often are tolerated better. • Consider NG feeding using pureed foods if the patient cannot swallow safely. • In severely ill patients give a small amount initially (e.g. 20–40 ml/hour) and monitor NG aspirates to check for absorption. • Increase rate of feeding as tolerated.	
Monitor, Record	**Every 8 hours (check SBP hourly if weaning off vasopressors); then daily** • SBP, pulse • Respiratory rate • SpO_2 • Mental status (AVPU)	
Respond	**Respond to changes as indicated for 2–6 hours on previous page.**	

3.2 Severely ill patient with difficulty breathing

In this section:

3.2.1 Approach to severely ill patient with difficulty breathing

Check again for evidence of life-threatening causes of respiratory failure that may be rapidly reversible.

Quick Check identifies emergency signs of airway and breathing difficulties, and provides instructions for initial emergency management, including:

- choking and upper airway obstruction
- anaphylaxis
- pneumothorax
- overdose of opioids or other sedative drugs
- organophosphate poisoning
- severe bronchospasm (asthma, COPD).

Remember, upper airway obstruction is always an emergency and should be treated immediately.

The instructions for managing the airway, giving oxygen and salbutamol are in Quick Check, pages 33–37.

Severely ill patients may present with difficulty breathing because of a primary problem with the respiratory system (lung tissue, airways, or respiratory muscles), cardiac system, or a systemic disease.

General signs of severe respiratory distress

- very fast or very slow respiratory rates
- use of accessory muscles to breathe (neck, intercostal, or abdominal muscles)
- inability to speak complete sentences
- cyanosis
- depressed level of consciousness.

For clinical purposes there are four categories of severe respiratory distress

	Respiratory	Cardiac	Blood	Drug toxicity
Common	Pneumonia • bacterial • influenza • PCP Pleural effusion COPD Asthma	Pulmonary oedema (acute heart failure)	Anaemia	Opioid Organo-phosphate
Less Common	Pulmonary embolism *Pneumothorax Acute lung injury (malaria, severe sepsis, TB)	*Tamponade (traumatic, malignancy, TB)	Acidosis (malaria, diabetic ketoacidosis)	ART (lactic acidosis)

* Although not common, these conditions need to be identified rapidly because they require an urgent therapeutic procedure.

Carry out a thorough history and physical examination to develop a differential diagnosis and to prioritize treatments and interventions.

History

- rapidity of onset (over days or weeks or within minutes)
- description of trouble breathing (at rest, with exertion, worse when lying down, wakens from sleep)
- associated symptoms (dry or productive cough, fever, chest pain, peripheral oedema, weight loss, night sweats)
- pre-existing diseases or medication use
  - ° lung problems (COPD, severe asthma, previous severe pneumonia)

- heart problems (myocardial infarction, hypertension, cardiomyopathy, heart failure, chest pain)
- systemic illnesses (diabetes, HIV, TB, cancer)
- medications (ART)
- recent opioid drug use
- tobacco use

- previous surgical or trauma history
  - recent trauma or bite
  - recent period of immobility.

Examination

Do a focused examination to identify likely causes.

Neurological

- constricted pupils (opioid overdose) or depressed mental status (suspect intoxication)

Respiratory

- stridor, swollen tongue, airway oedema (suspect upper airway obstruction)
- trachea pushed or pulled to one side (suspect tension pneumothorax)
- pattern of breathing
  - prolonged expiration time (suspect asthma or COPD)
  - deep, laboured breathing (suspect systemic acidosis)
  - small, rapid breaths (suspect severe pneumonia, acute lung injury, muscle weakness)
- quality and distribution of breath sounds
  - decreased air entry on auscultation
  - bibasilar crackles (suspect pulmonary oedema)
  - bronchial breath sounds (suspect consolidation from pneumonia)
  - wheeze (if wheezing, classify severity – see Section 3.2.4)
- percussion
  - dullness (suspect pleural effusion)
  - hyper-resonance (suspect bullae or pneumothorax)

Cardiovascular

- blood pressure (may be high, low, or normal depending on cause and severity)
- pulse (rhythm, rate, and volume)
- heart sounds soft or muffled (suspect pericardial effusion)
- extra heart sounds (suspect cardiomyopathy)
- loud murmurs (suspect valvular heart disease, endocarditis)
- distended neck veins and peripheral oedema (suspect fluid overload)

Metabolic

- sweet breath, smells of ketones (suspect diabetic ketoacidosis)
- haematologic
- pallor (suspect anaemia).

Urgent investigations include:

- Pulse oximetry to measure SpO_2, chest X-ray, haemoglobin, and HIV test (if status unknown).
- If fever, send blood cultures and other specimens for culture as clinically indicated.
- If suspect malaria, do a malaria test (microscopy with or without RDT).
- If suspect TB, do molecular testing with a nationally or WHO-approved technology, e.g. Xpert MTB/RIF, if available. Otherwise, send sputum for AFB smear and culture and other diagnostic assessment if suspect extrapulmonary TB. Send for culture if suspect MDR-TB.
- If wheezing, check peak flow.
- If suspect volume overload, check creatinine and potassium.
- If suspect cardiac problem, check ECG to evaluate ischaemia (ST segment elevations or depressions) or arrhythmias and perform limited echocardiography to evaluate cardiac function, mitral stenosis, or pericardial effusion.

Differential diagnosis of respiratory distress

DDx: Upper airway obstruction

Requiring urgent treatment	In favour
Choking see Quick Check page 27	• Very sudden onset • Cyanosed • Grasping at neck, eating just prior to attack
Anaphylaxis see Quick Check page 17	• Swollen neck or tongue • Wheeze and stridor • Urticaria or red rash • Angioedema • Exposure to food or medicine just prior to attack.
Severe upper airway infection (pharyngeal abscess, diphtheria, peritonsillar abscess, epiglottitis)	• Gradual onset • History of sore throat • Swelling and redness visible in lower pharynx • Drooling
Upper airway trauma	• History of trauma to face or neck
Inhalation burns see Section 3.10	• Burns around mouth and nose • Singed facial or nasal hair • Hoarseness, rasping cough • Stridor • Soot in the sputum • Evidence of glottic oedema
Ingestion of acid or alkaline substance see Section 3.8	• Pain in mouth or throat with swallowing, drooling, vomiting blood • Hoarse voice, stridor • Upper airway obstruction, aspiration pneumonia • Shock, renal failure
Inhalation of airway irritant (e.g. chlorine) see Section 3.8	• Cough, respiratory distress, chest pain • Burning sensation in throat, ocular or nasal irritation • Upper airway oedema, laryngospasm, acute lung injury

DDx: Severely ill patient with difficulty breathing not due to upper airway obstruction

Requiring urgent treatment	In favour
Pneumothorax see Quick Check page 46	• History of trauma, emphysema, or asthma • Very sudden shortness of breath • Chest pain • Increased resonance on one side, normal on the other • Decreased breath sounds on one side • Suspect tension if deviated trachea, low blood pressure or weak pulse • Decreased SpO_2
Cardiac tamponade see Section 7.4.5	• History of tuberculosis (fever, weight loss) or malignancy • Distended neck veins (increased JVP) • Distant heart sounds, tachycardia, weak pulse • Ultrasound can confirm diagnosis
Common causes	
Pneumonia (may be viral, bacterial, or opportunistic) see Section 3.2.3	• Fever, cough • Suspect community-acquired pneumonia if pleuritic pain, bronchial sounds • Suspect PCP if dry cough, HIV-infected, chest clear (see Section 10.6) • Suspect TB if productive cough, fever, weight loss, haemoptysis (see Section 15)
Lower airways obstruction (asthma, acute exacerbation of COPD) see Section 3.2.4	• Wheeze (or silent chest with cyanosis) • Use of respiratory accessory muscles of prolonged expiration and hyperinflation • Altered level of consciousness • Speaks only few words at a time
Pulmonary oedema (fluid overload from acute heart failure, renal failure)	• Frothy sputum, bilateral crackles • Distended neck veins, bilateral lower extremity oedema • Known cardiomyopathy, hypertension, recent myocardial infection • Peripartum • Suspect cardiomyopathy (tachycardia, extra heart sounds, displaced impulse) • Suspect valvular heart disease if loud murmurs • History of renal dysfunction
Severe malaria see Section 11.25	• Fever • Known endemic area or travel to area with malaria • Acute lung injury (non-cardiogenic pulmonary oedema) • Metabolic acidosis
Severe anaemia	• Pale (conjunctivae, palmar creases) • Recent heavy blood loss • AZT use • Severe malaria
Less common causes	
Pulmonary embolism	• Sudden onset shortness of breath, difficulty breathing • Sudden onset pleuritic chest pain • Unilateral leg swelling • Haemoptysis • Tachycardia • Risk factors (long travel, prolonged sitting, recent surgery, recent long bone fracture, cancer)
Pleural effusion	• History of tuberculosis • History of cancer

Requiring urgent treatment	In favour
Acute lung injury (non-cardiogenic pulmonary oedema) see Section 3.2.3	• Bilateral pulmonary infiltrates on chest X-ray • Severe and rapidly progressive hypoxaemia • No clinical evidence of fluid overload from poor cardiac function • Known predisposing condition (severe sepsis, pneumonia, pancreatitis, aspiration, blood transfusion) • In pregnancy: tocolytic medication, pre-eclampsia, amniotic fluid, embolism, sepsis, and severe haemorrhage
Metabolic acidosis (with hyperventilation to compensate)	• Clear chest on auscultation • Evidence of an underlying problem resulting in metabolic acidosis (diabetic ketoacidosis, severe sepsis, lactic acidosis, uraemia, intoxication with methanol or ethylene glycol)
Opioid intoxication see Sections 3.6 and 17	• Depressed respiratory rate or respiratory arrest • Acute lung injury • Pinpoint pupils • Known opioid user, track marks, or evidence of injecting equipment at the scene • Slurred speech, drowsiness • Unsteady gait
Organophosphate poisoning see Section 3.8	• Pinpoint pupils • Salivation, excess secretions • Bronchospasm, increased respiratory secretions • Coarse crackles, aspiration • Sweating • Bradycardia • Incontinence, defecation • Anxiety or coma
Alcohol or sedative intoxication **s**ee Section 3.7	• Depressed respiratory rate • Slurred speech • Unsteady gait • Smell of alcohol on breath • Evidence of medication containers or bottles of alcohol at the scene
Poisoning see Section 3.8	• History of exposure (inhalation) or ingestion (e.g. overdose) • If hyperventilation, suspect ingestion that causes acidosis (e.g. pesticides, ethylene glycol, methanol) or aspirin. • If crackles (rales) on auscultation, suspect aspiration (associated with depressed mental status) or acute lung injury (e.g. paraquat, carbon monoxide, chlorine). • If wheezing, suspect inhalation of irritant (e.g. chlorine) or organophosphate. • If slow respiratory rate or arrest, suspect opioid, sedative, carbamazepine.
Disseminated Kaposi sarcoma see Section 11.19	• Kaposi sarcoma lesions – purplish nodules on skin and palate
Drug reaction see Section 10.2	• Recent initiation of new medicine, particularly antiretrovirals (abacavir, nevirapine), cotrimoxazole • Skin rash
Respiratory muscle weakness (Guillain-Barré syndrome or botulism – see Section 10.10a, snake-bite – see Section 3.9	• Rapid, shallow breathing • History of snake bites, poisoning • Ascending weakness (Guillain-Barré syndrome) • Decreased reflexes • If weakness of facial muscles, trouble swallowing (botulism)

Obtain a chest X-ray to assist with narrowing the differential diagnosis

Table: Characteristic findings on a chest X-ray for common diseases	
Diagnosis	**Chest X-ray finding**
Pneumothorax	• There is a radiolucent area with absence of lung markings and a defined edge to the collapsed lung.
Cardiac tamponade	• Pericardial effusions are difficult to see on chest X-ray. Most obvious is the shape of the heart—a more rounded, globular shape—and a rapid increase in the cardiac shadow.
Bacterial or viral pneumonia	• Segmental or lobar consolidation
PCP	• Normal, or ground glass appearance, with nodular elements that can be confluent and consolidate.
Tuberculosis	• Varies from bilateral upper lobe consolidation to widened mediastinum with hilar lymphadenopathy, to cavitation and miliary nodules bilaterally. • Scarring, fibrosis, nodular opacities, pleural effusions, and collapse.
COPD or asthma exacerbation	• Can be normal or have large-volume lungs, flattening of the diaphragms, bronchial wall thickening, more obvious bronchovascular markings
Pulmonary oedema (acute heart failure)*	• Cardiomegaly, accumulation of fluid in the lung interstitium (diffuse fluffy opacities) progressing into consolidation, where air bronchogram can be seen. • Upper lobe diversion (dilated pulmonary veins). • May present with effusions bilaterally
Acute lung injury (non-cardiogenic)	• Bilateral infiltrates, no specific distribution • Heart size is normal.
Pleural effusion	• Blunted costophrenic angle, curved upper margin of the meniscus • Mediastinal shift
Metabolic acidosis	• Normal if cause is not pulmonary in origin.
Pulmonary embolism	• Usually normal. Some may have a wedge-shaped infracted area that might cavitate, a pleural effusion, atelectasis, or paucity of lung markings in the vicinity of the pulmonary embolus.

* Chest X-ray signs of pulmonary oedema may be difficult to interpret when radiographs are of variable quality and projection is an anterior-posterior view (e.g. heart may appear misleadingly large).

3.2.2 Provide initial emergency management for all severely ill patients with difficulty breathing

General principles of managing a patient with difficulty breathing

Manage airway . . . . . Quick Check pages 29–32
Give oxygen . . . . . Quick Check pages 33–35
If wheezing, give salbutamol . . . . . Quick Check page 37

Position patient in most comfortable position for breathing
Identify and treat cause

Monitor – record – respond . . . . . Section 3.0

Manage airway (see Quick Check pages 29–32)

Manage upper airway obstruction

When the upper airway is blocked, either from swelling of the airway caused by anaphylaxis or trauma, or from aspiration of a foreign object, the obstruction must be relieved. If basic airway interventions and emergency treatments fail to relieve obstruction or if it is likely that swelling will worsen (e.g. trauma, infection), then consider advanced airway management (see Quick Check page 32). If not trained in these interventions, call for help from a more senior clinician. This must be done quickly before progression to complete obstruction. In rare cases, such as direct airway trauma or a massive goitre compressing the trachea, a surgical procedure called a cricothyrotomy (emergent) or tracheotomy may be necessary to bypass the obstruction. If epiglottitis is suspected, antibiotics to cover *H. influenzae* (ceftriaxone or chloramphenicol) should be promptly administered after the airway is secured.

Give oxygen for hypoxaemia

Oxygen is necessary to maintain normal tissue and organ function. Suspect hypoxaemia (inadequate blood oxygen level) if the patient has respiratory distress or evidence of tissue or organ hypoxia, such as altered mental status or cyanosis. A measured SpO_2 of <90 confirms hypoxaemia. Give oxygen to all patients with suspected or confirmed hypoxaemia. Use a systematic approach to deliver increasing oxygen therapy (see Quick Check pages 34–35) and to assess for potential technical problems that may be encountered.

Hypoxaemia can result from the abnormal function of any component of the respiratory system.

- Bronchospasm (airway constriction and inflammation) causes reduced ventilation of lung areas and may result in mild to moderate hypoxaemia that usually responds to oxygen therapy.
- Filling of alveolar tissue with inflammatory cells (pneumonia) or fluid (pulmonary oedema) can cause an absence of ventilation of lung areas. Blood leaves these areas without the uptake of oxygen resulting in moderate to severe hypoxaemia. The more diffuse the alveolar filling process, the more severe the hypoxaemia and the less likely it is to respond to oxygen therapy alone.
- Abnormalities of the blood supply to the lungs (pulmonary embolus, pulmonary hypertension, or shock) can also cause hypoxaemia.
- Weakness of the respiratory muscles (tetanus, botulism, Guillain-Barré syndrome) and other causes of inadequate ventilation (e.g. drug overdose, snake bites) can cause hypoxaemia, which will improve with oxygen therapy, but assistance with ventilation is needed.

Most patients with hypoxaemia will improve when they are given oxygen. For those patients who do not respond to high flow oxygen (still in severe distress or SpO_2 <90), consider advanced airway management (see below).

Assist ventilation if ineffective breathing

Inadequate ventilation occurs when a patient has a low respiratory rate or inadequate breath volumes. A decreased respiratory rate can result from a central nervous system cause, such as an opioid overdose, stroke, or head trauma. Patients with weakness of the respiratory muscles, as seen with tetanus or botulism, also

can develop inadequate ventilation because breaths are small. In patients with COPD and asthma, severe bronchospasm leads to inadequate ventilation because air cannot be exhaled from the lungs and the patient has to use accessory muscles to breathe.

If left untreated, inadequate ventilation will result in the accumulation of carbon dioxide and acid levels in the blood, and the patient will develop an alteration in mental status or depressed level of consciousness. Inadequate ventilation is a clinical diagnosis if you cannot measure carbon dioxide and acid levels in the blood. The patient commonly also has hypoxaemia. If a patient with signs of inadequate ventilation develops an altered mental status or depressed level of consciousness, then assume the patient has progressed to acute respiratory failure but also exclude other rapidly reversible causes (e.g. hypoglycaemia).

For patients with inadequate ventilation, temporarily assist with BVM ventilation using high flow oxygen (see Quick Check pages 34). For certain drug overdoses, this can be done temporarily as antidotes are administered (such as naloxone for short-acting opioid overdose) until the patient awakens. For those patients who need continued assistance with ventilation, consider advanced airway management for the following conditions.

- For easily reversible conditions (e.g. long-acting opioids, other drug overdoses, poisoning, or snakebite where up to several days of ventilatory problems are anticipated), consider advanced airway management if manual ventilation is possible locally.
- For conditions that are not easily reversible and may likely require longer term ventilatory support (e.g. severe bronchospasm, progressive neuromuscular weakness, acute lung injury), intubation should be done if transfer is possible to a hospital where skilled invasive mechanical ventilation is available. Manual ventilation for some of these conditions (e.g. severe bronchospasm) can be challenging because the lungs are very abnormal (see Section 3.2.4).

Identify and treat underlying cause(s)

After giving emergency treatments (e.g. oxygen for severe respiratory distress), it is now time to treat the underlying cause(s). To do so, take a more detailed history, perform a physical examination, and use the differential diagnosis table (DDx: Severely ill patient with difficulty breathing that is not upper airway obstruction) and clinical reasoning (Section 1.6) to identify the most likely and most serious diagnoses. Specific treatments for the most likely and most serious diagnoses need to be initiated urgently (if not yet done) and continued. Appropriate laboratory investigations and a chest X-ray may assist in narrowing the differential diagnosis. Do not delay appropriate treatments while awaiting these results. In particular, a chest X-ray can be very useful as many diseases have characteristic radiographic findings (see Section 3.2.1), but may not be immediately available. Remember, the patient may have more than one disease process (e.g. pneumonia and severe bronchospasm), so it is important to identify the most likely diagnoses, initiate treatments, and reassess frequently.

Table: Key initial treatments for severely ill patients with respiratory distress	
Likely diagnosis	**Initial treatments**
Upper airway obstruction	• Manage airway (see Quick Check pages 39–32).
Anaphylaxis	• Give epinephrine (see Quick Check page 17 and Section 3.1.3).
Pneumothorax	• If tension, insert needle or chest tube (see Quick Check page 46).
Pericardial tamponade	• Drain pericardial fluid (see Section 7).
Pneumonia	• Non-severe pneumonia (see Section 10.6). • Severe pneumonia (see Section 3.2.3). Give empirical broad-spectrum antimicrobials within 1 hour. If PLHIV, give empirical PCP treatment as well. If suspect influenza, give antivirals. If TB is suspected, give antituberculosis regimen. • If shock, see Section 3.1.5.
Acute bronchospasm	• Give salbutamol immediately (see Quick Check page 37 and Section 3.2.4). If suspect asthma or COPD, give hydrocortisone 100 mg IV or equivalent oral dose.
Acute pulmonary oedema (fluid overload condition)	• Give furosemide 20 mg IV. • For severe hypertension give vasodilator (see Section 3.2.5).
Acute lung injury (e.g. severe malaria)	• Treat underlying cause (see Section 3.2.3). • If severe malaria, give antimalarials. • If severe sepsis, give empirical broad spectrum antimicrobials.
Anaemia	See Section 10.18.
Opioid overdose	• Give naloxone (see Quick Check page 40).
Poisoning	See Section 3.8.

The remainder of Section 2 will cover the management of the following:

- severe pneumonia and acute lung injury – see Section 3.2.3
  - If signs of heart failure or other causes of fluid overload, use Section 3.2.5 rather than this Section.
  - If shock (SBP<90), use Section 3.1.5.
- bronchospasm – see Section 3.2.4
- pulmonary oedema and fluid overload – see Section 3.2.5.

3.2.3 Manage respiratory distress in patients with suspected severe pneumonia or acute lung injury and without shock

During Quick Check, patients who had emergency signs of airway and breathing and fever were started on empirical antibiotics. Now it is time to take a more complete history, perform a physical examination, and obtain appropriate laboratory investigations and chest X-ray to prioritize the differential diagnosis and give appropriate additional treatments.

Common conditions to consider include primary lung infection (bacterial pneumonia, influenza,[1] advanced tuberculosis) and acute lung injury (ALI). Acute lung injury can be a complication of a severe primary lung infection or can be

1 Some management recommendations are based on *Clinical management of human infection with pandemic (H1N1) 2009: revised guidance.* WHO, 2009. Available at http://www.who.int/csr/resources/publications/swineflu/clinical_management/en/index.html

seen resulting from non-pulmonary sources of infections (e.g. severe sepsis from peritonitis), severe malaria, aspiration, pancreatitis, poisoning, or trauma with massive haemorrhage.

Suspect clinical diagnosis of severe pneumonia if:

- Fever or suspected infection
- Cough
- Respiratory rate >30
- Severe respiratory distress
- SpO_2 <90
- Primary lung infections to consider are bacterial (community-acquired), viral (influenza), TB, and PCP in PLHIV. A chest X-ray may be helpful to distinguish pathogens.

Suspect acute lung injury if:

- Rapid progression of severe hypoxaemia (e.g. requiring high-flow oxygen therapy)
- Chest X-ray shows diffuse infiltrates
- No clinical evidence of fluid overload from poor cardiac function
- Known precipitating cause, such as infection (pneumonia, severe sepsis, severe malaria, severe dengue) or non-infectious causes (acute pancreatitis, poisoning, transfusion-related, haemorrhage). In pregnant patients, consider additional causes (tocolytic medication, pre-eclampsia or eclampsia).

The remainder of this Section should be used if the patient does not have signs of pulmonary oedema or fluid overload or shock on initial examination

- If signs of heart failure or other causes of fluid overload, use Section 3.2.5 rather than this Section.
- If shock (SBP <90), use Section 3.1.4.

General principles to manage severe pneumonia or acute lung injury

- Manage airway . . . . . Quick Check pages 29–32 and Section 3.2.1
- Give oxygen . . . . . Quick Check pages 33–35 and Section 3.2.1
- Treat underlying cause(s)
- Conservative fluid management

The flowcharts at the end of Section 3.1.5 provide specific management by hours for oxygen and fluids and how to monitor, record, and respond to findings for septic shock and severe respiratory distress without shock. These two clinical pathways have similar interventions but different fluid recommendations.

Treat underlying causes

- For severe pneumonia give empirical broad-spectrum IV antimicrobials within the first hour. This is crucially important.

Refer to national or institutional recommendations. Common choices include:

- ceftriaxone 1–2 grams once daily PLUS a macrolide (preferred); OR
- ampicillin 2 grams IV 4 times a day PLUS gentamicin PLUS a macrolide.
- Macrolides include erythromycin 500 mg 4 times a day, azithromycin 500 mg once a day, clarithromycin 500 mg twice a day. Alternatives to a macrolide include doxycycline 100 mg twice a day (avoid in pregnancy) or an oral respiratory quinolone (for example, levofloxacin; see below for cautions).

Cautions: It is important not to treat patients suspected of having TB with a respiratory quinolone, as it may mask or only partially treat underlying TB. Use of respiratory quinolones should be avoided in high-prevalence TB areas unless TB can be excluded. The safety of respiratory quinolones in pregnancy has not been established.

- If the patient has a non-anaphylactic allergy to penicillin (for example, skin rash only), then ceftriaxone can be used.

- If the patient is known to be or suspected of being HIV-infected and has a severe pneumonia, include treatment for PCP in empirical regimen (see Section 10.6) and consider tuberculosis (see Section 15).
- If suspect tuberculosis, obtain prompt nationally or WHO-approved molecular testing, e.g. Xpert MTB/RIF, where available. Otherwise, send sputum for AFB smear, X-ray chest, send sputum for culture, and perform further clinical assessment.[2]

- Empirical antituberculous treatment may need to be started early in a critically ill PLHIV based on suggestive radiograph or clinical judgment. In those with signs suggesting severe pneumonia, this may mean simultaneous treatment for TB, bacterial pneumonia, and PCP.
- Consult with senior clinician.

If suspect influenza, give influenza-specific antivirals (see Section 11.17).[3]

If acute lung injury not from an infectious pneumonia, identify and treat underlying etiology.

- If suspect severe sepsis, give broad-spectrum antimicrobials (see Section 3.1.3).
- If suspect severe malaria, give antimalarials immediately and send blood for malaria testing (microscopy with or without RDT) (see Section 11.25).
- For aspiration, stop oral feedings and observe for development of aspiration pneumonia.
- For acute poisoning, see Section 3.8.
- For acute pancreatitis, see Section 10.7.

- For pre-eclampsia or eclampsia, give magnesium sulfate (see Quick Check page 57) and hydralazine IV (see Section 3.2.5).
- For tocolytic-associated acute lung injury, stop medication.

Conservative fluid therapy

Patients with severe pneumonia or acute lung injury usually have some degree of dehydration. However, overly aggressive fluid therapy may worsen hypoxaemia and respiratory distress. In addition, hypoalbuminaemia may also worsen oedema; this is seen in severe malaria and pre-eclampsia.

- If patient is able to take oral fluids without aspiration risk, oral rehydration is preferable.

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2 *Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents. Recommendations for HIV-prevalent and resource-constrained settings.* WHO, 2007. Available at http://whqlibdoc.who.int/hq/2007/WHO_HTM_TB_2007.379_eng.pdf

3 *Guidelines for pharmacological management of pandemic (H1N1) 2009 Influenza and other influenza viruses.* WHO, 2010. Available at http://www.who.int/csr/resources/publications/swineflu/h1n1_guidelines_pharmaceutical_mngt.pdf

- If patient not able to take oral fluids, give LR or NS at 1 ml/kg/hour.
- Monitor closely for worsening hypoxaemia and development or worsening of acute lung injury.
- If evidence of volume overload and SBP >100, give furosemide 20 mg IV.

Do not give a fluid bolus unless in shock (systolic BP falls below 90) (see Section 3.1) or if specific cause of acute lung injury requires more aggressive fluid therapy (e.g. acute pancreatitis, massive haemorrhage).

Monitor – record – respond

Respond to clinical changes

If SBP <90 give 1000 ml IV (see Section 3.1).
If respiratory function declining (increasing breathlessness, increasing RR or SpO_2 <90)
- Manage airway (see Quick Check pages 29–32).
- Check oxygen supply and increase flow rate (see Quick Check pages 33–35).
- Exclude pneumothorax, pleural effusion, heart failure, and poisoning.
- If wheezing, give salbutamol.
- Check that antimicrobials have been given (including repeat doses as indicated). Consider broader antimicrobial cover.
- Consider TB (in all patients) and PCP in PLHIV (see Sections 15 and 10.6).
- If evidence of fluid overload and SBP >100, stop IV fluids and give furosemide 20 mg IV.

If respiratory function continues to decline, the prognosis is poor (see Section 3.2.2 and Quick Check page 31).
- Reassess patient and reconsider diagnosis and complications as above.

If glucose <3 mmoles (54 mg/dl), give D50 25–50 ml (see Quick Check page 41).
Monitor closely.
Call for help from senior clinician.

- If the patient develops severe hypoxaemia that does not improve on high-flow oxygen, consider advanced airway management if transfer to centre with available mechanical ventilator is possible (see Quick Check pages 68–69). While awaiting transfer, provide manual ventilation carefully. A patient with respiratory failure from severe pneumonia or acute lung injury may have stiff lungs and require high pressures to inflate the lungs, making manual ventilation difficult. During exhalation, the lungs may collapse, and high pressures will again be needed to inflate the lungs for the next breath. High pressures, although necessary, may also be harmful. Because manual ventilation may be difficult, patients with severe pneumonia or acute lung injury should be intubated only when transfer to a centre with mechanical ventilation is possible. Mechanical ventilation is able to provide controlled levels of high pressures both during inspiration (to make sure pressures given are in safe range) as well as during expiration, to prevent lung collapse. (Repetitive lung collapse can be harmful.)

Principles of hospital management for pneumonia

If patient with pneumonia fails to improve after 3 days, re-evaluate the patient, the differential diagnosis, the diagnostic test results, and alter management as appropriate.
Common reasons patients being treated for community-acquired pneumonia fail to improve include:
- wrong dose of antibiotic – check that the correct dose of antibiotics are being given;

- poor penetration of the antibiotic − pulmonary abscess or empyaema, or distant complication such as endocarditis or meningitis;
- wrong antibiotic for the causative organism – for example, TB, *S. aureus,* PCP, and *Pseudomonas* can cause treatment failures because they are resistant to the usual antibiotics for community-acquired pneumonia;
- wrong diagnosis – other processes (e.g. cancer, fibrosis) can cause changes on the chest X-ray that may sometimes look similar to pneumonia.

Review all microbiologic data. If not helpful, then obtain another chest X-ray to look for complications such as empyema. Re-send blood culture, full blood count, sputum Gram stain and AFB smear, microscopy, and culture. Look for skin findings suggestive of fungal infection.

Alter treatment plan depending on suspected cause of treatment failure.
- Drain empyaema.
- Consider ceftriaxone if not already used.

When there is concern for *S. aureus* (e.g. in patients with suspected bacterial coinfection of concurrent influenza), consider your community epidemiology and the rate of methicillin resistant *S. aureus* (MRSA). Treat following your current national or institutional recommendation.
- When available, vancomycin should be used as a first choice for possible MRSA pneumonia.
- In areas of high community-associated MRSA prevalence, clindamycin, cotrimoxazole, and doxycycline all have potential activity against MRSA.
- Cloxacillin should be added only to regimens that are not already active against methicillin-susceptible *S. aureus*, and when there is low suspicion for MRSA.
- Avoid doxycycline in pregnant women.

If no improvement after 3–5 days (or earlier based on clinical judgment)[4]
- Initiate empirical TB treatment even if sputum is negative for AFB (see diagnosis of smear negative TB, Section 15). In PLHIV with signs suggesting pneumonia, this may mean simultaneous treatment for TB, bacterial pneumonia, and PCP.

Choosing a rational antibiotic treatment regimen for community-acquired pneumonia
- Intravenous therapy can be switched to oral therapy once the patient has been treated with 24 hours of IV therapy and is tolerating oral intake.
- Treat for a minimum of 5 days. Patient should be afebrile for 48–72 hours before discontinuation of therapy.
- Narrow antibiotic regimen according to culture results, when available.
- See treatment regimens for PCP, influenza, and tuberculosis in other sections.

4 *Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents. Recommendations for HIV-prevalent and resource-constrained settings.* WHO, 2007. Available at http://whqlibdoc.who.int/hq/2007/WHO_HTM_TB_2007.379_eng.pdf

Follow-up and discharge of severe community-acquired pneumonia once stable

- If HIV-infected and not on cotrimoxazole prophylaxis, start cotrimoxazole prophylaxis.
- Discharge when patient is able to walk and eat.
- If sputum is positive for AFB, treat for tuberculosis (see Sections 10.6 and 15).

3.2.4 Manage patients with severe respiratory distress from acute bronchospasm (from either asthma or chronic obstructive pulmonary disease or other causes of acute wheezing)

A patient with severe respiratory distress from bronchospasm has impaired ventilation. If left untreated, the patient will worsen, develop inadequate ventilation and respiratory failure, and die. This can be prevented with early and aggressive treatment.

During Quick Check a patient with emergency signs of airway obstruction with wheezing was given immediate salbutamol treatment. (See Quick Check page 37 for guidance on how to give sequential administration of bronchodilator therapy based on clinical response.) The method of giving salbutamol is determined by the severity of wheezing. For example, for those with moderate or severe wheezing, give nebulized salbutamol. After the initial treatment it is imperative to immediately reassess the patient's response and to continue to treat severe bronchospasm aggressively if it persists. At the same time, it is important to consider the possible causes of the wheezing, but this should not delay the sequential administration of inhaled salbutamol and other appropriate bronchodilators.

Acute bronchospasm can result from many conditions. In a patient with a known history of asthma or COPD, presentation with increased trouble breathing, chest tightness, cough and wheezing would make an exacerbation or acute attack of their chronic airways disease the most likely cause. However, a patient may not yet know that they have asthma or COPD, and this acute presentation may be their first presentation. If this is the case, a brief and targeted history may help prioritize the differential diagnosis (e.g. history of long-term exposure to tobacco smoke makes COPD likely; or a history of allergies may make asthma more likely). Other causes of acute bronchospasm include viral pneumonia or inhalation injury. Of note, pulmonary oedema can present atypically with wheezing, so a careful examination for signs of fluid overload should be carried out; if apparent, see Section 3.2.5.

The remainder of this section should be used if the patient does not have signs of acute pulmonary oedema or fluid overload.

A rapid and targeted clinical history and physical examination will help to classify the severity of wheeze and guide subsequent treatments.

History

- symptoms (chest tightness, shortness of breath, cough, wheezing)
- onset (acute or subacute)
- associated symptoms (fever)
- precipitating factors (cold weather, exercise, strong smell, viral syndrome)
- medical history (asthma, COPD and previous hospitalizations, allergies such as hay fever)

- risk factors (tobacco smoke, indoor air pollution)
- medications (previous use of salbutamol or steroids).

Examination

- respiratory rate (very fast or very slow)
- pulse and blood pressure (very severe asthma attacks can cause low blood pressure)
- the patient's level of breathlessness (at rest, with talking, or with walking)
- the patient's ability to speak (silent, speaking in single words, phrases, or full sentences)
- accessory muscle use, chest wall excursion
- loud wheezing, or is the chest silent as if no air were moving?

Urgent investigations include

- pulse oximetry to measure SpO_2
- peak flow after initial bronchodilator (if available) compared with predicted or personal best
- measure pulsus paradoxus
- chest X-ray if suspect pneumonia.

DDx: Acute wheeze

Etiology of acute wheeze	In favour
Acute bronchitis	• Diffuse wheezing or rhonchi • Productive cough • Preceded by viral upper respiratory tract infection (e.g. fever, cough, runny or stuffy nose)
Bacterial or viral pneumonia see Section 10.6	• More common in viral pneumonia • Diffuse or localized wheezing • Usually, acute onset fever and productive cough • Chest X-ray with infiltrate
Foreign body aspiration	• Localized wheezing • Acute onset; can have cough and shortness of breath
Asthma attack see Section 10.6	• Episodic chest tightness, shortness of breath, and diffuse wheezing • Night-time symptoms and cough are common • Precipitated by exercise, viral syndrome, strong smells • Personal history of asthma or allergies • Family history of asthma
COPD exacerbation see Section 10.6	• Increase in baseline breathlessness, cough, sputum quantity or purulence • Diffuse wheezing and rhonchi • Personal history of COPD or long-term exposure to tobacco smoke or indoor air pollution (e.g. open fire stoves)
Inhalation of airway irritants (e.g. smoke, chemicals, vapours)	• Diffuse wheezing and breathlessness • Immediately precipitated by inhalation of large amounts of irritating agent
Ingested poisons see Section 3.8	• Organophosphate poisoning (pinpoint pupils, urination, defecation, lacrimation)

Bronchiectasis	• Wheeze can be diffuse or localized • Increase in baseline or new cough productive of purulent sputum; haemoptysis is common • Personal history of TB infection or severe pneumonia
Cancer	• Localized wheeze • Chronic cough, haemoptysis are common • Associated with weight loss, anorexia • Personal history of exposure to tobacco smoke, exposure to indoor air pollution (e.g. indoor coal stoves)
Acute pulmonary oedema see Section 3.2.5	• Atypical presentation with diffuse wheezing and crackles (rales) • Fluid overload (elevated JVP, lower extremity oedema) • History of cardiomyopathy, valvular heart disease, hypertension, ischaemia, renal disease

General principles to manage a patient with acute bronchospasm

- Have patient sit upright and assume comfortable position.
- Manage airway (see Quick Check pages 29–32).
- Give oxygen therapy (see Quick Check pages 33–35).
- Give inhaled salbutamol immediately (see Quick Check page 37 for sequential bronchodilator treatment).
- Treat underlying causes.

Monitor-record and respond (see Section 3.0).

How to give sequential bronchodilator therapy for moderate, severe, or life-threatening wheezing

Signs	Classify as	Treatments
One or more of the following • silent chest • cyanosis • poor respiratory effort • altered consciousness • exhaustion	**LIFE-THREATENING WHEEZING**	• Mange airway (see Quick Check pages 29–32). • Give oxygen (see Quick Check pages 33–35). • Give salbutamol by continuous nebulizer (see Quick Check page 37 for sequential bronchodilators). • If acute asthma or COPD, give steroids (100 mg hydrocortisone IV or 40–60 mg methylprednisolone IV or 40–60 mg oral prednisolone or equivalent). • Reassess immediately (do not leave patient alone). • If no improvement, give salbutamol continuously. Add ipratropium by nebulizer. • If no improvement, give intravenous magnesium sulfate (2 grams over 20 minutes). • If fever, give IM or IV antibiotic.
One or more of the following signs: • breathless at rest • cannot complete sentences in one breath • respiratory rate ≥25 breaths/min • pulse ≥100	**SEVERE WHEEZING**	• Give oxygen (see Quick Check pages 29–32). • Give salbutamol by nebulizer (continuous or every 20 minutes) (see Quick Check page 37 for sequential bronchodilators). • If acute asthma or COPD, give steroids (100 mg hydrocortisone IV or 40–60 mg methylprednisolone IV or 40–60 mg oral prednisolone or equivalent). • Reassess immediately (15–30 minutes). • If not improving, give more salbutamol every 20 minutes or, if deteriorating, continuously. Add ipratropium by nebulizer. • If deteriorating, also give magnesium (2 grams over 20 minutes). • If fever, give IM or IV antibiotic.

Signs	Classify as	Treatments
No features of severe asthma	**MODERATE WHEEZING**	• Give oxygen. • Give salbutamol by primed spacer with 5 puffs; then give 2 puffs via spacer every 2 minutes. • If acute asthma or COPD, give steroids – oral prednisolone 40–60 mg (or equivalent). • If fever, give IM or IV antibiotic. • Reassess in 15–30 minutes.

The following investigations help grade severity

• SpO_2 <90 on room air • Peak flow <33% of predicted or personal best • Absence of pulsus paradoxicus (when respiratory arrest imminent, absence suggests muscle fatigue)	**LIFE-THREATENING WHEEZE**
• SpO_2 >90 • Peak flow 33–50% of predicted or personal best • Pulsus paradoxus >25 mmHg	**SEVERE WHEEZING**
• SpO_2 >90 • Peak flow 50–75% of predicted or personal best • Pulsus paradoxus may be present (10–25 mmHg)	**MODERATE WHEEZING**

If there is no inhaled salbutamol available, consider one of the following for severe bronchospasm

- Salbutamol 250 mcg slowly by IV for severe acute bronchospasm. (Be aware that this can lead to hypokalaemia.)
- Aminophylline 5 mg/kg slowly over 20 minutes
- Epinephrine 0.5 mg (0.5 ml of 1:1000) IM.

Note: Aminophylline is not recommended due to toxicity and lower efficacy and is not included on the WHO Model List of Essential Medicines, but it may be effective by slow IV infusion if no other drugs are available.

Monitor – record – respond

In addition to the other clinical parameters being monitored for severely ill patients (see Section 3.0), patients with severe wheezing should be monitored very closely as follows.

- Initially, patient should be monitored at least every 15–30 minutes, after every salbutamol treatment, to assess response and classify severity until improvement is observed, and then every hour for the initial 6 hours. Do not leave a patient with life-threatening features alone.
- Monitoring should cover:
  - physical examination
  - respiratory rate
  - peak flow
  - pulse
  - pulsus paradoxus.

Sequential bronchodilator therapy (see Quick Check page 37)

Caring for patients with moderate to severe wheezing requires close monitoring, reassessment, and accurate reclassification, as discussed above, and then appropriate administration of bronchodilators. Bronchodilator treatment acts immediately on the airway smooth muscles so that they relax and open up to allow the patient to breathe better.

- For any patient with life-threatening features, in addition to giving continuous salbutamol by nebulizer, make sure to give the patient ipratropium (another bronchodilator) by nebulizer and IV magnesium sulfate (2 grams over 20 minutes).
- If the patient has severe wheezing that is deteriorating despite salbutamol treatment, treat as if there are life-threatening features with continuous salbutamol, ipratropium every 4–6 hours, and magnesium sulfate.
- If patient with severe wheezing has an incomplete response, then continue with salbutamol by nebulizer (continuous or every 20 minutes) and also give ipratropium.
- If patient with wheezing is improving, then give salbutamol less frequently (e.g. if on continuous nebulizer treatment, go down to every 20 minutes or, if receiving nebulizer treatments every 20 minutes, go down to every two, then every four hours.

If suspect asthma or COPD, give steroids (either 100 mg hydrocortisone IV or 40–60 mg oral prednisolone or equivalent). Steroids should be given immediately, but benefits will take some time to appear. Thus, bronchodilator therapy needs to continue sequentially while awaiting the effects of steroid therapy. Steroids help to reduce airway inflammation and swelling so that the airways remain open and the patient can breathe better.

If fever, give empirical antibiotics (see Quick Check page 43). On arrival, it may be difficult to know if the patient has a bacterial pneumonia or is having an acute attack of asthma or COPD. Giving empirical antibiotics early is beneficial in case there is a concurrent bacterial infection.

Other things to consider if patient is not improving

- Check oxygen supply and increase flow rate if SpO_2 <90 (see Quick Check pages 34–36).
- Reconsider differential diagnosis (pneumothorax, heart failure, poisoning).
- **If patient develops inadequate ventilation that does not improve on high-flow oxygen and aggressive bronchodilator treatment, consider advanced airway management if transfer to a centre with available mechanical ventilator is possible** (see Quick Check pages 37, 62–67). A patient with respiratory failure from severe bronchospasm has severe airflow obstruction and is unable to exhale the air from the lungs. As a result, the lungs become hyperinflated, which can result in both hypotension and a pneumothorax. Because providing manual ventilation may be difficult and dangerous in patients with severe bronchospasm, these patients should be intubated only if transfer to a centre with mechanical ventilation is possible. Mechanical ventilation will allow greater control of the respiratory rate (enough time to exhale) and size of breaths being delivered (e.g. small breaths so complete exhalation can occur). While awaiting transfer, provide manual ventilation carefully.

- Use a large-diameter endotracheal tube (7.5 or 8.0 is desired to optimize ventilation).
- Allow sufficient time for exhalation to occur; therefore, give breaths at a slow rate (e.g. less than 10 per minute).
- If necessary, provide sedation to allow slow breath delivery.
- Make sure you continue to deliver bronchodilator treatment through the endotracheal tube.
- Monitor blood pressure and pulse for signs of hyperinflation (e.g. low SBP, fast pulse). If shock develops, stop ventilation to allow sufficient time for exhalation, give rapid fluids, and assess for pneumothorax.

3.2.5 Manage patients with severe respiratory distress from acute pulmonary oedema or fluid overload

Acute pulmonary oedema is the abnormal accumulation of fluid in the lung tissue and airspaces (alveoli), which makes it difficult for oxygen from the air to diffuse into the blood. There are two mechanisms by which this can occur.

- Most commonly, pulmonary oedema can form when the filling pressures of the heart are raised, leading to increased pressures inside the small pulmonary vessels. Fluid is then forced out of the vessels and into the lungs. This is what happens in acute pulmonary oedema from poor cardiac function (congestive heart failure) and from renal failure.
- Less commonly, pulmonary oedema can form when there is increased leakiness of the small pulmonary vessels and of the cells lining the alveoli, leading to movement of fluid and protein into the lungs. This is also known as acute lung injury or non-cardiogenic pulmonary oedema.

After Quick Check it is important to identify patients with possible pulmonary oedema (presence of respiratory distress, crackles on examination, and chest X-ray with diffuse infiltrates) and then to attempt to distinguish between these two forms of acute pulmonary oedema so as to guide early management. This should not delay immediate treatment with oxygen or other emergency treatments as described in Quick Check.

Look for clinical evidence of fluid overload.

- JVP is elevated, hepatomegaly or ascites, bilateral lower extremity oedema.
- Chest X-ray shows fluffy bilateral opacities, perihilar distribution, bilateral effusions.
  - If present, consider acute pulmonary oedema from cardiac or renal causes (see Table, Common diagnoses that may present with acute pulmonary oedema, below), and use this section for treatment guidance.
  - If not present, then consider acute lung injury (non-cardiogenic pulmonary oedema) and look for other characteristics of ALI (see Section 3.2.3).

Perform a history and physical examination to narrow the differential diagnosis.

History

- rapidity of onset (months, weeks, days, hours)
- associated symptoms (fever, cough, abdominal pain)
- difficulty breathing at rest, during exercise (exertional dyspnoea), when lying flat (orthopnoea), or at night that wakens the person from sleep (nocturnal dyspnoea)

- precipitating factors – increased intake of salty foods, increased water intake, recent infection, feeling irregular heart palpitations (atrial fibrillation) or chest pain
- any chronic diseases – HIV infection, cardiomyopathy, liver disease, renal disease
- Pregnancy – women with mitral stenosis will often decompensate in the middle of pregnancy. Peripartum cardiomyopathy develops in the last month of pregnancy or within six months after delivery. Women with pre-eclampsia or eclampsia may have convulsions, high blood pressure.
- Medications – if the patient has known heart failure, ask about medication adherence.
- The patient's wishes for intensity of therapy – patients with very advanced heart failure may not want intensive therapies.

Physical examination: focused examination to identify likely cause

- tachycardia (more than 120/min is common in acute heart failure)
- blood pressure (depending on the cause, the patient's blood pressure may be high, low, or normal). A wide pulse pressure (such as 120/30 mmHg) suggests possible severe aortic insufficiency.
- fever (may suggest concurrent and/or exacerbating pneumonia or other infection)
- weight (compare with previous weights)
- poor perfusion (blood flow) – cold extremities
- cardiovascular system
- displaced point of maximum impulse, extra heart sounds, loud murmurs
- distended neck veins, lower-extremity oedema
- respiratory
- bilateral crackles
- decreased breath sounds at bases
- gastrointestinal
- hepatomegaly, ascites
- epigastric tenderness.

Urgent investigations include:

- creatinine, potassium, haemoglobin
- Recommend an HIV test.
- If suspect infection, check blood cultures and other cultures as appropriate.
- chest X-ray
- ECG – evaluate for ischaemia, ventricular hypertrophy, arrhythmias.
- Limited echocardiography – assess cardiac function, presence of mitral stenosis, or pericardial effusion. This does not require a cardiologist or a radiologist and can be done with basic ultrasound equipment without Doppler.

Table: Common diagnoses that may present with acute pulmonary oedema	
Acute pulmonary oedema with clinical evidence of fluid overload	**Symptoms**
Cardiomyopathy	• HIV-infected, peripartum, long-standing hypertension • Displaced impulse and extra heart sounds (dilated cardiomyopathy) • ECG with left ventricular hypertrophy (hypertensive heart disease) • ECG with evidence of ischaemia (ischaemic heart disease)
Valvular heart disease	• Loud murmur at apex, in diastole (mitral stenosis) • History of rheumatic heart disease
Myocarditis (Chagas disease)	• Endemic area, cardiomyopathy • Syncope, ECG with arrhythmias or conduction abnormalities • Gastrointestinal symptoms
Endocarditis	• Fever and new murmur
Chronic kidney disease	• Diabetes, hypertension • HIV-associated nephropathy
Acute lung injury	**Symptoms**
Severe malaria	• Fever, pallor, headache, jaundice • Cough, shortness of breath are early signs of pulmonary oedema • Other signs of severe malaria are altered mental status, bleeding, shock, weakness, seizures, hypoglycaemia (see sections 3.2.3 and 11.25).
Severe pneumonia	See Section 3.2.3
Severe sepsis	See Section 3.1.5
Poisoning	See Section 3.8
Acute pancreatitis	• Epigastric pain with eating, loss of appetite
Pregnancy-related	• Tocolytic medication, pre-eclampsia or eclampsia

The remainder of this section focuses on the management of patients with acute pulmonary oedema or fluid overload from cardiogenic cause or from renal failure.

If severe pneumonia and/or acute lung injury, see Section 3.2.3 instead.

General principles to manage a patient with acute pulmonary oedema or fluid overload

Immediate diuretic and vasodilator therapy optimizes cardiac output and assists in mobilization of fluids from lungs to the kidneys for excretion.

- Have patient sit upright and assume comfortable position.
- Manage airway (see Quick Check pages 29–32).
- Give oxygen therapy (see Quick Check pages 33–35).
- Give diuretic therapy; check response in 30 minutes.
- Treat severe hypertension.
- Treat precipitating cause(s).
- Monitor-record-respond (see Section 3.0).

Give diuretic therapy; then check response in 30 minutes

Diuretic therapy reduces congestion in the lungs. The dose depends on whether the patient has been on this drug before and therefore may have some tolerance.

- If the patient has not been on furosemide as an outpatient, give 20 mg furosemide IV.
- If the patient has been on furosemide orally as an outpatient, give the oral dose of furosemide IV. For example, if a patient takes 40 mg orally once daily, then give 40 mg IV. IV furosemide is at least twice as effective as the oral dose.
- Monitor urine output. Furosemide works fairly quickly, and so a response should be observed within 30 minutes. Monitor also for development of hypotension if urine output is brisk.

Treat severe hypertension if present

Give vasodilators to decrease blood pressure. Start with low dose and watch effect.

- Start with isosorbide dinitrate 5 mg sublingual. If still hypertensive, can give another dose after 10–15 minutes, not to exceed 10 mg every 2–3 hours.
- If isosorbide dinitrate not available, give hydralazine 5 mg IV once. This also can be repeated, if necessary, after 30 minutes.
- If patient has good response to vasodilator treatment, start enalipril 5 mg orally within 6–24 hours if creatinine is normal.
- Monitor SBP, as combination of diuresis and vasodilators can greatly reduce blood pressure.
- In pregnant patient with pre-eclampsia or eclampsia and severe hypertension[5], give IV hydralazine or *sublingual nifedipine*. There is limited experience with the use of isosorbide dinitrate in pregnant women. Enalapril (or other ACE inhibitors) and sodium nitroprusside should be avoided in pregnancy. For continued management, consider *oral labetolol*, hydralazine, *alpha methyldopa*, *or nifedipine* based on cost, availability and experience using the medicine. For other aspects of management of pre-eclampsia or eclampsia, see also Quick Check page 57, and for acute lung injury, see Section 3.2.3.

Treat precipitating cause

Patients with cardiomyopathies or renal disease usually decompensate and develop acute pulmonary oedema because of a triggering event. Identify and treat potential triggers.

For example:

- cardiovascular – ischaemia, arrhythmia, hypertension, pericardial effusion, poorly controlled cardiomyopathy
- other – pneumonia (see Section 3.2.3), failure to adhere to medication, increased salt or water intake, pulmonary embolism.

5 *WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia*. WHO, 2011. Available at http://whqlibdoc.who.int/publications/2011/9789241548335_eng.pdf

Monitor – record – respond

In addition to the other clinical parameters (see Section 3.0), monitor patients with acute pulmonary oedema as follows to guide additional diuretic and vasodilator treatment.

- Urine output – monitor closely in the first couple of hours to assess early response to furosemide and need to increase dose if response is poor.
- Weight – monitor daily to assess response to diuresis.
- Electrolytes and creatinine – monitor daily to watch for hypokalaemia (see Section 5.2) and rising creatinine (see Section 11.31), which can be side effects of furosemide.

Respond to clinical changes

If within 30 minutes the patient does not urinate an adequate amount (e.g. 100–150 ml) and is still in distress

- Double the initial furosemide dose.

If after 1–2 hours the patient is still in distress and there has not been an adequate urine response

- Check oxygen supply and increase flow rate if SpO_2 <90 (see Quick Check page 35).
- Assure precipitating cause is being treated (arrhythmia, ischaemia, infection?).
- Reconsider the diagnosis (is there pneumonia, acute lung injury, pleural effusion, pneumothorax?).
- Obtain additional diagnostic tests if relevant (chest X-ray, limited echocardiogram).
- Call for help from senior clinician (consider doubling the last dose of furosemide).
- Check creatinine. If patient has renal failure, then give a higher dose of furosemide (e.g. 80–160 mg) and consider the addition of a thiazide diuretic (e.g. hydrochlorothiazide 25 mg by mouth daily before furosemide dose).
- Monitor closely.

If SBP <90, give 250–500 ml of LR or NS IV (see Section 3.1.5).

- Call for help from senior clinician.
- Stop diuresis.

Flowchart: Severe acute pulmonary oedema or fluid overload

First 2 hours

Recognize	**Clinical diagnosis of severe acute pulmonary oedema** • **Respiratory rate >30 or SpO_2 <90 and** • **Bilateral crackles on lung exam** • **Signs of volume overload: distended neck veins, hepatomegaly, ascites, lower-extremity oedema** • **History of cardiomyopathy or kidney disease**
Fix the physiology	**Oxygen: titrate to SpO_2 90** **Fluids: Give furosemide 20 mg IV**
Treat trigger	**If hypertension: Isosorbide dinitrate 5 mg sublingual** **If ischaemia: Give aspirin; other management per national guidelines** **If arrhythmia: Treat per national guidelines** **If fever: give empirical antimicrobials** • Antibiotics • Antimalarials • Antiviral if suspect influenza
Monitor, record	**Every 30 minutes until stable; then every 1 hour** • SBP, pulse, RR, SpO_2, mental status (AVPU), urine output • JVP, auscultate for crackles (rales) • Weight on admission • Creatinine, potassium on admission
Respond	**If respiratory distress fails to improve or worsens and urine output is not adequate** • Check oxygen supply, increase oxygen flow • Give furosemide IV 40 mg (double dose) • If renal failure, call for help and consider higher doses of furosemide and additional diuretics

Flowchart: Acute pulmonary oedema or fluid overload

2–6 hours	**Recognize**	**If poor response, reconsider** • Severe pneumonia, acute lung injury, pneumothorax, pleural effusion, poisoning, TB, PCP in PLHIV, malaria
	Fix the physiology	**Oxygen:** titrate to SpO_2 90 **Fluids:** If urinary response not adequate (150–200 ml), give 40 mg IV furosemide. If adequate response, do not give additional dose.
	Treat trigger	**If still hypertension:** Give another dose of isosorbide dinitrate SL (5–10 mg). Can repeat every 2–3 hours.
	Monitor, record	**Every 30 minutes until stable; then every 1 hour** • SBP, pulse, RR • Mental status (AVPU) • Urine output • JVP, auscultate for crackles (rales)
	Respond	**If respiratory function declining** • Check oxygen supply and increase flow rate **If fluid overload unresponsive to escalating diuretic doses** • Call for help from senior clinician to give higher dose of furosemide or add another diuretic agent **If renal failure** • Call for help from senior clinician to assist with diuretic management and consider transfer to a centre with haemodialysis **If SBP <90** • Stop diuresis. Give 250 LR or NS bolus. Call for help from senior clinician; if cardiogenic shock, consider vasopressors.

Flowchart: Acute pulmonary oedema or fluid overload

6–24 hours

Recognize	**If poor response, reconsider** • Severe pneumonia, acute lung injury, pneumothorax, pleural effusion, poisoning, TB, PCP in PLHIV, malaria
Fix the physiology	**Oxygen:** titrate to SpO_2 90 **Furosemide:** Repeat effective diuretic dose every 6–8 hours
Treat trigger	**Continue to treat hypertension:** Start long-acting enalipril 5 mg oral if creatinine normal **Continue to treat myocardial ischaemia –** next dose **Continue to treat arrhythmia –** next dose **Continue to treat pneumonia:** Empirical antimicrobials – next dose
Monitor, record	**Every hour if SBP <90 or on pressors; otherwise every 2 hours** • SBP, pulse • Respiratory rate • SpO_2 • Mental status (AVPU) • JVP, auscultate for crackles (rales) **Monitor every 6 hours** • Temperature • Urine output • Repeat glucose and Hb if initial value abnormal
Respond	Respond to changes as indicated on previous page for 2–6 hour period

Flowchart: Acute pulmonary oedema or fluid overload

Post-resuscitation	**Recognize**	Perform full reassessment Review available diagnostic data and **treat underlying diagnosis** Switch to its specific management
	Fix the physiology	**Oxygen:** titrate to SpO_2 90; discontinue when 90 on room air **Furosemide:** Titrate down frequency as tolerated, every 8–12 hours. Change to oral dose.
	Treat trigger	**Continue to treat hypertension – next dose** **Continue to treat myocardial ischaemia – next dose** **Continue to treat arrhythmia – next dose**
	Nutrition	• Begin once the patient has stabilized and in any case after 1–2 days. • Due to risk of aspiration do not give food orally if patient cannot safely swallow, due, for example. to altered mental status, severe shortness of breath or severely ill, ongoing vomiting. • All other patients should be provided with food. Most patients lose their appetite when ill and may find soft foods and oral fluids easier to tolerate. Small, frequent meals are often tolerated better. • Consider NG feeding, using pureed foods, for patients who cannot swallow safely due to risk of aspiration. • In severely ill patients give small amount initially, e.g. 20–40 ml/hour, and monitor NG aspirates to check for absorption. • Increase rate of feeding as tolerated.
	Monitor, Record	**Every 8 hours (check SBP hourly if weaning off pressors); then daily** • SBP • Respiratory rate • SpO_2 • Mental status (AVPU)
	Respond	Respond to changes as indicated earlier

3.2.6 Managing acute decompensated cardiac problems

Patients with chronic cardiovascular diseases may present with acutely severe illness and respiratory distress with episodes of decompensation. Section 3.2.5 described the initial management of acute pulmonary oedema from multiple causes. For management of acute and chronic cardiomyopathy, valvular heart disease, arrhythmias, and hypertensive emergencies, refer to national guidelines.

The WHO Model Formulary has guidance on many relevant treatments.

3.3 Approach to the patient with chest pain

Chest pain is a common complaint that may be a symptom of serious illness, particularly when associated with shortness of breath, low blood pressure, or fever. Or it may be associated with less serious conditions. A good history and physical examination is important to prioritize the differential diagnosis. The character of the pain is often a helpful clue as to the cause – pleuritic pain (sharp, well localized pain that is worse with breathing or coughing) is usually associated with a primary pulmonary problem such as pneumonia, pleural effusion, or pulmonary emboli. Crushing pain or a tight pain in the chest (that may radiate to the left arm, throat, or jaw) is more suggestive of myocardial ischaemia. See the table that follows for a differential diagnosis that includes common and not so common causes of chest pain.

DDx: Chest pain

Condition	In favour
Stable angina	• Chest pain with exertion (crushing in nature, radiating to jaw or arm) • Associated with nausea and shortness of breath • Easily relieved with rest • History of cardiac disease • Risk factors − hypertension, diabetes, tobacco, hyperlipidaemia, family history
Acute coronary syndrome (unstable angina, non-ST elevation or ST elevation myocardial infarction)	• Crushing chest pain (pressure, tightness) radiating to the jaw or arm at rest • Clammy, sweaty • Associated with nausea and shortness of breath • History of cardiac disease • Risk factors − hypertension, diabetes, sickle-cell anaemia, tobacco, hyperlipidaemia, family history • ECG changes – Q waves, ST depression or elevation, T wave changes
Pneumonia see Sections 3.2.3 and 10.6	• Fever and cough • Pain exacerbated by breathing (pleuritic) • Respiratory distress, hypoxaemia • Crackles on auscultation, bronchial breath sounds • Consolidation on chest X-ray
Pulmonary embolus	• Risk factors – recent immobilization, travel, pregnancy, cancer, recent surgery, long bone or pelvic fracture • Evidence of DVT – swollen leg • May have fever (usually mild) • Difficulty breathing • Haemoptysis • Tachycardia • ECG – sinus tachycardia
Oesophageal reflux (GERD) See Section 10.7b	• Burning epigastric, retrosternal pain • Worse at night • Worse with food • Long history symptoms • Relieved by antacids or acid blockers
Musculoskeletal	• Chest pain that is reproducible on palpation • Pain can be worse with movement or with inspiration • Usually associated with muscle strain or from minor trauma

Condition	In favour
Less common causes	
Oesophageal rupture	• Sudden onset central chest and abdominal pain • During or following excessive vomiting • Vomiting blood • Shock
Aortic dissection	• Tearing pain radiating to the back, abdomen or between shoulder blades • Asymmetrical pulses or BP • New stroke
Tension pneumothorax see Quick Check page 46	• Difficulty breathing • Elevated JVP • Displaced trachea to opposite side • Decreased breath sounds on affected side • Hyperresonance on percussion on affected side
Tuberculosis see Section 15	• May involve lungs, pericardium, pleura • Fever, cough, haemoptysis • Common complication of HIV
Panic attack see Section 10.11	• Hyperventilation • History of anxiety or recent stress
Pericarditis	• Sharp, posterior pain • Relief when leaning forward • Acute rheumatic fever, TB pericarditis, chest trauma • ECG with diffuse ST elevation

For pneumonia, see Sections 3.2.3 and 10.6.

For TB, see Section 15.

For oesophageal reflux, see Section 10.7.

For management of pneumothorax, see Quick Check page 46.

For panic attacks and panic disorder, see Section 10.11.

For management of acute coronary syndromes and coronary artery disease, refer to national guidelines. The WHO Model Formulary has guidance on several relevant treatments.

3.4 Approach to the patient with altered consciousness (including coma, confusion, intoxication, agitation, and convulsions)

In this section:

3.4.1 Clinical approach to the patient with altered consciousness

Assessment and urgent treatments

It is important to ensure that, if a patient has an altered level of consciousness, the airway is protected and breathing and circulation are maintained.

Ensure that the violent or confused patient is not a danger to himself or to health workers.

Assess for coma, convulsions, or other abnormal mental states. Check the level of consciousness on the AVPU scale.

- A – alert
- V – responds to voice
- P – responds to pain
- U – unresponsive.

If the patient is not able to answer questions, make sure to take a brief, focused history from the people who brought the patient to the hospital before they leave (see below).

- If the patient is not awake and alert, try to rouse the patient by talking or shaking an arm. If the patient responds to voice, then the patient is lethargic. If the patient does not respond to voice or pain (squeezing on a fingernail or pressing on the sternum), the patient is in a coma (unconscious) and needs emergency treatment.
- Is the patient convulsing (having seizures)? Are there spasmodic, repeated movements in an unresponsive patient? Remember to consider that seizures may present with little movement.
- If there are seizures and the patient is a woman, check if she is pregnant or has recently been pregnant (see Section 3.5).

Take vital signs – respiratory rate, pulse, temperature, blood pressure

- Also, perform emergency laboratory investigations – blood glucose, Hb, malaria test (microscopy with or without RDT), pulse oximetry, and electrolytes.

A patient may be unconscious because of processes involving the brain (infection, ischaemia, epilepsy), drugs, toxins and poisons, or severe metabolic problems. Patients with pre-existing confusion, such as those with dementia, may become more acutely confused as a result of other problems, such as infection, worsening organ failure, or new medications. An altered state of consciousness may overlap with other syndromes, such as shock or respiratory distress. Shock commonly presents with an altered state of consciousness due to reduced oxygenation of the brain. Severe respiratory distress may present as coma due to retention of carbon dioxide. This Section outlines management of patients with an altered state of consciousness identified as their primary problem after initial assessment and management.

Urgent treatment is required for:

- hypoglycaemia (blood glucose <3.0 mmol/l or <50 mg/dl) – give the patient a sweet drink orally (if not at risk of aspirating) or via nasogastric tube, or else 50% dextrose 25–50 ml IV over 2 minutes (see Quick Check page 41 and Section 3.4.2);
- infections – meningitis (see Section 10.10b), severe sepsis (see Section 3.1.5), severe malaria (see Section 11.25);
- metabolic problems – diabetic ketoacidosis (see Section 3.4.1), electrolyte imbalances (see Section 5.2), hypoxaemia (see Section 3.2);
- trauma and head injury (see Quick Check page 44 and Section 4);
- poisonings (see Section 3.8) – opioids, organophosphates;
- other – hypertension, status epilepticus (see Section 3.5).

History

A history obtained from family members or witnesses should focus on the following areas:

- onset and duration of illness
- injuries – particularly neck trauma and head injury
- other medical problems – asthma, diabetes, epilepsy, drug and alcohol use, dementia, HIV, mental health problems
- exposures – malaria, typhoid, travel
- possible overdose.

Examination

- If head or neck injury is suspected, do not move neck (see Quick Check page 44).
- Exclude additional serious causes – shock (low blood pressure), respiratory failure (cyanosis, difficulty breathing).
- Abnormal temperature (>38oC or <36oC)
- Small pupils (opioids, organophosphate)
- Stiff neck (meningitis)
- Skull fracture
- Focal neurological signs – unequal pupils, asymmetrical tone, abnormal movement (stroke, brain herniation, etc.)

- Brainstem problem – suggested by abnormal gag reflex or absent corneal reflex or "doll's eye" reflex
- Involuntary side-to-side eye movements.

Differential diagnosis

DDx: If a patient is unconscious or has a decreased level of consciousness or is confused or delirious

Condition	In favour
Rapidly reversible causes	
Hypoglycaemia see Section 3.4.2	• Sweating • Seizures • Confusion • Use of hypoglycaemic agents or heavy alcohol use • Severe sepsis or malaria • Responds quickly to glucose
Severe dehydration see Section 3.1.2	• Signs of shock (elevated pulse, low blood pressure) • Decreased skin turgor • Impaired ability to drink fluids
Heat stroke see Section 10.1	• Prolonged exposure to heat and sun • High temperature (>40.5°C)
Hypoxaemia see Sections 3.2.2 and 10.6	• Cyanosis (look at nail bed, lips; cyanosis may not be apparent in anaemic patients) • Shortness of breath • Low SpO_2
Infection	
Cerebral malaria see Section 11.25	• Endemic area in season • Migrant workers • Fever, altered mental state • Rapid malaria test positive or smear positive
Meningitis see Section 10.10b	• Fever • Neck stiffness, photophobia, headache • Known epidemic of meningitis • History or likely to have HIV infection
Sepsis from various causes including pneumonia, UTI see Section 3.1.5	• Fever • Shock • Sometimes: warm extremities, endocarditis • Signs of focus of the infection
HIV encephalopathy see Section 13	• Disabling cognitive or motor dysfunction • Interference with activities of daily living • Progression over weeks or months in the absence of a cause other than HIV • LP excludes other causes • HIV infection with low CD4 count
Human African trypanosomiasis see Section 11.41	• Endemic areas in Africa • Intermittent fever, headache • Generalized lymphadenopathy, particularly in posterior cervical triangle • Slow onset • Poor concentration and personality changes

Condition	In favour
Encephalitis	• Fever • Altered conscious state, personality change, coma • Seizures
Rabies see Section 11.30	• Encephalitic (furious): agitation, hydrophobia (fear of drinking), "fan test" (agitation with breeze on face), pharyngeal spasm, drooling • Paralytic (dumb): paralysis, incontinence • History of animal bite
Metabolic	
Diabetic ketoacidosis (DKA) or hyperosmolar non-ketotic (HONK) coma see Section 3.4.1	• History of diabetes mellitus (known Type 2 in HONK) • Acidotic – deep, laboured breathing (more common in DKA) • Ketotic odour (sweet smelling breath) in DKA • High glucose in blood or urine (very high in HONK) • Dehydrated • Focal neurological signs (more common in HONK) • Ketones in urine and blood (no or trace ketones in HONK)
Hypernatraemia see Section 5.2.1	• Lethargy, weakness, irritability (early) • Twitching, seizures, coma (late)
Hyponatraemia see Section 5.2.1	• Nausea, vomiting, fatigue • Apathy • Coma • Seizures
Hyperkalaemia see Section 5.2.2	• Twitching, abdominal pain, paraesthesia, seizures
Hypokalaemia see Section 5.2.2	• Lethargy, generalized weakness leading to ascending paralysis, ileus
Hypercalcaemia see Section 5.2.3	• Nausea, vomiting • Muscle weakness, bone and joint pain • Confusion, fatigue, coma • Frequent urination, excessive thirst, nephrolithiasis, acute and chronic renal insufficiency • Abdominal pain, constipation, pancreatitis • Bradycardia
Hypocalcaemia	• Constipation, confusion, chronic generalized pain, bone pain • Seizures, tetany • History of thyroidectomy (look for scar)
Myxoedema	• Hypothyroidism • Deterioration in mental status • Goitre, swelling of skin/soft tissue • Delayed relaxation of reflexes • Elderly female
Toxic	
Poisoning see Section 3.8	• History of exposure • Organophosphate – pinpoint pupils, salivation, bradycardia, incontinence, anxiety, coma
Drug overdose, intoxication, or interactions – prescribed drugs see Section 3.8	• Drug overdose (accidental or deliberate) of prescribed drugs • ARV toxicity: fulminant liver failure from NVP, especially in pregnancy; confusion with EFV toxicity • Drug interactions in AIDS patients taking multiple medications (see Section 13)

Condition	In favour
Drug overdose, intoxication – psychoactive substance use see Sections 3.6, 3.7, 17	• Known hazardous alcohol use or psychoactive drug use • Evidence of drug use – injection marks, illicit substances in pockets • Alcohol – breath smells of alcohol, reddened face • Opioids – sedation, pinpoint pupils • Amphetamine-type drugs – dilated pupils, agitation, sweating, fever
Neurotoxic snake bite see Section 3.9	• Snake bite history or bite marks in a setting with neurotoxic snakes
Other causes	
Status epilepticus see Section 3.5	• Ongoing or recurrent stiffening or jerking movements of limbs • Known history of seizures
Post-seizure state	• History of recent seizure (stiffening, jerking movements) • Bitten tongue, incontinence • Known history of seizures • Postictal improvement over minutes or hours from: ° confusion ° poor attention ° poor short-term memory ° cognitive deficits below baseline functioning
Eclampsia see Quick Check page 58	• Usually associated with hypertension, oedema • Usually occurs at term, during delivery or immediately following delivery
Head trauma see Section 4	• Bruises, lacerations, other visible injury or history of injury around head or eyes or ears • History of recent traffic accident, fall or violence • Periorbital "racoon eyes" or bruising behind the ears • CSF leaking from nose (rhinorrhoea) or ears (otorrhoea) • Focal neurology (unequal pupils, flaccid limbs) • Seizures
Intracranial mass	• Headache • Nausea, vomiting • Focal neurological signs and symptoms (unequal pupils, cranial nerve findings, limb weakness, papilloedema)
Hypertensive encephalopathy	• BP systolic >180 • Known hypertensive • Papilloedema and retinal haemorrhages or exudates
Cerebral vascular accident (CVA)	• Neurological deficit or impairment • Sudden onset • Lasting >24 hours (can lead to death) • Presumed vascular origin
Transient ischaemic attack (TIA)	• Focal neurological symptoms or signs • Lasting <24 hours, with full recovery
Hypothermia	• Decreased core body temperature • Exposure to cold
Acute liver failure or hepatic encephalopathy	• Asterixis – hepatic flap (flapping tremor when arms are outstretched and wrists are dorsiflexed) • History of hazardous alcohol consumption or liver disease • Stigmata of chronic liver disease (spider naevi, petechiae, white nails) • Hepatosplenomegaly, ascites, foetor hepaticus (musky breath) • Jaundice, hypoglycaemia

Condition	In favour
Uraemia see Section 11.31	• Asterixis – uraemic flap • Peripheral oedema, ascites, uraemic frost • History of renal disease • Elevated creatinine and BUN
Withdrawal from alcohol or other substances see alcohol (Section 16) and other substance use (Section 17)	• Chronic use of alcohol or sedative drugs, with recent discontinuation • Tremulousness • Confusion • Seizures • Visual hallucinations
Wernicke-Korsakoff encephalopathy see Section 16	• Confusion • Ataxia • Ophthalmoplegia (double-vision, inability to moves eyes to side) • Confusion • History of hazardous alcohol consumption
Some mental health problems can present as confusion; however, they do not cause a reduced level of consciousness.	
Psychosis, dementia, mania, severe learning disabilities see Section 10.11	• See abnormal behaviour, Section 10.11 Mental health

3.4.2 Manage delirium

The appropriate treatment of delirium involves determining its underlying causes as well as treating its symptoms. If it is an acute case, health workers should consider the following:

- Take measures to prevent the patient from self-harming or harming others due to confusion or agitation.
- Assess for dehydration and give fluids as necessary.
- Check blood glucose and manage appropriately (see Quick Check page 41).
- Decide where treatment should take place. (Hospitalization is usually desirable.)
- Coordinate care with all team providers (the district clinician, nurses, medical assistants) who are caring for the delirious patient. This helps ensure appropriate and comprehensive evaluation and care.
- Treat the underlying medical conditions.
- For delirium due to alcohol withdrawal, give a benzodiazepine (diazepam) (see Section 3.7). Give parenteral thiamine and then glucose. Keep well-hydrated. If delirium persists, consider using antipsychotics such as haloperidol 2.5–5 mg orally up to 3 times daily.
- For agitation or psychosis, give the patient low doses of antipsychotic medications (see Quick Check page 59 and Section 10.11 on mental health).

The objectives of managing delirium are as follows:

- Identify the underlying aetiology of the patient's delirium and begin medical management.
- Ensure that the patient is safe and comfortable. Supervise agitated patients.
- Determine the appropriate place for the patient's treatment (home versus hospital). For cases of severe delirium, treatment should take place in a

hospital or other health setting. Treatment should involve several clinicians or the equivalent, including a mental health expert. If persons with delirium have milder symptoms, they may be treated in a nursing facility or at home.

- Ensure an appropriate environment that does not worsen the delirium, confusion, and misperceptions.
- Some environmental considerations include:
  - lighting that corresponds with day and night to help reduce sleep disturbances; availability of a window may also assist in orienting the patient to time;
  - control of the noise level, making it neither over-stimulating nor too quiet;
  - ensuring that individuals who wear eyeglasses or hearing aids wear them, to help lessen confusion and disorientation;
  - provision of a clock and calendar in the room to help keep patients oriented to the time and the day of the week.

Determine whether management with psychotropic medication is appropriate. If symptoms do not abate, despite addressing medical problems and providing environmental support, consider very low-dose antipsychotics (see Quick Check page 59). If withdrawing from alcohol, see Section 3.7 Acute alcohol withdrawal.

3.4.3 Manage diabetic ketoacidosis

Clinical presentation of diabetic ketoacidosis (DKA)

The three main features of DKA are hyperglycaemia, ketosis, and acidosis. DKA is characterized by the following:

- hyperglycaemia with blood glucose usually more than 300 mg/dl (more than 17 mmol/l);
- ketonuria and *ketonaemia with total ketones (beta-hydroxybutyrate [βOHB] and acetoacetate) in serum more than 3 mmol/l;*
- *acidosis with blood pH <7.3 or serum bicarbonate <15 mEq/l;*
- hyperosmolar dehydration with *serum osmolarity >320 mmol/l.*

DKA is commonly seen in paediatric patients with Type 1 diabetes, both at first presentation and in established patients. DKA is also seen in adult patients with Type 2 diabetes at presentation, and in adult patients with established diabetes. This is the case particularly in the presence of infection, myocardial infarction, discontinuation of medications, or long duration of the disease. DKA is a major source of morbidity and mortality; therefore, preventing it should be the primary goal.

DKA may cause

- Dehydration – fluid loss is generally 3 to 6 litres; expect to give many litres of fluid.
- Acidosis with consequent potassium (K) loss – all patients will require potassium replacement.

Usual presentations

- nausea, vomiting, abdominal pain
- polyuria, polydipsia, and weight loss are often early indicators of hyperglycaemia
- lethargy

- a 2–3 day history of deterioration that may be precipitated by infection
- apparent shortness of breath (hyperventilation with deep breaths, sighing breaths due to acidosis)
- shock (due to dehydration or to sepsis)
- coma
- characteristic ketotic (sweet-smelling) breath
- signs suggestive of a source of infection (pneumonia, urinary tract infection).

The acute metabolic problems and dehydration are more dangerous than the underlying high blood sugar and should be addressed immediately

Investigations for DKA

Confirm the diagnosis
- blood glucose more than 14 mmol/l or 252 mg/dl.

If blood glucose is not available, the following investigations should be done:
- Urine dipstick with 3+ or 4+ glucose with ketones.
- Check electrolytes, creatinine, bicarbonate. Calculate anion gap (serum sodium – (serum chloride + serum bicarbonate). An anion gap of more than 12 mEq/l is abnormal; suspect acidosis.
- If available (not required), check arterial blood gas if urine ketones or anion gap is elevated. *Blood pH <7.3 confirms acidosis (if venous, then +0.03 less than arterial).*
- Check an ECG (see Monitoring, below).
- Consider precipitating cause for DKA
  - urine dipstick and microscopy (for urinary tract infection)
  - blood culture (if fever)
  - chest X-ray (for pneumonia)
  - ECG for chest pain (myocardial infarction).

Treatment of DKA

Principles of management include giving IV fluids and insulin, correction of electrolyte abnormalities (K), and treatment of precipitating cause. Use Quick Check pages 17–18 to assess airway and breathing, to protect the airway, and to give oxygen as needed. Use Quick Check page 19 to assess the circulation.

If the patient is in shock, insert IV line.
- Manage fluids
  - Administer 1 litre normal saline immediately – **do not** add K to this litre.
  - Infuse normal saline as quickly as possible.
  - If the patient is haemodynamically stable, infusion rate is 10–5 ml/kg body weight per hour in first few hours (maximum 50 ml/kg in first 4 hours) – generally 1 litre per hour in an average-size person.
  - Fluid replacement should be more cautious in elderly or pregnant patients or in heart or renal failure.

- Manage potassium (see .5.2.2)
  - Rapid hydration with normal saline and early initiation of insulin can result in dangerously low K levels. When insulin is given, K moves rapidly into the cells, which can cause a drop in serum K. This is associated with a risk of heart arrhythmias.
  - It is important to monitor serum K or ECG hourly for first 3 hours if possible (then every 2 hours) and to carefully replace K to avoid hypokalaemia. It is also important to give K by infusion over an hour, never by bolus.
  - Potassium chloride supplementation – maintain the K level between 4–5 mEq/l.
  - Do not begin replacement until the level is <5.3 and there is adequate urine output (more than 50 ml/h).
  - Add 20 mmol to each subsequent litre of saline – unless hyperkalaemia or hypokalaemia is present (see Monitoring below). A litre of normal saline with added K should be infused over 1 hour.
  - Hyperkalaemia – if the level is ≥5.3 or there are tall, pointed T waves and a widened QRS complex, then continue NS or Ringer's solution without K and check the level every 2 hours, or repeat ECG.
  - Hypokalaemia – if the level is <3.3, or there are small or absent T waves and a large U wave following the T wave on the ECG, give 20–30 mmol K/hour until the level is higher than 3.3.
  - If there is no capacity to measure K and no ECG, consider slowing the rehydration rate and giving empirical K supplementation starting from the second hour (20 mmol K in each litre of fluid). Do not give K supplementation empirically until the patient has produced urine.
- Manage glucose with insulin
  - Administer soluble (short-acting) insulin IV or IM as soon as you have initiated fluid resuscitation (see the table below). Be aware that children and adolescents younger than 18 years are at increased risk of cerebral oedema, and it is better to wait until fluids have been given for 1–2 hours before starting insulin.
  - Continue to monitor blood glucose and adjust insulin according to the table.

Table: Management of DKA if K measurement or ECG is available and SBP >90 (If in shock with SBP<90, see Quick Check page 18 and Section 3.1.**)**

	Give fluids	**Give K and insulin according to serum K or ECG result**		
		If K <3.3 mEq/l or ECG small (or absent) T waves and large U waves following T waves	**If K 3.3–5.3 mEq/l or normal ECG**	**If K >5.3 mEq/ l or ECG tall, pointed T waves and widened QRS**
First hour from time of initiation of IV fluids	Give 1 litre NS IV over 1 hour	**Rapid repletion K:** add 40 mEq/l K to one-half NS; run over 1 hour. **No insulin** therapy until K >3.3 mEq/l.	**Do not add K.** **Give short-acting insulin** by IV infusion or IM* • If IV, then bolus 0.15 U/kg body weight followed by infusion at 0.1 U/kg/hour • If IM or SC, 0.4 U/kg given as half IV and half IM or SC	**Do not add K. Give insulin as in box to left.**

	Give fluids	Give K and insulin according to serum K or ECG result		
2nd and 3rd hours	Give NS 1 litre/ hour (average-size person)	**Rapid repletion K:** add 40 mEq/l K to 1/2 NS; run over 1 hour. **No insulin** therapy until K >3.3 mEq/l.	**20 mmol K in each litre fluid** **Continue insulin and adjust according to decrease in blood glucose.** If blood glucose does not decrease by 50 mg/dl or 2.8 mmol/l in first hour, increase insulin rate by 50% and repeat same procedure until glucose falls by 50 mg/dl or 2.8 mmol/l over a period of 1 hour.	**Do not add K. Continue insulin as above.**
Over next 4 hours	Give NS 1 litre/ hour (average-size person). Change to 5% dextrose in 0.45% NS when blood glucose <14 mmol/l or <250 mg/dl.	**Continue K repletion as above.** **Delay or reduce rate of insulin therapy** until K >3.3 mEq/l.	**20 mmol K in each litre fluid** **Continue insulin** and decrease the rate to 0.05 U/kg/hr when blood glucose <14 mmol/l or <250 mg/dl.	**Do not add K.** **Continue insulin** and decrease the rate to 0.05 U/kg/ hour when blood glucose <14 mmol/l or <250 mg/dl.

* In children and adolescents younger than 18 years, delay initiation of insulin until after the first hour of rehydration to avoid cerebral oedema. See specific paediatric DKA protocols.

Monitoring DKA

- Check the patient's pulse, blood pressure, hydration status, and level of consciousness every hour, and confirm that the fluids are being infused intravenously.
- If possible, check blood glucose every hour until it is stable (<12 mmol/l or <216 mg/dl), then maintain on a dextrose infusion and check every 2 hours.
- Check K levels on presentation, then every hour for 4 hours, and then after 6 hours.

Cease intravenous therapy and hourly insulin when the patient can eat and drink unaided and there are no signs of acidosis (deep sighing, breathing) and, if blood sugar testing is available, when the blood sugar is <12 mmol/l or 216 mg/dl. Patients should receive a maintenance insulin regimen once they are eating and drinking. See guidelines on chronic management of diabetes.

Assess for signs of infection and initiate antibiotics as indicated.

3.4.4 Manage hypoglycaemia

Hypoglycaemia can be defined as a blood glucose level of <3.1 mmol/litre (<50 mg/dl). However, people with diabetes experience symptoms of hypoglycaemia at varying degrees of blood glucose concentration. Therefore, many people accept Whipple's triad (symptoms likely caused by hypoglycaemia, low glucose measured at the time of the symptoms, and relief of symptoms when the glucose is raised) as confirmation of hypoglycaemia. The exact level of blood glucose that defines hypoglycaemia remains a matter of debate.

A lack of glucose to supply the brain may result in:

- dizziness, confusion, difficulty speaking

- decreased consciousness or drowsiness
- seizures
- altered behaviour
- focal neurological deficit
- sympathetic over-activity – sweating, anxiety, palpitations, hunger, tremor.

Hypoglycaemia should be suspected as a possible cause in all of these presentations, especially in patients being treated with hypoglycaemic agents (oral agents or insulin) for diabetes mellitus or with quinine for malaria, or consuming hazardous amounts of alcohol, as well as in those with severe infections or malnutrition.

If hypoglycaemia is suspected, perform a finger-prick test or carry out laboratory testing immediately to either confirm or rule it out, and urgently give 25–50 ml of 50% dextrose slowly.

If glucose testing is unavailable or a delay in obtaining results is expected, treat with glucose empirically.

Some causes of hypoglycaemia

Drugs and toxins	Insulin, sulphonylureas (e.g. glibenclamide), alcohol, quinine, pentamidine, β-blockers, herbal medicines, cotrimoxazole, haloperidol
Organ failure	Liver failure, hypopituitarism, adrenal failure, myxoedema, chronic renal failure, chronic cardiac failure
Infections	Sepsis, malaria
Decreased food intake	Malnutrition, starvation, unable to eat due to illness, prolonged fasting (religious or otherwise)

Treatment of hypoglycaemia

The goal of treatment of hypoglycaemia is to increase the blood glucose to a safe level and prevent sequelae by using an intervention that works fast and relieves symptoms quickly while avoiding rebound hyperglycaemia.

- Mild to moderate hypoglycaemia is usually treated with food, oral glucose powder or tablets, or sucrose solutions. The guide is to administer 15–20 g glucose, to raise blood glucose by about 3 mmol/l (65 mg/dl). If the patient is conscious, give sweet drinks (not diabetic or sugar-free), e.g. cola, juice, sweet water.
- After the administration of the first 15–20 g glucose, patients should wait 15 minutes for symptoms to subside. Administration of glucose can be repeated after that time if the symptoms persist or if the blood glucose level is checked and is still low.
- In case of loss of consciousness, give glucose (see Quick Check page 41). The treatment is 20–30 g dextrose IV as 200–300 ml 10% dextrose or 25–50 ml D50 (50% dextrose) slowly, followed by a saline flush to avoid damage to the vein.
- When the patient recovers consciousness, food should be provided as soon as the patient can ingest food safely. He or she will need sugary drinks, followed by a long-acting carbohydrate (e.g. bread, rice, maize) to prevent recurrence of symptoms.

- Monitor blood sugar every 1–2 hours. A continuous infusion of dextrose (1 litre over 8 hours) may be required if blood sugar falls to <3 mmol/l.
- Look for and treat the underlying cause.
- If there is a possibility of hazardous alcohol consumption or if the patient is malnourished, also give parenteral thiamine (see Section 16).

Prevention of hypoglycaemia

- Every person taking anti-diabetic agents (insulin or tablets) should be taught how to recognize the warning symptoms of hypoglycaemia and how to treat them promptly, even if they are subtle, to prevent progression to neuroglycopaenia.
- Relatives, friends, teachers, and co-workers also should be taught how to recognize symptoms of hypoglycaemia. In general, they should be suspicious of any unusual behaviour on the part of the person with diabetes.
- All hypoglycaemic episodes require treatment, even in the absence of symptoms.

3.4.5 Steroid deficiency (Addison's disease; adrenal insufficiency)

Patients with a deficiency of steroid hormones (cortisol and aldosterone) can present with hypotension, dehydration, and in severe cases: shock and hypoglycaemia.

Causes of adrenal insufficiency

Adrenal insufficiency should be considered in all cases of shock (see Section 3.1). Impaired adrenal gland production of these steroids can result from the following infections.

- TB (most commonly)
- HIV (opportunistic infections)
- disseminated fungal infection
- meningococcal sepsis (resulting in adrenal haemorrhage)
- human African trypanosomiasis
- syphilis.

Adrenal insufficiency also can be caused by autoimmune adrenalitis, metastatic cancer, and certain drugs, e.g. ketoconazole, or chronic use of prescribed steroids (i.e. for more than 2 weeks) or steroid-containing traditional remedies.

An Addisonian crisis can be triggered by the underlying cause as well as by intercurrent infection, acute illness, surgery, abrupt cessation of steroids, or the administration of certain drugs (e.g. rifampicin or phenytoin) that increase hepatic breakdown of cortisol.

Investigations

- electrolytes
- glucose (finger-prick or laboratory)
- Low Na, high K, and hypoglycaemia support the diagnosis; high calcium may also be present.
- chest X-ray (look for TB)

- abdominal X-ray (look for adrenal calcification)
- blood and urine cultures (can help indicate underlying cause)
- ECG, especially if electrolyte imbalances are detected.

Treatment

- In hypotensive patients or patients in shock, immediately establish IV access and commence fluid resuscitation with dextrose-containing fluid. Give 1 litre immediately, the next litre over a 1-hour period, and then further fluids at a slower rate determined by the patient's response and fluid volume status.
- If the patient is hypoglycaemic, give 25–50 ml D50 IV slowly (see Quick Check page 41).
- Commence urgent steroids. Give 100 mg hydrocortisone IV or 8 mg dexamethasone IV immediately then repeat every 8 hours. If neither is available, give 50 mg oral prednisolone once daily. This is a less effective alternative. See dose equivalents of different corticosteroids in Section 8.2.
- Consider general supportive measures, including oxygen and broad-spectrum IV antibiotics for underlying infection, and a Foley catheter to monitor fluid balance.
- Regularly monitor pulse and blood pressure, as well as ECG, electrolytes, and glucose as possible.
- Investigate and treat the underlying cause.

Ongoing care

- As the patient recovers and is eating and drinking unaided, IV fluids can be stopped. The IV glucocorticoid should be given in decreasing doses over 3−4 days and then converted to an oral maintenance dose. A typical maintenance regime would be hydrocortisone 10 mg and 5 mg and 5 mg (with meals) or prednisone 5–7.5 mg once daily.
- Newly diagnosed patients will need education on long-term steroid use, on the importance of compliance, and on doubling the dose with intercurrent illness. Dietary advice on a salt-rich, low-K diet should be provided when mineralocorticoid replacement is not possible.

Gradual dose reduction after chronic steroid use

- When steroids are prescribed for other medical conditions for more than 2 weeks, the dose should be reduced gradually.

3.5 Approach to the patient with seizures or status epilepticus[1]

Seizures (fits) are manifestations of excessive or abnormal electrical activity in the brain. They are characterized by abnormal movements or, less commonly, transient abnormalities in consciousness or sensation. They usually last for seconds or minutes but may be recurrent.

Prolonged continuous seizures or recurrent seizures, where the patient does not recover consciousness between episodes, are known as status epilepticus. Depending on the cause, status epilepticus is associated with high mortality, particularly if seizures last more than 30 minutes. Always check glucose levels if possible.

- Eclampsia is associated with pregnancy and should be considered in all female patients presenting with seizures. However, other causes may be possible.
- In patients with suspected or known HIV infection, many opportunistic infections, such as toxoplasmosis, tuberculosis, cryptococcus, and lymphoma, may cause seizures.
- Infections are a common cause of seizures, including meningitis, malaria, encephalitis, and parasitic infection *(Taenia solium,* neurocysticercosis).

Diagnosis of seizures and status epilepticus

Most seizures are of limited duration, lasting only a few minutes. Symptoms are stereotyped: the same – at least at the start – of each episode. There is usually a period following the seizure in which patients return slowly to their normal mental state, known as the postictal period. Many patients will have a known history of seizures. If a person tends to have recurrent seizures, this is known as epilepsy.

There are two types of seizures.

Focal (partial) – these start from one part of the brain; the initial symptoms depend on the part of the brain involved. For example, with a lesion in the motor area, a focal seizure will start with involuntary movements on one side of the body (e.g. jerking movements of the left arm). The patient may be conscious. Less commonly, focal seizures may involve recurrent, brief, stereotyped sensory symptoms (tingling or paraesthesia), psychic symptoms (for example, recurring déjà vu), or varying degrees of loss of responsiveness, perhaps with stereotyped movements (e.g. recurrent lip-smacking). Focal seizures may progress to involve other parts of the body (secondary generalization). The affected area may be weak during the postictal period (Todd's palsy).

Generalized – in this type of seizure, the patient is almost always non-responsive. The most common type is known as tonic-clonic seizures, which start with stiffening and collapse (tonic); then jerking movements of the limbs occur (clonic). The patient may be incontinent or bite the tongue.

1 *mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings.* WHO and mhGAP Evidence Resource Centre, 2010. Available at: http://www.who.int/mental_health/evidence/mhGAP_intervention_guide/en/index.html. The mhGAP Guidelines and the mhGAP-IG will be reviewed and updated in 5 years. Any revision and update before that will be made to the online version of the document.

DDx: Seizures

Condition	In favour
Cysticercosis	• Endemic area • History of recurrent seizures • May or may not have focal neurological signs
Pregnancy	• Eclampsia, usually associated with hypertension, oedema • Usually occurs at term, during delivery, or immediately following delivery
Epilepsy	• Tendency to recurrent seizures, including where the cause is not known
Hypoglycaemia	• Diabetic patient on treatment • Responds to glucose
Alcohol or sedative drug withdrawal see Sections 3.6 and 3.7	• History of hazardous alcohol use or use of sedative-hypnotic drugs, with recent cessation or markedly lower level of use
CNS infection (meningitis, cerebral malaria)	• Fever • Signs of meningitis (neck stiffness, photophobia) • Signs of encephalitis (confusion) • Signs of brain abscess (focal neurological signs or septic emboli)
HIV-related	• Toxoplasmosis, tuberculosis, cerebral lymphoma – all presenting with focal signs • If chest X-ray suggestive of tuberculosis, treat for TB (see Section 15). • If chest X-ray not suggestive of TB, treat for toxoplasmosis (see Section 11.40). • Electrolyte abnormalities (calcium, sodium, potassium)
Poisoning see Section 3.8	• Pesticides, antidepressants, amphetamines

Management of acute seizures

- Check the patient's airway, breathing. Place in recovery position (see Quick Check page 42). Give oxygen using nasal prongs.
- Give IV glucose D50 25–50 ml slowly (see Quick Check page 41).
- Single short seizures that stop on their own (less than 5 minutes) may not require medication.
- If seizures have not stopped after 5 minutes, give diazepam 10 mg IV or rectally. If available, lorazepam 4 mg IV is an effective alternative.
- Look for the cause of the seizure. In particular, consider pregnancy-induced conditions (such as eclampsia), hypoglycaemia, meningitis (see 10.10b), and malaria (see Section 11.25).
- If the seizure is thought to be due to alcohol withdrawal, also give thiamine 100 mg IV. On recovery give diazepam 10–20 mg every 2 hours until the patient is lightly sedated (or has received a total of 120 mg) to manage the withdrawal syndrome and prevent further seizures (see Section 3.7 Alcohol withdrawal).

Seizures in pregnancy (usually more than 30 weeks, or just after pregnancy) may be caused by severe eclampsia.

- For eclampsia, give magnesium sulfate (see Quick Check page 57); consider delivery and anti-hypertensives (see IMPAC MCPC).

Management of ongoing seizures (status epilepticus)

Status epilepticus is defined as seizures that last more than 30 minutes, or when successive convulsions occur so frequently that the patient does not recover consciousness between them.

This is associated with high mortality.

- Give glucose – D50 IV 25–50 ml IV slowly.
- Give a repeat dose of diazepam 10 mg IV or rectally. Monitor the patient's respiratory rate closely.
- Give phenytoin 15–18 mg/kg IV (usually 1 g) in normal saline over a 1-hour period through a different line from the diazepam.
- Monitor the pulse (preferably via an ECG) and respiratory rate every 15 minutes.
- If the patient is already on phenytoin or it is not available, give phenobarbital 10 mg/kg IV over 15 minutes.
- Give thiamine 100 mg IV (if seizures due to alcohol withdrawal) if not given previously.

In ongoing seizures check the patient's glucose. If resources (both equipment and staff) for airway management with bag valve mask ventilation or intubation with manual ventilation are available (see Quick Check page 31), then consider giving an additional dose of phenobarbital 10 mg/kg. Respiratory failure is a major risk when using phenobarbital, particularly with a repeat dose. Use with caution, particularly in severe malaria and if other drugs have been given that also cause respiratory depression. Monitor carefully. Apnoea can occur suddenly.

Ongoing maintenance treatment of first seizure (see Section 10.10c)
Adult-onset seizures are more likely to be associated with recurrence and will require further investigation to establish the underlying cause. Treatment is indicated for patients with recurrent seizures. However, ongoing maintenance treatment may not be required for seizures associated with alcohol withdrawal or pregnancy (eclampsia).

Anticonvulsant regimens that provide effective maintenance treatment of seizures include:

- phenytoin starting at 150–200 mg/day, increasing by small increments of 25–30 mg until maintenance dose of 200–400 mg daily is reached;
- carbamazepine 100–200 mg/day, increasing weekly by 100–200 mg; maintenance dose of up to 400–1400 mg daily in divided doses;
- phenobarbital starting at 1 mg/kg/day for 2 weeks. If poor response, increase to 2 mg/kg/day for 2 months. If seizures persist, increase to 3 mg/kg/day (180 mg) in divided doses.

For patients with HIV, possible treatable causes include TB (see Section 15) and toxoplasmosis (see Section 11.40).

3.6 Manage intoxication or overdose, or withdrawal from injecting or other use of opioids, amphetamine-type stimulants, or cocaine[2,3]

In this section:

3.6.1 Opioid intoxication or overdose

Overdose is a leading cause of morbidity and mortality among injectors of opioid drugs. Up to 80% of heroin users have experienced an overdose while using it. The high risk of overdose is associated with the following:

- when 2 or more drugs that have interacting effects are used concurrently (e.g. combined use of opioids, alcohol, and benzodiazepines or other sedatives);
- injection methods rather than smoking of opioids;
- injecting or other heroin use on one's own – when no one else is present;
- when tolerance is low (e.g. in the first few weeks following release from prison, after detoxification, or after discharge from a rehabilitation centre).

Depressant drugs such as opioids (e.g. heroin) and sedatives (e.g. benzodiazepines and alcohol) slow down the body's functions. A person who overdoses on a depressant may experience respiratory arrest, i.e. their breathing will become very slow or will stop altogether, leading to death. Death usually occurs 1–3 hours after injection rather than immediately afterwards.

Signs and symptoms of opioid intoxication or overdose:

- **pinpoint pupils and**
- **slow breathing, often with**
- slurred or interrupted speech
- nodding
- unsteady gait.

Consider also the differential diagnosis for other causes of decreased level of consciousness and confusion (see Section 3.4). Consider that the patient may be using other drugs.

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2 *Guidelines for the psychosocially assisted pharmacological treatment of opioid dependence.* WHO, 2009. Available at http://www.who.int/rpc/guidelines/9789241547543/en/

3 *mhGAP Intervention Guide for mental, neurological and substance use disorders in non-specialized health settings*. WHO, 2010. Available at http://www.who.int/mental_health/evidence/mhGAP_intervention_guide/en/ The mhGAP Guidelines and the mhGAP-IG will be reviewed and updated in 5 years. Any revision and update before that will be made to the online version of the document.

Treatment of opioid intoxication or overdose

See Quick Check (page 40) for instructions on giving naloxone. Not everyone with pinpoint pupils and the above signs requires naloxone. It is indicated when the respiratory rate is <10/minute, or SpO_2 <90.

Giving someone who has overdosed an injection of naloxone can precipitate an opioid withdrawal syndrome that can cause temporary but often significant agitation and discomfort. The person may become upset that they have lost their «high», refuse to stay in the hospital, and may become aggressive if restrained. To minimize this risk, naloxone should be administered in small doses as indicated in Quick Check. This makes the reversal of overdose more gradual and more controllable.

Naloxone is short-acting and wears off within 2–3 hours. This is long enough to reverse the effects of short-acting opioids such as heroin. If a person has used long-acting opioids (such as methadone or oral slow-release morphine formulations), they may develop the signs of overdose again when the naloxone wears off. It is therefore important to establish whether the person has used short- or long-acting opioids. An adequate supply of naloxone should be available in district hospitals and staff should be trained in administering it properly.

Once the patient has recovered from the overdose, there is an opportunity to talk to the patient.

- Establish what drugs were used.
- Explain the implications of the overdose.
- Consider whether they may need drug detoxification or opioid substitution treatment (see Section 17).
- Consider that they may have TB or be infected with HIV or viral hepatitis B or C infection.
- Recommend HIV testing and counselling (see Section 9), assess for TB and viral hepatitis, and vaccinate for viral hepatitis B.
- Counsel about harm reduction (see Section 17).
- Counsel about safer sex. Promote and provide condoms, if needed.

3.6.2 Manage opioid withdrawal

The effects of acute opioid withdrawal

Withdrawal symptoms differ depending on the dose and duration of action of the opioids used, and the patient's neuroadaptive state. Stopping short-acting opioids leads to withdrawal symptoms at an earlier phase than with long-acting opioids; symptoms peak and resolve earlier. Most opioids have a short duration of action (hours), and the withdrawal syndrome usually lasts 4 to 5 days. The main exceptions are methadone and buprenorphine, and also slow-release preparations of morphine and oxycodone.

Signs and symptoms of acute opioid withdrawal:

- tremors, shivers
- tear formation, rhinorrhoea, yawning
- muscle cramps
- restlessness

- gooseflesh
- disturbed sleep or inability to sleep
- diarrhoea
- extreme anxiety
- nausea and vomiting
- tachycardia.

When assessing withdrawal, examine the patient for both subjective and objective withdrawal symptoms. Subjective withdrawal symptoms are more sensitive measures of opioid withdrawal, but, when they are present, objective symptoms are more reliable.

Manage acute opioid withdrawal

(See Section 17.8 for management of withdrawal in hospitalized patients with a medical condition that is causing acute pain.)

The management of acute opioid withdrawal depends on the medications available. Buprenorphine (a partial opioid agonist) and methadone (a full agonist) [4]are the most effective for relieving symptoms and ensuring that patients can complete a detoxification schedule.

- Buprenorphine is given sublingually at a dose range of 4–16 mg/day for 3−14 days. It must not be given while the person has any signs of opioid toxicity because there is a risk that it will precipitate a withdrawal syndrome.
- Methadone is given orally at an initial dose of 15–20 mg, increasing to 30–40 mg/day, and then tapering off over 3−28 days.
- Care should be taken particularly if the patient is prescribed other sedative drugs.
- Treat symptoms as necessary using pharmacological and non-pharmacological care.

If the patient has:

- muscle cramps and pain
  ⇨ give ibuprofen or other NSAIDs
- nausea and vomiting
  ⇨ give anti-emetics (see Section 10.7c)
- restlessness or sleep disorder
  ⇨ give mild sedatives such as a sedating antihistamine
- diarrhoea
  ⇨ see Section 10.7d. Consider giving *loperamide.*

Advise the patient about harm reduction, safer sex, and recommend HIV testing. Consider referral to a drug treatment facility for opioid substitution – see Section 3.6.1 above.

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4 If these medications are not available, use *oral alpha-2 agonists: clonidine 300 mcg–1.2 mg daily (in doses of 75–300 mcg, 3−4 times daily), or lofexidine 600 mcg–2.4 mg daily (in doses of 150–600 mcg 3−4 times daily). The exact dose depends on body weight, severity of withdrawal, and the patient's response.* Continue for 4−7 days. See Adaptation Guide.

3.6.3 Manage stimulant intoxication and overdose

Stimulant intoxication from amphetamine, amphetamine-type stimulants (ATS), or cocaine can be classified as "standard" or "complicated".

Standard stimulant intoxication

Signs and symptoms of standard intoxication include **dilated pupils** associated with any of the following:

- irritability, hyperactivity
- teeth grinding
- restlessness
- intermittent paranoia
- fast pulse.

Complicated stimulant intoxication

Complicated intoxication presents as an **acutely disturbed mental state** typified by marked paranoia. Also, it can be associated with a number of other symptoms, such as:

- nausea and vomiting
- sweating
- malaise
- abdominal pain
- fever
- chest pain
- arrhythmia (that can lead to myocardial infarction)
- progressive psychotic disturbance, including auditory hallucinations
- behaviour that is dangerous to the patient or to others
- seizures
- uncontrolled hypertension.

Amphetamine and cocaine acute intoxication – initial management

Patients with acute complicated psychostimulant toxicity should immediately be admitted to the hospital for treatment. Manage the patient as follows:

- Ensure the patient is taking fluids and monitor their urine output.
- Provide a soothing, non-stimulating and non-threatening environment.
- For severe agitation, anxiety and psychosis, give diazepam in titrated doses until the person is calm and lightly sedated.
- If there is an inadequate response to diazepam and no other cause of delirium is identified, give antipsychotics (haloperidol or chlorpromazine).
- Periodically monitor the patient's ECG, BP, and body temperature.

For standard (less severe) psychostimulant intoxication, the interventions available are largely social and supportive.

- Provide a non-stimulating environment, with support and reassurance.
- Prevent the person from harming themselves or others (provide a safe space to "chill out").

- Avoid confrontation.
- Encourage support from family or sober friends.

Special features of cocaine intoxication or overdose

Cocaine overdose is associated specifically with some potentially lethal reactions, including myocardial infarction, hypertensive crisis, cerebral haemorrhage, aortic dissection and hyperthermia. Arrhythmias may also occur, but are likely to be lethal only in the presence of previous myocardial damage.

3.6.4 Manage stimulant withdrawal

Characteristics of psychostimulant withdrawal syndrome include:

- fatigue and exhaustion (lack of energy)
- hunger
- emotional lability and irritability
- depressed mood and anxiety
- restlessness and agitation
- fear
- drowsiness and overwhelming desire to sleep (but may sleep poorly)
- cravings.

The withdrawal syndrome usually lasts 2–4 weeks, although the acute "crash" only lasts for 1–4 days. This syndrome is followed by strong urges to use amphetamines again, which may increase over the following 6 weeks. Symptoms include:

- disrupted sleep
- headache
- body aches
- increased appetite
- irritability
- paranoia
- misinterpretations.

Symptomatic management of withdrawal

The withdrawal syndrome should be treated sparingly and symptomatically (with extra care if benzodiazepines are used). The person usually becomes symptom-free 1–3 months after stopping amphetamine use, although the cravings may persist for years.

Non-pharmacological management of withdrawal

In addition to the symptomatic treatment above, the management of the environment is important. A safe environment includes a safe, secure situation, access to supportive family and other supports, instruction in relaxation, sleep advice with contingency management, and other drug counselling.

An inpatient facility or detoxification centre may be appropriate, particularly in the presence of polydrug dependence, psychiatric complications, absence of social supports or a previous complicated withdrawal.

3.7 Acute alcohol withdrawal and intoxication[5]

3.7.1 Acute alcohol withdrawal

Alcohol withdrawal is a neural hyperexcitability syndrome which occurs when an alcohol dependent person suddenly stops heavy alcohol consumption.

To make a diagnosis of alcohol withdrawal

There must be a recent cessation of or a reduction in drinking after repeated, often prolonged and hazardous alcohol consumption.

Symptoms and signs that are compatible with known features of alcohol withdrawal:

- tremor of the tongue, eyelids, or outstretched hands
- sweating
- nausea, retching, or vomiting
- tachycardia or hypertension
- psychomotor agitation
- headache
- insomnia
- malaise or weakness
- transient visual, tactile, or auditory hallucinations or illusions
- grand mal convulsions.

Symptoms and signs are not accounted for by a medical disorder unrelated to alcohol use, and are not better accounted for by another mental or behavioural disorder.

If delirium is present, the diagnosis should be alcohol withdrawal state with delirium (delirium tremens).

Alcohol withdrawal syndrome is often mild and may not require medical intervention. However, when severe, it can be life threatening, and can include tonic-clonic seizures, and a delirium characterized by disorientation and visual hallucinations. The aim of management is to identify patients at risk of alcohol withdrawal and to treat withdrawal symptoms before they become too severe.

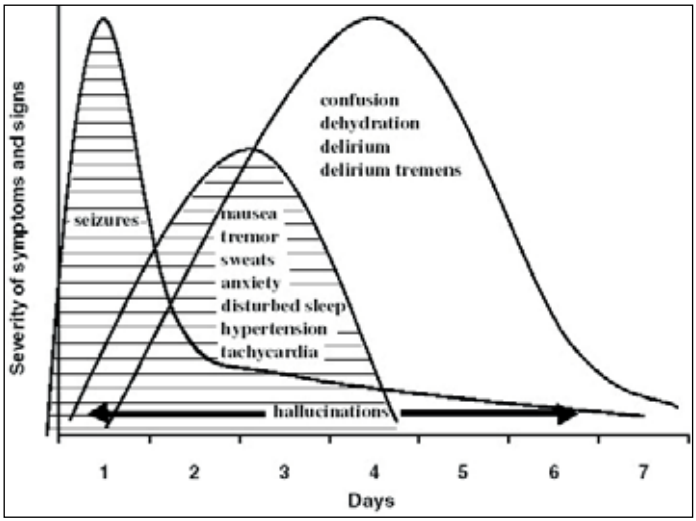
Alcohol withdrawal usually develops within 24 hours of the last drink, peaks at 2–3 days, and usually resolves within 5 days. When withdrawal seizures occur, this is usually in the first 48 hours. Confusion, delirium, and hallucinations occur in severe withdrawal, and can persist for days or (rarely) up to 2 weeks.

Sedation with benzodiazepines reduces the severity of delirium and hallucinations due to alcohol withdrawal. However, it must be recognized that other causes of delirium and hallucinations may be present, which will require specific, additional forms of treatment.

5 *mhGAP Intervention Guide for mental, neurological and substance use disorders in non-specialized health settings.* WHO and mhGAP Evidence Resource Centre, 2010. Available at http://mental_health/mhgap/evidence/en/index.html. The mhGAP Guidelines and the mhGAP-IG will be reviewed and updated in 5 years. Any revision and update before that will be made to the online version of the document.

The following figure summarizes the progression of the alcohol withdrawal syndrome over time.

Progression of the alcohol withdrawal syndrome



A patient with alcohol withdrawal often has other medical problems. This increases the probability of severe alcohol withdrawal. These other medical problems may include:

- urinary tract infections
- pneumonia
- Wernicke's encephalopathy
- hepatic encephalopathy
- gastrointestinal bleeding
- head injury with or without subdural haematoma
- stroke
- hypoglycaemia
- metabolic and fluid and electrolyte disturbances
- acute psychotic illness.

It is important to consider and treat these other medical problems. Use the Quick Check, then the acute care Section 10 for each main symptom.

Alcohol-dependent individuals also may be dependent on benzodiazepines. This means that higher doses of diazepam will be needed to treat the alcohol withdrawal.

Delirium tremens

- Occurs in about 5% of patients with alcohol withdrawal.
- Onset – usually 24 hours to 96 hours after the last drink.
- Seizures may herald the onset of delirium tremens, generally preceded by other alcohol withdrawal features.

Clinical features of delirium tremens

Symptoms are similar to those of severe alcohol withdrawal, with marked tremor, and the following:

- delirium (agitation, disorientation, and confusion)
- hallucinations (typically visual, sometimes auditory)
- paranoid delusions
- autonomic hyperactivity, marked agitation
- sweating, dehydration, electrolyte disturbances (hypokalaemia, hypomagnesaemia)
- possible cardiovascular collapse.

Untreated delirium tremens has a mortality of up to 30%. Patients with severe alcohol withdrawal and, in particular, delirium tremens need to be hospitalized urgently and investigated to identify any aggravating factors.

Treatment of alcohol withdrawal syndrome

Treatment of alcohol withdrawal is with a benzodiazepine, typically diazepam. The doses needed may vary from 5–10 mg to several hundred milligrams. The principle of safe treatment is titration of the dose, based on frequent monitoring of the severity of withdrawal symptoms and the response to treatment. The aim of treatment is to keep the patient for 3 days in a state of light sedation. Alcohol withdrawal severity is easily measured clinically.

An **alcohol withdrawal scale**, such as the Clinical Institute Withdrawal Assessment of Alcohol Scale Revised (CIWA-AR), can be used to quantify the severity of alcohol withdrawal, can assist in its early detection and monitoring, and can guide diazepam dosing instructions for nursing staff (see example below).

Adequate sedation reduces anxiety and agitation and helps to prevent hallucinations, seizures, and delirium tremens. A patient with alcohol withdrawal that progresses to a severe syndrome and delirium tremens may need a high level of medical and nursing attention.

The following regime is suitable for patients who have no complicating medical disorders

1. Sedation

If there are no contraindications, a benzodiazepine should be given. Diazepam is the most commonly used.

If the patient presents in an alcohol withdrawal state, give diazepam 10–20 mg orally every 2 hours until the patient is calm and **mildly** sedated. Titration of diazepam can be delegated to non-medical staff with the assistance of a withdrawal scale.

Use extreme caution in using diazepam if the patient has a head injury or other medical cause of confusion or delirium (such as hepatic encephalopathy).

Patients can have a tendency to abuse benzodiazepines; therefore, they should not be prescribed for more than 1 week. The diazepam regime for a simple withdrawal should be finished within a week to avoid risk of benzodiazepine dependence.

Following delirium tremens, up to 10 days of sedation reduction may be required. Patients should not be discharged with a prescription for benzodiazepines.

2. Antipsychotic medication
There is no place for antipsychotics in the management of simple alcohol withdrawal. In alcohol withdrawal delirium, diazepam is the preferred medication (see below for dose schedule). Antipsychotic drugs, such as haloperidol 2.5–5 mg orally 3–4 times daily, can be used in addition to benzodiazepines to manage delirium that persists after tremor and sweating have subsided. The use of antipsychotic drugs early in withdrawal increases the likelihood of seizures.

3. Thiamine and multivitamin supplements
Administer thiamine 100 mg daily orally for 5 days for all patients. If the patient is malnourished or unable to take oral medication, give thiamine 100 mg daily IM for 5 days, then switch if possible to oral medication. Continue thiamine 100 mg daily long term. Consider other vitamin supplementation when indicated. Ensure that the patient is well-hydrated and eats well.

4. Oral or intravenous fluids
If a patient is dehydrated, the condition needs to be corrected. Use ORS if there are signs of dehydration (see Section 10.7 on diarrhoea). Use IV fluids if the patient has a delayed recovery from a seizure.

5. Potassium
Correct hypokalaemia with appropriate potassium supplements 80–240 mmol daily (see Section 5.2).

6. Magnesium
Correct hypomagnesaemia, e.g. magnesium aspartate 500 mg orally 2–4 times a day, taken with meals (contraindicated in cases of renal failure).

7. Supportive care
If patient has hypoglycaemia, give glucose (see Quick Check page 41) but only **after** the patient has received thiamine 100 mg IV or IM.

If there have been periods of prolonged immobility which may cause rhabdomyolysis and acute renal failure, *check CPK.* Turn the patient regularly.

8. Skilled nursing
Skilled nursing is vital in managing alcohol withdrawal. Manage the environment, nurse the patient in a quiet dimly lit room, constantly reassure and reorientate the patient, and check the alcohol withdrawal scale regularly, e.g. every 2−4 hours in the hospital.

9. Close monitoring
Close monitoring (every 2–4 hours) of the alcohol withdrawal is recommended for all patients (CIWA-AR should be <10).

If the patient has a seizure
- Use Quick Check and Section 3.5.
- Ensure a responsible person remains with the patient at all times.
- Place the patient in a quiet room without bright lights.

- Every 30–60 minutes monitor BP, pulse, temperature, respiratory rate, and record the alcohol withdrawal score.
- If recovery of consciousness is slow, ensure adequate IV fluids.

Following recovery from the seizure, give diazepam 10–20 mg every 2 hours until the patient is lightly sedated (or has received 80 mg) to manage the withdrawal syndrome, prevent further seizures, and reduce the likelihood of delirium. There is no need for ongoing anticonvulsant therapy after an alcohol withdrawal seizure.

If the patient has alcohol withdrawal delirium

- Use Quick Check and Section 3.4.
- Insert an IV cannula.
- Give 5 mg diazepam IV, repeated if necessary every 15 minutes until the patient is in a state of light sedation or can take oral diazepam.
- Exclude other causes of confusion, e.g. hypoxia, infections, subdural haematoma, metabolic and electrolyte imbalance, CVA, or decompensated liver disease.
- Ensure skilled nursing care is available.
- Place the patient in a quiet room with adequate but not bright lights.
- Every 30 minutes monitor BP, pulse, temperature, respiratory rate, and record the alcohol withdrawal score.
- Give thiamine 100 mg IV or IM daily.
- Give adequate fluids IV.

Following recovery from the delirium, diazepam should be given according to the severity of the residual withdrawal state.

Precautions in patients who have complicating medical disorders

If patients have chronic airflow limitation without respiratory failure, the dose of diazepam should be reduced and carefully titrated. Monitor SpO_2 before and after each dose of diazepam.

If there is respiratory failure, DO NOT sedate. Use Quick Check airway management instructions (page 29) and obtain help urgently to maintain a clear airway. Give oxygen cautiously and assist with ventilation.

In patients with liver disease with hepatic decompensation (encephalopathy, ascites, jaundice), benzodiazepines may worsen hepatic encephalopathy. In these cases, often the patient is already drowsy and no diazepam is necessary. If patients are exhibiting signs of autonomic hyperactivity consistent with alcohol withdrawal, give them a small dose of diazepam, and wait to see what effect it has and how long it lasts. Often, one dose is sufficient.

An example alcohol withdrawal scale follows – the **CIWA-AR alcohol withdrawal scale**.[6] The scale is used to monitor and treat all patients who might be alcohol-dependent and have ceased alcohol consumption in the previous 72 hours.

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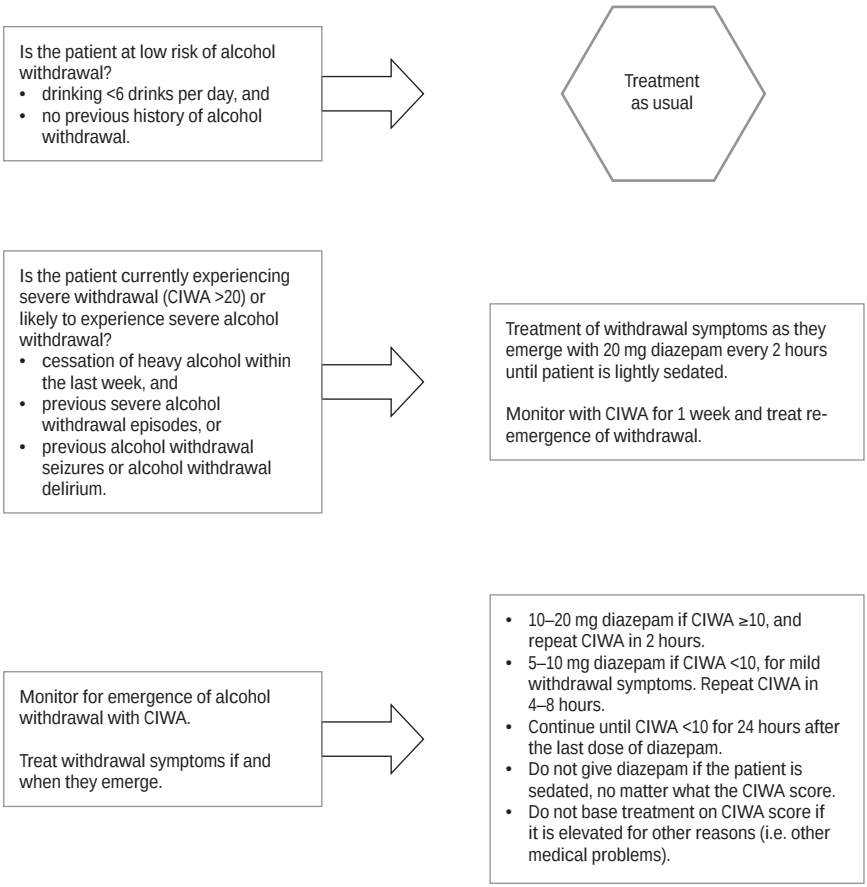
6 Sullivan JT, Sykora K, Schneiderman J, Naranjo CA, Sellers EM. Assessment of alcohol withdrawal: The revised Clinical Institute Withdrawal Assessment for Alcohol scale (CIWA-Ar). *British Journal of Addiction*, 1989;84:1353-7.


Is the patient at low risk of alcohol withdrawal?
• drinking <6 drinks per day, and
• no previous history of alcohol withdrawal.
Treatment as usual
Is the patient currently experiencing severe withdrawal (CIWA >20) or likely to experience severe alcohol withdrawal?
• cessation of heavy alcohol within the last week, and
• previous severe alcohol withdrawal episodes, or
• previous alcohol withdrawal seizures or alcohol withdrawal delirium.
Treatment of withdrawal symptoms as they emerge with 20 mg diazepam every 2 hours until patient is lightly sedated.
Monitor with CIWA for 1 week and treat re-emergence of withdrawal.
Monitor for emergence of alcohol withdrawal with CIWA.
Treat withdrawal symptoms if and when they emerge.
• 10–20 mg diazepam if CIWA ≥10, and repeat CIWA in 2 hours.
• 5–10 mg diazepam if CIWA <10, for mild withdrawal symptoms. Repeat CIWA in 4–8 hours.
• Continue until CIWA <10 for 24 hours after the last dose of diazepam.
• Do not give diazepam if the patient is sedated, no matter what the CIWA score.
• Do not base treatment on CIWA score if it is elevated for other reasons (i.e. other medical problems).

CIWA-AR alcohol withdrawal scale (AWS)

Record observations according to the following scale. Transfer the scores to the summary sheet on the following page.

Nausea and vomiting Ask "Do you feel sick to your stomach? Have you vomited?"	**Tactile disturbances** Ask "Have you any itching, pins and needles sensations, any burning, any numbness, or do you feel bugs crawling under your skin?"
0 No nausea and no vomiting 1 Mild nausea and no vomiting 2 3 4 Intermittent nausea with dry heaves 5 6 7 Constant nausea, frequent dry heaves and vomiting	0 None 1 Very mild itching, pins and needles, burning or numbness 2 Mild itching, pins and needles, burning or numbness 3 Moderate itching, pins and needles, burning or numbness 4 Moderately severe hallucinations 5 Severe hallucinations 6 Extremely severe hallucinations 7 Continuous hallucinations
Tremor Observe patient's arms extended and fingers spread apart.	**Auditory hallucinations** Ask "Are you more aware of sounds around you? Are they harsh? Do they frighten you? Are you hearing anything that is disturbing to you? Are you hearing things you know are not there?"
0 No tremor 1 Not visible, but can be felt fingertip to fingertip 2 3 4 Moderate, with patient's arms extended 5 6 7 Severe, even with arms not extended	0 Not present 1 Very mild harshness or ability to frighten 2 Mild harshness or ability to frighten 3 Moderate harshness or ability to frighten 4 Moderately severe hallucinations 5 Severe hallucinations 6 Extremely severe hallucinations 7 Continuous hallucinations
Paroxysmal sweats Record observations.	**Visual disturbances** Ask "Does the light appear to be too bright? Is its colour different? Does it hurt your eyes? Are you seeing anything that is disturbing to you? Are you seeing things you know are not there?"
0 No sweat visible 1 Barely perceptible sweating, palms moist 2 3 4 Beads of sweat obvious on forehead 5 6 7 Drenching sweats	0 Not present 1 Very mild sensitivity 2 Mild sensitivity 3 Moderate sensitivity 4 Moderately severe hallucinations 5 Severe hallucinations 6 Extremely severe hallucinations 7 Continuous hallucinations

Anxiety Ask "Do you feel nervous?"	**Headaches, fullness in head** Ask "Does your head feel different? Does it feel like there is a band around your head?" Do not rate for dizziness or light headedness. Otherwise rate severity.
0 No anxiety, at ease 1 Mildly anxious 2 3 4 Moderately anxious, or guarded, so anxiety is inferred 5 6 7 Equivalent to acute panic states as seen in severe delirium or acute schizophrenic reactions	0 Not present 1 Very mild 2 Mild 3 Moderate 4 Moderately severe 5 Severe 6 Very severe 7 Extremely severe
Agitation	**Orientation and clouding of sensorium** Ask: "What day is this? Where are you? Who am I?"
0 Normal activity 1 Somewhat more than normal activity 2 3 4 Moderately fidgety and restless 5 6 7 Paces back and forth during most of the interview, or constantly thrashes about	0 Orientated and can do serial additions 1 Cannot do serial additions or is uncertain about date 2 Disorientated for date by no >2 calendar dates 3 Disorientated for date by >2 calendar dates 4 Disorientated for place or person

Estimated date and time of last drink_____

Date:														
Time:														
Nausea and vomiting														
Tremor														
Paroxysmal sweats														
Anxiety														
Agitation														
Tactile disturbances														
Auditory hallucinations														
Visual disturbances														
Headaches, fullness in the head														
Orientation and clouding of sensorium														
Score														

Vital signs:														
Temperature														
Pulse														
Respiratory rate														
BP														

3.7.2 Acute alcohol intoxication

This Section summarizes interventions for acute alcohol intoxication and other acute syndromes related to acute alcohol consumption. People with alcohol intoxication, or who are suffering acute problems from its use, may present to services such as health posts, the police, ambulance services, emergency departments, and acute care clinics.

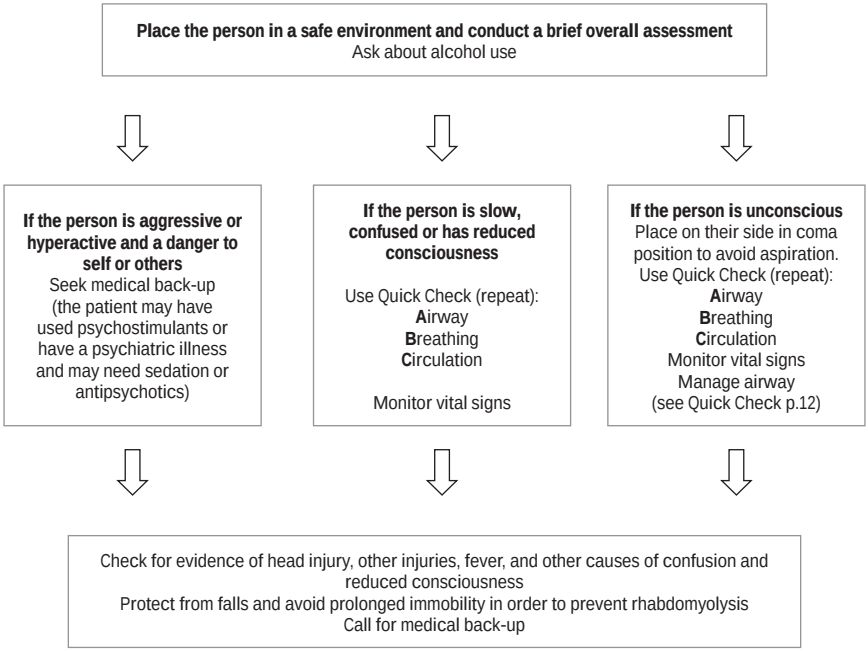
Ensure the patient is in a safe environment. Use Quick Check and monitor vital signs. Repeat Quick Check regularly. Conduct a brief overall assessment.

a. Is the person aggressive or hyperactive? If yes, then:
   - consider whether the person has used psycho-stimulants, or has a psychiatric disorder;
   - beware of giving sedation if the intoxication is due to alcohol alone as this may increase the degree of aggression or cause sudden loss of consciousness;
   - medical back-up may be needed.

b. Is the person slow, confused or do they have a reduced conscious level? If yes, then:
   - ensure that vital signs are stable by regularly monitoring airways, breathing, circulation.

c. Is the person unconscious? If yes, consider the following:
   - Place the patient on their side (in "coma position") to avoid aspiration. Consider the need to use assisted respiration in patients with severe respiratory depression.
   - Check for evidence of a head injury, other injuries, fever and other causes of confusion and reduced conscious level.
   - If the patient is confused, give parenteral thiamine.
   - Protect the patient from falls and avoid prolonged immobility to prevent rhabdomyolysis.
   - Check blood glucose.

Repeated use of intoxicating amounts of alcohol places a person at high risk of acute harm and of long-term damage (see Section 16 on alcohol).


Place the person in a safe environment and conduct a brief overall assessment
Ask about alcohol use
If the person is aggressive or hyperactive and a danger to self or others
Seek medical back-up
(the patient may have used psychostimulants or have a psychiatric illness and may need sedation or antipsychotics)
If the person is slow, confused or has reduced consciousness
Use Quick Check (repeat):
Airway
Breathing
Circulation
Monitor vital signs
If the person is unconscious
Place on their side in coma position to avoid aspiration.
Use Quick Check (repeat):
Airway
Breathing
Circulation
Monitor vital signs
Manage airway
(see Quick Check p.12)
Check for evidence of head injury, other injuries, fever, and other causes of confusion and reduced consciousness
Protect from falls and avoid prolonged immobility in order to prevent rhabdomyolysis
Call for medical back-up

3.8 Poisoning

In this section:

Suspect poisoning if a previously healthy patient presents with any unexplained illness. Poisoning can occur with pharmaceutical agents, recreational drugs, commercial and household chemicals, agrochemicals, plants and fungi. Traditional medicines and contaminated food and water can also be sources of poisoning. Ingestion is the most common route of exposure, but poisoning can occur through inhalation and skin exposure, as well as from venomous bites and stings (see Section 3.9 Snakebite). Possible poisoning from alcohol, opioids, and other recreational drugs is discussed in Sections 3.6 and 3.7.

3.8.1 Ingested poisons or overdose of medicines

Poisoned patients can present to a medical facility in a multitude of clinical scenarios. They may walk in, be brought in a drowsy state with stable vital signs, or brought in unconscious with upper airway obstruction and unstable cardiovascular status (shock or arrhythmia). All patients who present with a possibility of poisoning should be evaluated immediately for life-threatening conditions such as hypotension, hypoxia, hypoglycaemia, and electrolyte abnormalities, followed by a risk assessment.

- Use Quick Check to assess emergencies of airway, breathing, circulation, coma or convulsions, and to deliver emergency treatments.

Prevent aspiration of gastric contents

This is one of the most important aspects of the management of poisoning with either central nervous system depressants or those causing significant vomiting. Preventing aspiration is also important during transport of the patient from the site of poisoning to the nearest medical facility.

- Patients who are drowsy should be managed in the recovery position (see Quick Check page 42) to prevent gastric aspiration.

Assess airway and breathing

Use Quick Check for guidance on the assessment of airway and breathing emergencies and how to deliver emergency treatments, such as how to manage the airway (e.g. head manoeuvres), how to give oxygen, how to give salbutamol for wheezing, and advanced airway management (e.g. indications for intubation, manual ventilation, transferring a patient). Also, see Section 3.2.3 for more detailed discussion of caring for the severely ill patient with respiratory distress.

Patients with poisoning can present with severe respiratory distress from multiple causes, such as the inability to protect the airway, poor respiratory effort, upper airway obstruction, bronchospasm, aspiration, or acute lung injury. Look for signs of severe respiratory distress in the poisoned patient, such as:

- a rapid or very slow respiratory rate
- cyanosis, SpO_2 <90
- abnormal auscultatory findings (e.g. bronchospasm, crackles, or rales)
- Sluggish chest movement with compensatory abdominal movement suggests severe diaphragmatic muscle weakness and is an indication of inadequate ventilation.
- Low AVPU score (P or worse) suggests the patient may not be able to protect their airway and is at high risk for aspiration. If the patient does not cough during suction of secretions in the pharynx, it is unlikely that they can protect their airway.

It is difficult to generalize a safe rate of breathing in a patient with poisoning. In assessing the airway, it is paramount to remember the above-mentioned clinical features and monitor the patient closely to see if symptoms worsen or improve. A respiratory rate of <8 warrants action as soon as possible. For example, in patients with opioid toxicity, give naloxone and assist ventilation with a bag valve mask (BVM) (see Quick Check page 31) until the patient recovers and can breathe unassisted. A rate of 12 (normal) may indicate the need for further assessment of other clinical parameters and close monitoring to see if breathing becomes abnormal. If the patient has a respiratory rate greater than 25 or other signs of respiratory distress, look for the cause. Fast breathing can be caused by many factors, for example:

- hypoxia secondary to excessive secretions from respiratory mucosa, as in cases of organophosphorous self-poisoning. This should be confirmed by auscultation for crackles (rales) or wheezing, followed by the administration of atropine.
- hypoxia due to aspiration of gastric contents. Auscultation will reveal coarse crepitations in a single lung in most cases. This can lead to acute lung injury, with diffuse crackles and infiltrates on chest X-ray (see Section 3.2.3).
- changes in acid-base status, such as metabolic acidosis or primary stimulation of the respiratory centre (causing respiratory alkalosis), as in salicylate

toxicity. It is very important to think of this possibility if the patient has a normal peripheral saturation and clear lungs. (*Analysis of arterial or venous blood gas is useful.*)

Assess circulation

If the patient is talking and alert, serious cardiovascular abnormality is unlikely. In most cases of poisoning, hypotension can be treated with the administration of IV fluids (see Quick Check page 39 and Section 3.1). In addition, some cases may require administration of antidotes. Determine further fluid requirements based on the clinical response (look for signs of adequate perfusion and signs of fluid overload). See Section 3.1 for further details regarding management of shock. For shock that is unresponsive to fluid resuscitation and antidotes, consider vasopressors early, as many poisons can cause depressed myocardial contractility.

The presence of hypertension following overdose is rare, and should alert to the possibility of cocaine, amphetamine, or other sympathomimetic agents (see Section 3.6.3).

Assess neurologic impairment

Neurological status should be assessed using the AVPU scale (see Section 3.4). If the score is P or worse and the patient has no cough reflex, the patient is at high risk for aspiration. Failure to protect the airway is an indication for advanced airway management with tracheal intubation. This should be considered when it is feasible to perform manual ventilation for short-term conditions, or if transfer to another hospital with mechanical ventilation is possible. See Quick Check pages 29–32 for further details on advanced airway management. Patients who are drowsy should be managed in the recovery position (see Quick Check page 42) to prevent gastric aspiration.

Assess the need for antidotes

After resuscitation, the patient's need for antidotes should be assessed.

Risk assessment

Try to determine what was taken (name of drug, product, plant), whether multiple substances were taken (ethanol is often a co-ingestant), **how much** (strength of tablets, volume, and concentration of liquids), **when** it was taken (time elapsed since exposure) and the **duration** of exposure, whether the patient has vomited, and whether any first aid has been given (obtain a description of the first aid). It is also important to find out **why** the poisoning occurred: was it accidental or deliberate? If the latter (suicide or homicide attempt), then the overdose may be more severe. If this was a suicide attempt, see also Quick Check page 70 and Section 10.11.2. The route of exposure is important since this may determine the speed of onset of toxic effects. Multiple routes of exposure are possible (e.g. inhalation and dermal).

- Ask for the container, bottle, or plant sample to be brought in with the patient (it may be found near the patient or in a rubbish bin).
- Check whether another person was involved.
- Check the medical and occupational history of the patient since these factors may influence the risk of toxicity, e.g. chronic illness such as diabetes, cardiovascular disease, drug dependency, occupational exposure to chemicals, or psychological and familial problems. Nutritional status is

also important, e.g. malnourishment may increase the risk of toxicity in paracetamol overdose.

- Check what other medications the patient is taking, including traditional medicines, because these may interact with the substance that has been taken in overdose, resulting in faster onset of toxic effects, or more prolonged or severe toxic effects. The co-ingestion of two serotinergic drugs, for example, increases the risk of serotonin syndrome. An important group of medicines are antiretroviral protease inhibitors, which are metabolised by hepatic P450 enzymes. Ritonavir, for example, inhibits metabolism of dextropropoxyphene resulting in a greater risk of toxicity and a number of protease inhibitors inhibit metabolism of benzodiazepines such as diazepam.[1]

Common agents

- **Medicines:** pain killers (e.g. paracetamol [acetaminophen], opioids, salicylates), antidepressants, anticonvulsants, sedatives, antimalarials, iron salts, antihypertensives, hypoglycaemic agents, bronchodilators, and drugs of abuse.
- **Plants:** e.g. *Datura stramonium* (thorn apple, jimson weed), *datura merel* (angel's trumpet), *ricinus communis* (castor bean), *thevetia peruviana* (yellow oleander), *atropa belladonna* (deadly nightshade), *gloriosa superba* (glory lily).
- **Fungi:** e.g. *Amanita phalloides, gyromitra species.*
- **Herbal preparations:** e.g. pennyroyal, bitter melon, arnica, aristolochia.
- **Pesticides:** e.g. rodenticides (rat or mouse killers), (e.g. anticoagulants, aluminium, and zinc phosphide), insecticides (e.g. organophosphate and carbamate compounds), herbicides (e.g. paraquat, 2, 4-D, glyphosate, propanil, bispyribac sodium).
- **Household products:** e.g. detergents, bleach, drain cleaner, disc batteries.
- **Common chemicals:** e.g. acids, alkalis, kerosene or paraffin, fire lighters, paints, methanol, ethylene glycol, arsenic, lead.

Diagnosis and treatment decisions should be based on a combination of the history (identity of the poison, quantity taken), physical examination (assessment of vital signs, presence of characteristic symptoms and signs, i.e. toxidromes), simple bedside laboratory tests (e.g. urine colour tests and SpO_2) and general laboratory examinations (blood glucose, ECG, and arterial or venous blood gas). In the case of opioids, a challenge dose of naloxone is diagnostic, but should be given cautiously, especially in opioid-dependent patients (see Quick Check page 40 and Section 3.6).

The treatment table below is a guide to toxic doses of medicines. However, it is important to note that a number of factors affect the risk from poisoning, such as body weight, age, pre-existing health problems, chronic use of medications, and genetic factors. Therefore, the patient should be assessed as a whole, rather than relying on the history of the overdose alone. If a toxicology laboratory is available to measure serum levels, these provide helpful indicators of the need for treatment for certain drugs and toxic substances.

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1 Medicine interaction information can be found in the *WHO Model Formulary.* WHO, 2008. Available at http://apps.who.int/emlib/ModelList.aspx?Language=EN&MdType=FORMULARY or the *British National Formulary* (BNF), available through HINARI at http://extranet.who.int/hinari/en/journals.php. The BNF also includes a short section on poisoning.

If there is no clear history of the agent ingested, the diagnosis of the agent involved should be based on symptoms and signs and a limited number of investigations. If this is not possible, patients should be given supportive care and vital parameters should be stabilized, such as blood pressure and SpO_2.

- Use Quick Check to check for emergency signs and to provide emergency treatments as appropriate (e.g. airway management, oxygen, IV fluids, glucose, naloxone).
- Look in the patient's mouth and smell the breath.
- Feel the pulse and do an ECG to check for arrhythmias.
- Examine the patient from head to toe: look for trauma, cyanosis, blisters, burns in or around the mouth, and check for stridor (laryngeal damage from corrosives).

Management principles for ingested poisons

- Perform Quick Check to assess for emergencies of airway, breathing, circulation, or coma or convulsions.
- Manage the airway (see Quick Check pages 17–18).
- If inadequate ventilation, assist ventilation with BVM (see Quick Check pages 17–18).
- If signs of severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35).
- If wheezing, give salbutamol (see Quick Check page 37).
- Is there an indication for advanced airway management with tracheal intubation (see Quick Check pages 62–67)?
  - Failure to maintain or protect airway?
  - Failure to oxygenate or ventilate?
  - Impending airway obstruction?
- For patients who have indications for tracheal intubation and continued assistance with ventilation, consider advanced airway management taking into account these requirements (see Quick Check pages 62–67 and Section 3.2.2):
  - for easily reversible conditions (e.g. long-acting opioids, other drug overdoses, or poisoning where several days of ventilatory problems are anticipated), manual ventilation may be possible;
  - for conditions that are not easily reversible and that may require longer term ventilatory support (e.g. paraquat-associated acute lung injury or upper airway obstruction from corrosive ingestion), transferral to a hospital where skilled invasive mechanical ventilation is possible must be arranged.
- If shock, give rapid IV LR or NS fluids (see Quick Check page 39 and Section 3.1). If not in shock, give fluids more slowly (100 ml per hour). Monitor closely for signs of adequate perfusion (urine output) and signs of fluid overload. Titrate accordingly.
- If consciousness is altered, check glucose and treat if low (<3 mmol/54 mg/dl) or unknown (see Quick Check page 41).
- If consciousness is reduced, place in the recovery position.
- Manage seizures with diazepam or *lorazepam* (see Quick Check page 41 and Section 3.5). If poisoning is suspected, phenobarbital should be the second-line antiepileptic (phenytoin is usually considered the anticonvulsant of last choice for drug-induced seizures since it may be ineffective or may worsen cardiac toxicity).

- Check Hb, Hct, and urinalysis.
- If the patient is hypothermic (use a low-reading rectal thermometer), wrap them in warm blankets and administer warm IV fluids if necessary.
- If the patient is hyperthermic, see Section 10.1 and guidance below for specific agents.
- Check for focal neurological signs or any asymmetry (see Section 10.10a).
- Manage agitation with diazepam (see Quick Check page 59 and Section 3.4). Avoid haloperidol and chlorpromazine, especially in haemodynamically unstable patients.
- Few patients require active removal of the poison or the use of antidotes.
- Frequently monitor vital signs, neurological and respiratory status (see Section 3.0 on the general principles for caring for severely ill patients).

Important considerations in resuscitation and stabilization in clinical toxicology that may differ from management of non-poisoned patients

- Caustic ingestion may lead to severe upper airway injury (mucosal inflammation and necrosis), stridor, and obstruction, and requires advanced airway management (see Section 3.2.2). Call for help from a senior clinician immediately as progression to complete obstruction can happen rapidly. This type of injury can make tracheal intubation very difficult. Ensure an experienced senior clinician is present and be prepared for surgical airway management, if necessary. If the airway is already obstructed, proceed to emergency cricothyroidotomy (see Quick Check page 69) or surgical tracheotomy to bypass obstruction.
- Fixed dilated pupils are not necessarily an indicator of poor prognosis in comatose patients with tricyclic antidepressant or other anticholinergic poisoning, or who are receiving atropine.
- Intubation and insertion of a nasogastric tube in beta-blocker poisoning may worsen concurrent bradycardia. Use prophylactic atropine (0.6 mg for adults) prior to the procedure.

Differences with standard guidelines for management of arrhythmias and advanced cardiac life support (such as the ACLS protocol)

- Resuscitation with IV fluids and vasopressors may be needed for a longer period than in non-poisoned patients.
- Higher doses of atropine may be needed in patients with organophosphate-induced cholinergic symptoms.
- Class 1a agents such as procainamide, quinidine, and disopyramide are contraindicated for ventricular dysrhythmias in overdose with cyclic antidepressants and other myocardial sodium channel-blocking agents.
- Class Ia and Class III antiarrhythmics should be avoided in sotalol-induced cardiac arrhythmias.
- Intravenous calcium is indicated in poisoning with hydrofluoric acid, calcium channel-blocking agents, and magnesium (see Quick Check p. 28).
- Calcium salts should be avoided in digoxin toxicity.
- Synchronized electrical cardioversion for atrial tachyarrhythmias may precipitate asystole in digoxin poisoning.
- Sodium bicarbonate should be given to treat ventricular tachycardias caused

by toxic agents (see individual guidance on management) and those with salicylate poisoning.

- Insulin-dextrose should be used early in managing severe hypotension following calcium channel blocker poisoning, and may have a role in beta-blocker poisoning.

Criteria for inpatient hospital admission

These include patients who:

- have intentionally poisoned themselves;
- may have been given the drug or poison intentionally by another person;
- are at risk of recurrent self-harm or homicide;
- present with a reduced level of consciousness;
- present with hypotension or other cardiovascular impairment;
- have ingested pesticides, methanol, iron, paracetamol, aspirin, narcotics, antidepressant drugs, chloroquine, antiarrhythmic drugs, or other highly toxic agents associated with serious morbidity or mortality;
- have taken poisons that have a delayed action, even if they appear well. Delayed-action poisons include aspirin, iron, lithium, paracetamol, paraquat, tricyclic antidepressants, and anticoagulants. The effects of modified-release or prolonged-release preparations can also be delayed.
- have ingested corrosives or petroleum products. These patients should be admitted or observed for at least 6 hours. Corrosives can cause oesophageal burns that may not be immediately apparent. Petroleum products, if aspirated, can cause pulmonary oedema that may take several hours to develop.

If personnel and resources are inadequate to manage the severely ill patient with poisoning, and there is a referral hospital with available resources to treat the patient (see Quick Check pages 70–71), safely transfer the patient after ensuring that the airway is protected. Transferring unstable patients may lead to adverse events during transfer.

Consult a poisons expert. Some countries have a poison centre warm or hot line. If not, these services can be reached by telephoning a poison centre in another country.[2] A directory of poisons centres can be found at http://www.who.int/ipcs/poisons/centre/directory/en/.

Removal of the poison from the gastrointestinal tract (gut decontamination)

Gut decontamination should not be attempted in a drowsy or unconscious patient with an unprotected airway due to the risk of pulmonary aspiration.

Induction of vomiting (emesis) to treat poisoning should usually not be used

There is no evidence that vomiting reduces absorption of the poison, and it may increase the risk of aspiration. Furthermore, the effects of the substance given to

2 Insert phone numbers of cooperating centres; insert warm or hot line number, if available, during country adaptation.

induce vomiting may complicate the diagnosis. In particular, vomiting should not be induced following ingestion of corrosives and hydrocarbons, as it increases the risk of complications.

There is a very limited role for gastric lavage

Gastric lavage is rarely required, and should be considered only if the patient has ingested, within the last hour, a life-threatening amount of a substance that cannot be removed effectively by other means (e.g. iron). Gastric lavage is unnecessary if the risk of toxicity is small, or if the patient presents too late. The main risk is pulmonary aspiration of stomach contents and trauma to the uncooperative patient.

The prerequisites for gastric lavage are:

- patient consent
- the patient is conscious and able to protect the airway, or is intubated
- the patient has been adequately resuscitated and has a stable cardiovascular status.

The contraindications to gastric lavage are:

- a patient with an unprotected airway, such as a patient with a depressed level of consciousness and without endotracheal intubation;
- a patient who has ingested corrosives (likely to increase the risk of injury to the oesophagus and stomach during gastric lavage);
- if its use increases the risk and severity of aspiration (e.g. a patient who has ingested a hydrocarbon with high aspiration potential);
- a patient at risk of haemorrhage or gastrointestinal perforation due to pathology, recent surgery, or other medical conditions.

Gastric lavage should be performed by a qualified and experienced clinician and the procedure MUST be explained to the patient. The patient's pulse and blood pressure should be monitored throughout the procedure. Never use force to introduce the tube. Place the patient in the left lateral position, with the head tilted down. Insert a orogastric tube (36 to 40 French gauge or 30 English gauge in adults, with an external diameter of 12 to 13.3 mm; and 24 to 28 French gauge in children, external diameter 7.8 to 9.3 mm). Introduce 200 to 300 ml (10 ml/kg in children) of normal saline or water (preferably warmed to 38°C – avoid water in children to prevent hyponatraemia). Remove the volume introduced before giving further fluid. If the patient becomes restless or if the blood pressure drops, abandon the procedure. Give a dose of activated charcoal (50 g) to an adult and 1 g/kg to a child after the lavage (see below).

Activated charcoal may be useful in the first 1–2 hours after ingestion for some poisons

Activated charcoal acts by **adsorbing** the poison and preventing it from being absorbed by the patient.

- It is ineffective in poisoning due to alkalis, acids, heavy metals, iron, lithium, toxic alcohols, glycols, and hydrocarbons such as kerosene.

Activated charcoal is contraindicated:

- if the patient has an unprotected airway, such as in a patient with a depressed level of consciousness and without endotracheal intubation;

- if its use increases the risk and severity of aspiration (e.g. a hydrocarbon with a high aspiration potential);
- in patients who are at risk of gastrointestinal haemorrhage or perforation due to pathology, recent surgery, or medical conditions that could further be compromised by single dose of activated charcoal.

How to prepare activated charcoal

Activated charcoal should be mixed with water according to manufacturer's instructions and well-shaken.
- For adolescents and adults: give 50–100 g as a single dose (children 1–12 years: give 1 g/kg, maximum 50 g).
- The solution can be administered via a nasogastric tube if the airway is protected and the patient is compliant.

The presence of activated charcoal in the gastrointestinal tract may obscure endoscopic visualization. However, a corrosive is not a contraindication when charcoal is used for co-ingested agents that are systemic toxins.

There is a very limited role for whole bowel irrigation (WBI) for gut decontamination

This aims to clear the entire gastro-intestinal tract using an **osmotically balanced** polyethylene glycol-electrolyte solution.
NB: WBI should only be performed using this solution, which is carefully formulated to prevent development of electrolyte and fluid imbalance.
- The indications for WBI are potentially toxic ingestion of sustained-release or enteric-coated drugs, iron, and packets of illicit drugs.
- WBI is contraindicated in the presence of ileus, bowel obstruction, bowel perforation, clinically significant gastrointestinal haemorrhage, haemodynamic instability, uncontrollable intractable vomiting, and an unprotected, compromised airway.

A 12 French nasogastric tube is passed into the stomach (gastric location should be confirmed by auscultation during air injection). The tube is then attached to a reservoir bag of irrigation solution that is hung from an elevated site. The patient should be seated or the head of the bed elevated to at least 45°. The irrigation fluid is given at a rate of 1500–2000 ml/h for adults and adolescents. The patient should be placed on a commode or similar receptacle to collect the effluent. WBI should be continued at least until the rectal effluent is clear.

Management of specific poisons

Brief guidance on the management of specific poisonings is given in the table on the next page, Poisons and agents, symptoms of toxicity in overdose, and brief guidance on specific management. This does not cover all aspects of management or complications, and the reader is advised to consult additional sources. Some agrochemicals and medicines do not lead to serious adverse clinical outcomes and should only be treated with supportive care (see Table: Agrochemicals and pharmaceuticals that are unlikely to lead to adverse clinical outcomes).

Table: Poisons or toxins, symptoms of toxicity in overdose, and brief guidance on specific management		
Poison or toxin	**Symptoms**	**Management**
Drugs		
Aspirin (acetylsalicylic acid) Toxic dose: >150 mg/kg or 6.5 g aspirin equivalent (whichever is less) Ingestion of >4 ml of oil of wintergreen (98% methyl salicylate) or more than a lick or taste for <6 years of age	Vomiting, deafness, tinnitus, confusion, hyperventilation, fast pulse, low SBP, dehydration, hypoglycaemia, coma Prolonged or delayed absorption possible	• If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). Target adequate urine output. • Give activated charcoal, followed by a second dose 4 hours later. • Monitor electrolytes and bicarbonate 2 hourly. • Correct hypokalaemia. Maintain serum K between 4 and 4.5 mmol/l. • Check and monitor the serum salicylate concentration. • *Correct metabolic acidosis with sodium bicarbonate 1–2 mmol/kg as IV bolus, followed by maintenance infusion.* • If salicylate level is >500 mg/l, give sodium bicarbonate to alkalinize the urine (pH>7.5). Give sodium bicarbonate 225 mmol (225 ml of an 8.4% solution) intravenously over 1 hour. Give additional boluses of intravenous sodium bicarbonate to maintain urine pH in the range of 7.5–8.5. Note: Urinary alkalinisation should only be done if there are facilities to monitor plasma bicarbonate and urine pH. • Regular monitoring of urine pH, serum bicarbonate, and potassium. • Refer for haemodialysis if salicylate concentration >700 mg/l, renal failure, pulmonary oedema, progressive deterioration of vital signs, coma, convulsions, severe acid base or electrolyte imbalance, despite appropriate treatment, or hepatic compromise.

Poison or toxin	Symptoms	Management
Beta-blockers Toxic dose: variable response to overdose	Hypotension and bradycardia, AV block, electromechanical dissociation, intraventricular conduction delays and asystole CNS depression and seizures with propranolol	• If hypotension or shock, give IV fluids rapidly (see Quick Check page 41 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease. • Give activated charcoal if within 2 hours of ingestion, provided patient is stable. • For sustained-release preparations, give multiple doses of activated charcoal and *consider the use of whole bowel irrigation.* • *Cardiac monitoring* and perform 12-lead ECG. If QRS is wider than 120 millisecond, give sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg). • Give atropine IV if bradycardia is associated with hypotension: 0.5 to 1 mg IV. Repeat every 3 to 5 minutes to a total dose of 0.04 mg/kg. • If shock is unresponsive to fluids, give vasopressors, starting with dopamine followed by epinephrine (see Section 3.1.4) and titrate up as needed. • *For unresponsive bradycardia with hypotension, give isoprenaline (1 mcg/minute).* • If BP does not improve, consider IV calcium salts: give calcium gluconate 10% – 0.6 ml/kg up to a maximum of 30 ml over 5 minutes. Can be repeated every 10–20 minutes up to 4 doses . For alternate, see footnote.[3] • *If available, give glucagon as follows: loading dose IV 5 to 10 mg in 5% dextrose solution and 1 to 10 mg/hour in 5% dextrose in water, titrated against response, as maintenance dose for no more than 48 hours.* • If SBP does not improve, give insulin-dextrose treatment with loading dose of short-acting insulin 1–2 U/kg with 50 ml of 50% dextrose followed by 0.5–2 U/kg per hour and an infusion of dextrose titrated to blood glucose level • Closely monitor blood sugar (check every 30–60 minutes) and serum potassium. Note: With insulin therapy, hypokalaemia may occur because of redistribution from plasma into cells, so take care not to overcorrect. • Treat seizures with diazepam (see Quick Check page 41 and Section 3.5). Avoid the use of phenytoin in propranolol overdose.

3 Calcium chloride 10% – 0.2 ml/kg to a maximum of 10 ml over 5 minutes.

Poison or toxin	Symptoms	Management
Calcium-channel blockers Toxic dose: any overdose is potentially serious	Hypotension and bradycardia, cardiogenic shock Reflex tachycardia with nifedepine	• If hypotension or shock, give IV fluids rapidly (see Quick Check page 41 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease. • Give activated charcoal if patient presents within 2 hours and is stable. • For sustained-release preparations, give multiple doses of activated charcoal and *consider the use of whole bowel irrigation.* • *Cardiac monitoring* and perform 12-lead ECG. • If no response to IV fluids, give IV calcium salts (calcium chloride 10% – 0.2 ml/kg to a maximum of 10 ml over 5 minutes; OR calcium gluconate 10% – 0.6 ml/kg up to a maximum of 30 ml over 5 minutes). Can be repeated every 10–20 minutes up to 4 doses. • If there is bradycardia, give atropine: 0.5 to 1 mg IV. Repeat every 3 to 5 minutes to a total dose of 0.04 mg/kg. • Monitor calcium, *arterial blood gases,* glucose, and potassium. • If SBP is unresponsive to calcium salts, initiate insulin-dextrose treatment as follows: loading dose of short acting insulin 1–2 U/kg with 50 ml of 50% dextrose followed by 0.5–1 U/kg per hour and an infusion of dextrose titrated to blood glucose level. • Closely monitor blood glucose (check every 3–60 minutes) and serum potassium. Note: With insulin therapy, hypokalaemia may occur because of redistribution from plasma into cells, so take care not to overcorrect. • Hypotension unresponsive to the above treatment should be treated with vasopressors starting with epinephrine (see Section 3.1.4). Large doses may be needed. If nifedipine taken, give dopamine. • If necessary, follow with glucagon: loading dose IV 5 to 10 mg in 5% dextrose solution and 1 to 10 mg/hour in 5% dextrose in water, titrated against response, as maintenance dose for no more than 48 hours. • If unresponsive to other measures and this is available, consider intravenous lipid emulsion (1.5 ml/kg of 20% emulsion bolus followed by 0.5 ml/kg/minute for 30 to 60 minutes).
Carbamazepine Toxic dose: >20 mg/kg	Nystagmus, dilated pupils, ataxia, slurred speech, fluctuating level of consciousness, hypotension, tachycardia, urinary retention In severe poisoning: seizures, coma, respiratory depression, and arrhythmias	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease. • Give repeat dose of activated charcoal provided that bowel sounds are present and the airway is protected. • *Cardiac monitoring* and perform 12-lead ECG. • If still in shock after fluid resuscitation, give vasopressors (see Section 3.1.4). • Administer sodium bicarbonate at a dose of 50 ml of 8.4% or 1–2 mmol/kg to treat a patient who has metabolic acidosis or arrhythmias, or progressive widening of QRS (or QRS longer than 120 millisecond). • For a patient who develops seizures, give diazepam as a first-line treatment, followed by phenobarbital if necessary (see Quick Check page 41 and Section 3.5). Do not give phenytoin.

Poison or toxin	Symptoms	Management
Tricyclic antidepressants, e.g. amitriptyline, imipramine Toxic dose: despiramine, trimipramine, and nortriptyline >2.5 mg/kg Protriptyline >1 mg/kg All others >5 mg/kg	**Cardiovascular:** hypotension, dysrrythmias, cardiac arrest **Central nervous system:** excitation, restlessness, myoclonus, hyperreflexia, disorientation, confusion, hallucination, coma, seizures **Anticholinergic:** hyperthermia, urinary retention, paralytic ileus, mydriasis, dry mouth, flushing of skin	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). • Give activated charcoal if patient presents within 2 hours after ingestion, provided airway is protected. • Monitor blood gases, correct hypoxia. • *Cardiac monitoring* and perform 12-lead ECG, measure the QRS width. • If shock persists, give vasopressors (see Section 3.1.4) – *norepinephrine is preferred* or give epinephrine. • Correct acidosis if can measure bicarbonate. • Sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg) should be given to all patients with QRS prolongation (>120 millisecond) or arrhythmias. *Give repeated boluses of sodium bicarbonate to keep QRS at <120 millisecond and arterial pH between 7.45–7.55.* • Seizures should be treated with diazepam (see Quick Check page 19 and Section 3.5). Avoid the use of phenytoin. • Following seizures, a dose of bicarbonate is suggested to correct acidosis and reduce risk of further toxicity.
Chloroquine Toxic dose: >20 mg/kg is toxic	Nausea, vomiting, diarrhoea, and abdominal pain, dizziness, convulsions, coma, hypotension, arrhythmias, sudden cardiac arrest	• Manage airway and assist ventilation, as needed (see Quick Check pages 29–32). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). • If shock persists, give vasopressors (see Section 3.1.4) – epinephrine is preferred. • Give activated charcoal if airway is protected and within 1 hour of ingestion. • Observe for a minimum of 12 hours, monitor vital signs. • Monitor blood glucose, urea, electrolytes, blood gases. • *Cardiac monitoring* and perform 12-lead ECG, and measure the QRS width. If >120 millisecond, give sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg). Give repeated boluses of sodium bicarbonate to keep QRS at <120 millisecond and arterial pH between 7.45–7.55. • Correct hypokalaemia if <3 to no more than 3.5 (beware of rebound increase in potassium). • Seizures should be treated with diazepam (see Quick Check page 41 and Section 3.5). Avoid barbiturates as these may precipitate cardiac arrest. Avoid phenytoin.

Poison or toxin	Symptoms	Management
Quinine Toxic dose: >15 mg/kg could be toxic	Tinnitus, deafness, abdominal pain, visual changes, blindness, ataxia, coma, convulsions, arrhythmia, torsade de pointes, hypoglycaemia	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). • Give activated charcoal if airway is protected. • In severe cases, provided airway is protected, give repeat doses of activated charcoal. • Monitor urea, electrolytes, blood glucose, blood gases. • *Cardiac monitoring* and perform 12-lead ECG and measure the QRS width – if >120 milliseconds there is a risk of cardiac arrhythmias. • If shock persists, give vasopressors to treat hypotension (see Section 3.1.4). • Treat cardiotoxicity (hypotension, wide QRS complexes, and QTc prolongation) with sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg). Give repeated boluses of sodium bicarbonate to keep QRS at <120 millisecond and arterial pH between 7.45–7.55. • Treat torsade de pointes with magnesium sulfate 1–2 grams IV. • Seizures should be treated with diazepam (see Quick Check page 41 and Section 3.5). Avoid barbiturates and phenytoin.

Digoxin, oleander (Thevetia peruviana, Nerium oleander, Digitalis spp)
 	
Toxic dose digoxin: ≥3 mg (produces toxic level in adults). Note: ≥10 mg is often lethal.
 	
Patients on digoxin therapy are more susceptible in overdose.
	Nausea, vomiting, abdominal pain, visual changes, headache, fatigue, coma,
	Heart block and tachy – or brady–arrhythmias
		• Give a dose of activated charcoal if presenting within 1 hour.
		• Multiple doses of activated charcoal (every 4 hours for 24 hours) may be considered in the absence of digoxin antibodies.
		• Monitor ECG.
		• Monitor electrolytes at least every 6 hours and correct if necessary (particularly potassium).
		• *Monitor blood gases and pH and correct metabolic acidosis with sodium bicarbonate.*
		• *Digoxin antibodies* should be given, if available, for the following indications:
		  ° serum potassium >6 mmol/l
		  ° bradycardia or heart block with hypotension
		  ° tachyarrhythmia with hypotension.
		• Treat hyperkalaemia: if K >5.5 mmol/l give sodium bicarbonate (1mmol/kg), glucose (0.5 g/kg IV), PLUS insulin (0.1 U/kg IV) (see Section 5.2.2). Note: Do not use calcium, furosemide, or salbutamol as these may worsen toxicity.
		• Give atropine for bradycardia or heart block associated with hypotension.
		• If readily available, consider referral for insertion of a temporary pacing wire if there is evidence of significant bradycardia or AV block with haemodynamic compromise.
		• Ventricular tachyarrhythmia – give magnesium sulfate 2 g IV over 20 minutes in an adult initially. If no response consider lidocaine.

Poison or toxin	Symptoms	Management
Antidiabetic agents: hypoglycaemic agents (if metformin see separate entry) Toxic dose: for suphonylurea and insulin, more than the usual recommended dose	Sweating, agitation, giddiness, confusion, coma. Delayed onset of hypoglycaemia possible, also recurrent hypoglycaemia	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If unconscious, give 25–50 ml D50 (see Quick Check page 41). A continuous infusion of 10% dextrose (1 litre over 8 hours) may be required if blood sugar falls to <3 mmol/l (see Section 3.4.2). • When the patient recovers consciousness, give sugary drinks and food, followed by a long-acting carbohydrate (e.g. bread, rice, maize) to prevent recurrent symptoms. • Give activated charcoal if airway is protected and it is within 1 hour of ingestion of an oral hypoglycaemic. • Check blood sugar and monitor every 1 to 2 hours. • Continue monitoring for at least 24 hours. • Monitor level of consciousness using AVPU. • Correct asymptomatic hypoglycaemia with sweet drinks (not diabetic or sugar-free), e.g. cola, juice, sweet water, oral glucose powder or tablets (see Section 3.4.2). • Do not give prophylactic dextrose without symptoms or a low blood glucose. • *Octreotide*, if available, could be given to patients whose blood sugar does not normalise after above measures.
Antidiabetic agents: metformin Toxic dose: variable response	Lactic acidosis (does not cause hypoglycaemia)	• Give activated charcoal if airway is protected and it is within 2 hours of ingestion. • *Monitor blood gases and lactate.* • *If acidotic, ensure that patient is adequately ventilated and perfused and give IV sodium bicarbonate.*
Opioids e.g. morphine, diamorphine (heroin), raw opium, codeine, methadone, dextropropoxy-phene, oxycodone, tramadol Toxic dose: variable	Respiratory depression, central nervous system depression (drowsiness to coma), miosis, hypotension, hypothermia, ataxia, respiratory arrest, non-cardiogenic pulmonary oedema Tramadol: seizures, serotonin syndrome Dextropropoxyphene: cardiac dysrhythmias	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • Give naloxone (see Quick Check page 40 and Section 3.6). • Give activated charcoal if within 2 hours of ingestion and airway is protected. • *Cardiac monitoring* and perform 12-lead ECG if dextroproxyphene taken. If QRS >120 millisecond, give sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg). • For serotonin syndrome, see SSRIs.

Poison or toxin	Symptoms	Management
Paracetamol (acetaminophen) Note: Risk of toxicity is increased in patients taking enzyme-inducing drugs, e.g. carbamazepine, phenobarbital, phenytoin, primidone, rifampicin.	Vomiting, right upper quadrant abdominal pain, hepatic encephalopathy	• Give activated charcoal if less than 2 hours after ingestion. • Obtain blood level if possible; however, the sample should be taken at 4 hours or more after the ingestion. • Efficacy of antidote declines from 8 hours post-ingestion, so give antidote based on history only if there is a delay in getting the paracetamol level or it cannot be obtained. • See paracetamol nomogram below. • If paracetamol level not available, base treatment on ingested dose: ° 75 mg/kg if high risk (nutritionally deficient, acute starvation, AIDS, alcoholic, on enzyme-inducing drugs); ° 150 mg/kg if not high risk. • Give acetylcysteine IV or orally: ° IV acetylcysteine: initially 150 mg/kg over 15 minutes, then 50 mg/kg over 4 hours, then 100 mg/kg over 16 hours. Administration: dilute requisite dose in glucose intravenous infusion 5% as follows – initially 200 ml given over 15 minutes, then 500 ml over 4 hours, then 1 litre over 16 hours. ° Oral acetylcysteine (acetylcysteine solution intended for antidotal use, not granules for mucolytic use) – administer a loading dose of 140 mg/kg body weight. Four hours after administration of the loading dose, initiate a maintenance dose of 70 mg/kg administered at 4-hourly intervals for 17 doses. The acetylcysteine solution should be given until 72 hours post-ingestion – continue for longer if LFTs abnormal. Dilute to a 5% solution in soda pop, juice, or water prior to oral or nasogastric administration. ° Check liver function tests, INR (prothrombin time), creatinine and BUN, and electrolytes.
Selective serotonin reuptake inhibitors (SSRI) e.g. fluoxetine, paroxtine, sertraline Toxic dose: variable	Nausea, vomiting, dry mouth, tachycardia, drowsiness, coma Serotonin syndrome may occur: agitation, confusion, delirium, drowsiness, coma, tremor, teeth grinding, myoclonus and hyperreflexia, hypertension or hypotension, seizures, hyperthermia, rhabdomyolysis, renal failure, coagulopathies may develop	• Give activated charcoal within 2 hours of ingestion. • Perform 12-lead ECG. • Manage serotonin syndrome: ° Monitor urea, electrolytes, CK, and renal function. ° *Cardiac monitoring* and perform 12-lead ECG. ° Give IV fluids to maintain good urine output. If in shock, give rapidly (see Quick Check page 39). ° If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). ° Sedate with diazepam if agitated or if having seizures (see Quick Check pages 41, 59). ° Hyperthermia (>40.5°C) should be treated with rapid cooling (see Section 10.1). ° *Cyproheptadine can be considered if available, and no response to above measures. Give 4 to 8 mg every 1 to 4 hours. Repeat until therapeutic response is achieved. Maximum dose of 32 mg over 24 hours.* ° In cases of severe hyperthermia (>41°C) not improving despite sedation and cooling measures, consider deeper sedation and paralysis, provided advanced airway management is possible – either manual ventilation or transfer to a hospital with a mechanical ventilator..

Poison or toxin	Symptoms	Management
Monoamine oxidase inhibitors (MAOI), e.g. phenelzine, tranylcypromine Toxic dose: In adults >5 tablets of any preparation can be toxic	Anxiety, vomiting, restlessness, confusion, flushing, sweating, hypertension, hyperthermia, seizures Note: MAOIs interact with a wide range of drugs and some foods to cause severe hypertension. They have a life-threatening interaction with pethidine. Serotonin syndrome may occur.	• Give activated charcoal if airway is protected and within 2 hours of ingestion. • If symptomatic, monitor pulse, blood pressure, temperature, respiratory rate, and AVPU every 30 minutes. • Check urea and electrolytes and full blood count. • Check creatine kinase activity in all symptomatic patients. • Hypertension: give IV diazepam (0.1–0.2 mg/kg). If ineffective, then treat with IV nitrates, e.g. sodium nitroprusside. Beta blockers are contraindicated. • Give diazepam for agitation or seizures (see Quick Check pages 41, 59). • Hyperthermia (>40.5°C) should be treated with rapid cooling (see Section 10.1). • In cases of severe hyperthermia (>41°C) not improving despite sedation and cooling measures, then consider deeper sedation and paralysis, provided advanced airway management is possible, either manual ventilation or *transfer to a hospital with mechanical ventilator*. • If convulsions unresponsive to first- and second-line antiepileptics (see Quick Check page 41 and Section 3.5), and advanced airway management is feasible, consider anaesthetic (e.g. thiopental or propofol). • See also management of serotonin syndrome under SSRIs.

Iron (ferrous salts)
Toxic dose: >40 mg/kg elemental iron, or if there is persistent vomiting or diarrhoea
Approximate elemental iron content of ferrous salts is:
• ferrous fumarate 210 mg (68 mg iron)
• ferrous gluconate 300 mg (35 mg iron)
• ferrous succinate 100 mg (35 mg iron)
• ferrous sulfate 300 mg (60 mg iron)
• dried ferrous sulfate 200 mg (65 mg iron)
 	
Note: Check label to make sure.
	Vomiting and diarrhoea – often bloody; drowsiness, lethargy, coma, shock, convulsions, liver failure Delayed pyloric stenosis.
	Note: Initial symptoms may be followed by apparent recovery, then a relapse. Therefore all symptomatic patients should be observed for minimum of 12 hours.
		• If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1).
		• If more than 40 mg/kg body weight of elemental iron ingested then:
		  ° do abdominal X-ray (if possible) to check if tablets are visible in gut (Note: A negative X-ray does not necessarily exclude iron ingestion.)
		• If within 4 hours of ingestion, initiate whole bowel irrigation with osmotically balanced polyethylene glycol-electrolyte solution (2 litres per hour for adults and 0.5 litres/hour in children – see above).
		• If WBI is not available, give gastric lavage (with a wide-bore tube) within 1 hour of ingestion or if radiography reveals tablets in the stomach.
		• Monitor urea and electrolytes, WBC, blood glucose, LFTs, whole blood clotting time, renal function, and blood gases.
		• *If possible, check iron level 4 hours post-ingestion and give deferoxamine if the serum iron level is over 90 µmol/l.*
		• If iron levels are not available, give deferoxamine if patient has:
		  ° taken 60 mg/kg elemental iron (see table of elemental iron content or check label), or
		  ° any of the following: metabolic acidosis, hypotension, shock, coma, convulsions.
		• Give deferoxamine by slow IV infusion: initially 15 mg/kg/hour, reduced after 4–6 hours so that total dose does not exceed 80 mg/kg in 24 hours.

Poison or toxin	Symptoms	Management
Lithium Toxic dose: Acute overdose is >2 g in adults Note: Acute overdose is usually well-tolerated. Acute-on-chronic: any amount more than the usual daily dose could be toxic	Mild toxicity: nausea, vomiting, diarrhoea, fine tremor Moderate toxicity: confusion, fasciculation, and hyperreflexia Severe toxicity: coma, convulsions and cardiac arrhythmias	• Acute overdose with normal renal function – no gut decontamination is needed. • Overdose in patient on lithium therapy (taking sustained-release) or with impaired renal function – consider the use of whole bowel irrigation. All: • If hypotension or shock, give rapid IV fluids (see Quick Check page 39 and Section 3.1) – NS preferred. Titrate to ensure good urine output. • *Cardiac monitoring* and perform 12-lead ECG. • Monitor renal function. • Monitor and correct electrolyte imbalance. • Seizures should be treated with diazepam (see Quick Check page 41 and Section 3.5). • *Haemodialysis for patients with coma, convulsions, respiratory failure, or acute renal failure.*
Phenobarbital Toxic dose: variable response	Drowsiness, lethargy, slurred speech, nystagmus, coma, respiratory depression, hypotension, tachycardia, hypothermia	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). • If symptomatic, give repeat doses of activated charcoal provided bowel sounds are present and airway is protected. • Manage hypothermia. • Give supportive care. • Monitor pulse, respiratory rate, BP, temperature, AVPU. • *Haemodialysis if ileus, failure to respond to supportive care.*
Theophylline Toxic dose >20 mg/kg	Vomiting (may be protracted), haematemesis, agitation, tachycardia, hypertension, hypotension, hyperventilation, cardiac dysrhythmias, seizures, acid-base disturbance, hypokalaemia, rhabdomyolysis, respiratory arrest	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 39 and Section 3.1). • Give multiple dose activated charcoal. • Give antiemetic such as metoclopramide (may need large dose) or ondansetron. • Monitor electrolytes and cautiously correct hypokalaemia if <3 to no more than 3.5 (beware of rebound increase in potassium). • Monitor vital signs. • *Cardiac monitoring* and perform 12-lead ECG. • Treat SVT if it is causing haemodynamic compromise. Give a beta-blocker (preferably beta-1 selective blockers, such as *esmolol, metoprolol*, but beware of bronchospasm in asthmatics and those with COPD – in these cases consider *verapamil or adenosine*). • For ventricular arrhythmias causing haemodynamic compromise, use magnesium or lidocaine. If severe, treat with DC cardioversion. • Diazepam for seizures (see Quick Check pages 41, 59). If unresponsive, follow with phenobarbital. If convulsions are unresponsive to first-line antiepileptics (see Section 3.5), and advanced airway management is feasible, consider anaesthetic (e.g. thiopental). Do not use phenytoin. • *Consider haemodialysis, if available, for life-threatening toxicity.*

Poison or toxin	Symptoms	Management
Warfarin	See anticoagulant pesticides further down.	
Pesticides		
Aluminium or zinc phosphide	Retrosternal burning, persistent vomiting, hypotension, shock, bradycardia or tachycardia, myocardial depression, refractory hypotension, headache, dizziness, restlessness, hypoglycaemia, metabolic acidosis, non-cardiogenic pulmonary oedema, acute respiratory distress syndrome, acute renal failure, hepatic damage	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1). • If shock persists after fluid resuscitation, start vasopressors (see Section 3.1). • *Cardiac monitoring* and perform 12-lead ECG. • Monitor for and correct hypoglycaemia. • Monitor for and correct electrolyte imbalance. • *Give sodium bicarbonate (1–2 mmol/kg) for metabolic acidosis.* • Magnesium sulfate may improve cardiac output – give 1 g 6 hourly. • Other supportive care as required. • Monitor renal and hepatic function.
Anticoagulant rodenticides (raticides, rat and mouse killers) or anticoagulant therapy (warfarin	Bleeding: spontaneous bruising, haematomas, haematuria, rectal bleeding and haemorrhage into any internal organ Delayed onset and may be prolonged	• *Monitor INR at 24 and 48 hours.* • *If poisoning and INR mild to moderately elevated without major bleeding, give oral vitamin K 10–20 mg.* • *If patient is on anticoagulant therapy and there is no active bleeding but the INR is prolonged (INR 5.0–9.0), omit 2 doses of warfarin, then repeat the INR. Further doses may be missed as needed, titrated to INR. Restart at lower maintenance dose once the INR is in the therapeutic range.* • *If patient is on anticoagulant therapy and there is no active bleeding but the INR is dangerously prolonged (INR ≥9.0), warfarin should be stopped and give vitamin K 2.5 to 5 mg orally. Further doses may be given as necessary, titrated to the INR.* • If serious or life-threatening bleeding, stop warfarin and give vitamin K 10 mg IV by slow infusion (over 20 to 60 minutes), supplemented by transfusions of fresh frozen plasma (FFP) 2-3 units initially, or prothrombin complex concentrate. • In case of long-acting anticoagulant rodenticides, vitamin K therapy may be needed for several weeks. The dose should be titrated to response.

Poison or toxin	Symptoms	Management
Chlorphenoxy herbicides e.g. MCPA, 2, 4-D	Burning pain in the mouth and epigastrium. Muscle pain and rigidity, muscle twitching, agitation, seizures, hyperpyrexia, rhabdomyolysis leading to renal failure. Metabolic acidosis, hyperventilation, tachycardia, hypotension, ECG abnormalities, prolonged coma	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1). Titrate to maintain adequate urine output. • Monitor *blood gases*, renal and liver function, creatine kinase. • Look for dark-coloured urine (*check for myoglobin*). • *Cardiac monitoring* and perform 12-lead ECG. • In symptomatic cases, alkalinise the urine to pH>7.5 with IV sodium bicarbonate. Suggested regimen: sodium bicarbonate 225 mmol (225 ml of an 8.4% solution) intravenously over 1 hour. Give additional boluses of intravenous sodium bicarbonate to maintain urine pH in the range 7.5–8.5. Urinary alkalinisation should only be done if there are facilities to monitor plasma bicarbonate and urine pH. • Treat rhabdomyolysis with fluid replacement to maintain good renal output together with urinary alkalinisation. • *In severe poisoning use haemodialysis, if available.*
Organophosphates and carbamates	Muscarinic effects: DUMBBELS (defecation, urination, miosis, bronchospasm, bronchorrhea, emesis, lacrimation, salivation) Nicotinic effects: weakness, fasciculation, paralysis, mydriasis Other: agitation, confusion, lethargy, convulsions, coma	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1). Titrate to maintain adequate urine output. • Give atropine 1–3 mg intravenously as a bolus. • Listen to lungs, take pulse, and measure blood pressure. • Aim for clear lungs, stable blood pressure • (>90 mmHg systolic), dry mucous membranes, and oxygen saturation of >95%. • Recheck at five minutes. If no improvement, give double the initial dose of atropine. Dilated pupils and tachycardia alone should not be considered as end points. • Continue to give doubling doses of atropine every • 5–10 minutes until the patient is stable. If the lung crepitations persist after 3 to 5 boluses of atropine (doubling doses), consider that the patient may have aspirated. • If blood pressure does not improve with atropine, consider giving fluid boluses and exclude metabolic acidosis. • Once the patient has been atropinized, initiate an infusion of atropine (20% of the total dose required to atropinize) as an hourly infusion. • Monitor signs of atropine toxicity (agitation, confusion, hyperthermia) every 4 to 6 hours. If atropine toxicity develops, stop the infusion and restart at 70% of the last infusion rate once the toxicity settles. • Monitor respiratory rate, pulse rate, and blood pressure. Prepare to intubate and if necessary ventilate. • Give diazepam 5–10 mg IV for agitation, seizures, and fasciculations (see Quick Check pages 41, 59 and Section 3.5). Repeat dose as necessary. • *For organophosphates ONLY, give pralidoxime, if available.*[4]

4 Pralidoxime chloride or mesylate: 30 mg/kg IV over 5–10 minutes, followed by the same dose every 4–6 hours, or by IV infusion of 8 mg/kg/hour, maximum of 12 g in 24 hours. Most useful within 24–48 hours. Pralidoxime is not on the WHO EML..

Poison or toxin	Symptoms	Management
Paraquat	Early stages (hours to a few days): burning pain of the mouth, lips, and tongue. Gastrointestinal corrosion leading to painful swallowing (odynophagia), nausea, vomiting, abdominal pain. Following large ingestions: coma convulsions, cardiovascular collapse, and shortness of breath. Burning sensation of the skin. Later (few days): ulceration of the tongue and oral cavity with contact bleeding, shortness of breath due to acute alveolitis, pulmonary oedema, pneumothorax, and pneumomediastinum. Acute renal failure and hepatitis. Acute pancreatitis. Later (weeks). Chronic hypoxia due to progressive lung fibrosis. Renal failure.	• If shock, give rapid IV fluids (see Quick Check page 40 and Section 3.1). Titrate to maintain adequate urine output. • Avoid giving supplemental oxygen if possible as this worsens lung injury. Oxygen may be needed in late stage as fibrosis develops. • Give activated charcoal or Fullers earth for patients presenting within 2 hours. • Insert a nasogastric tube as early as possible to facilitate feeding. • *Confirm systemic absorption with urine dithionite test, if available.* • Assess baseline electrolytes, creatinine, FBC, and blood gases, and correct all reversible abnormalities. • Screen and treat for sepsis – monitor temperature, check WBC, blood cultures when indicated. Start empirical antibiotics (see Section 3.1.5). • Give IV fluids to maintain good renal output. • Liberal pain relief and sedation with opioids and benzodiazepines as needed.

Poison or toxin	Symptoms	Management
Propanil	Causes methaemoglobinaemia. Nausea, vomiting, diarrhoea, dizziness, cyanosis, headache, tachycardia, hypotension, respiratory depression, lactic acidosis, chest pain, confusion, coma, and convulsions. Dark brown or reddish urine.	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40). • Give activated charcoal. • Monitor blood gases with *co-oximeter* (Note: A pulse oximeter will give a misleading result in the presence of methaemoglobin). • *Cardiac monitoring* until patients maintain stable cardiovascular status. • Check haemoglobin level to detect anaemia due to haemolysis. • Patients who present with depressed level of consciousness tend to have poor prognosis. These patients should be closely observed. • *Check methaemoglobin concentration, if possible.* • A qualitative test for methaemoglobin is to place 1 to 2 drops of the patient's blood on white paper. Normal blood will be dark red or violet and will brighten on exposure to oxygen. Methaemoglobin will appear "chocolate" brown and will not change colour. • If the patient *has a methaemoglobin level of >20–30%* or is symptomatic (confusion, tachycardia, hypotension, chest pain, cyanosis) in the absence of methaemoglobin level, treat with methylthioninium chloride (methylene blue). ° Give a loading dose of methylthioninium chloride 2 mg/kg IV of 1% solution (10 mg/ml) over 5 minutes. Assess after 15 minutes. If no improvement, give a further dose of 1 mg/kg and transfer if possible for further treatment with methylthioninium chloride. ° After 6 hours *recheck methaemoglobin level*, clinical status, and blood gases. Then, if necessary repeat the dose of 1 mg/kg. Continue to repeat 6 hourly while patient is symptomatic or *methaemoglobin level remains >30%.* ° May need methylthioninium chloride for 2–3 days. ° If patient is deteriorating on this therapy, consider possibility of G6PD deficiency or haemolysis. ° If methylthioninium chloride is not available or patient has G6PDD, give IV or oral ascorbic acid 500 mg every 12 hours. ° If patient continues to deteriorate consider exchange transfusion.

Poison or toxin	Symptoms	Management
Other chemicals		
Corrosive substances	Pain in mouth, throat, epigastrium, or abdomen. Dysphagia, hypersalivation (drooling), hoarse voice, and stridor. Gastrointestinal bleeding and haematemesis. Perforation, shock. Aspiration pneumonia, airway obstruction. A**cids** cause coagulation necrosis. Strong acetic acid also causes haemolysis and renal failure. **Alkalis** cause liquefaction necrosis, which may result in extensive penetration of tissue.	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If stridor, consider advanced airway management (see Quick Check pages 62–65) and surgical airway (see Quick Check page 69 and Section 3.2.2). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1). • Do NOT induce vomiting or give gastric lavage or activated charcoal. • Do NOT attempt neutralization. • Give adequate pain relief with IV opioids. • *Refer all patients for assessment of gastrointestinal injury by cautious endoscopy between 6–24 hours of ingestion.* • If grade III injury, put nasojejunal tube under endoscopy or perform feeding jejunostomy. • Monitor *pH, fluid*, and electrolyte status, haemoglobin and clotting time. • If possible perform abdominal and chest X-ray to assess for aspiration and perforation. • Patients with acid ingestion: *correct metabolic acidosis with sodium bicarbonate.* • Consider surgical intervention for any signs of perforation.

Poison or toxin	Symptoms	Management
Ethylene glycol	Drunken-state, nausea, vomiting, metabolic acidosis, renal failure, calcium oxalate crystals in urine, hypocalcaemia, seizures, coma, tetany	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1) and titrate to maintain good urine output. • Give strong alcoholic drink (e.g. brand-named vodka or whisky, not informally distilled spirit) to block metabolism. Oral loading dose (by PO or by NG tube) – 1.8 ml/kg of a 40–43% alcohol drink over 15–30 minutes (diluted). Patient should be managed at tertiary facility. Transfer at this stage if necessary. • Continue oral administration of alcohol drink as follows. • Maintenance dose: ° 0.2 ml/kg/hour (non-drinker) ° 0.46 ml/kg/hour (heavy alcohol user). • Maintenance dose during dialysis: ° 0.5 ml/kg/hour (non-drinker) ° 0.77 ml/kg/hour (heavy alcohol user). • May need to give alcohol for 2–3 days. • Correct metabolic acidosis with sodium bicarbonate (may need high doses) and fluid replacement. Important to monitor electrolytes for hypernatraemia and hypokalaemia. • To confirm diagnosis, if possible, check osmolar gap, anion gap, and serum ethanol. In the early stages a gap of >19 mOsm/kgH2O may be indicative of ethylene glycol poisoning if serum ethanol is 0 (if not, subtract 24 mOsm/kgH2O per 100 mg/dl of ethanol). Later a raised anion-gap metabolic acidosis develops. • *Haemodialysis if there is a severe metabolic acidosis (pH <7.25 or base deficit >15 mm despite buffer) or renal failure.* Consider peritoneal dialysis if haemodialysis is not available. • *Fomepizole* is an alternative to ethanol. Give a bolus dose of 15 mg/kg followed by 10 mg/kg twice daily for a maximum of 4 doses; followed by 15 mg/kg IV every 12 hours thereafter. • If hypocalcaemia – cautious correction with calcium gluconate. • If readily available, pyridoxine 50 mg IV or IM every 6 hours for 6 doses, and thiamine 100 mg IV or IM every 8 hours for 6 doses. These may be beneficial if the patient is alcoholic.

Poison or toxin	Symptoms	Management
Methanol	Non-specific features: GI symptoms (nausea, vomiting, abdominal pain), chest pain, dyspnoea. More specific features: metabolic acidosis, visual disturbances of all kinds leading to blindness, coma.	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1) and titrate to maintain good urine output. • Give strong alcoholic drink (e.g. brand-named vodka or whisky, not informally distilled spirit) to block metabolism. Oral loading dose (by PO or by NG tube): 1.8 ml/kg of a 40–43% alcohol drink over 15–30 minutes (diluted). Patient should be managed at a tertiary facility. Transfer at this stage if necessary. • Continue oral administration of alcohol drink as follows. • Maintenance dose: ° 0.2 ml/kg/hour (non-drinker) ° 0.46 ml/kg/hour (heavy alcohol user). • Maintenance dose during dialysis: ° 0.5 ml/kg/hour (non-drinker) ° 0.77 ml/kg/hour (heavy alcohol user). • May need to give alcohol for 2–3 days. • Correct metabolic acidosis with sodium bicarbonate and fluid replacement. • To confirm diagnosis, if possible, check osmolar gap, anion gap and serum ethanol). In the early stages a gap of >19 mOsm/kgH2O may be indicative of ethylene glycol poisoning if serum ethanol is 0 (if not subtract 24 mOsm/kgH2O per 100 mg/dl of ethanol). Later a raised anion-gap metabolic acidosis develops. • *Haemodialysis if there is a severe metabolic acidosis (pH <7.25 or base deficit >15 mm despite buffer) or signs of end organ toxicity, coma and seizures, renal failure, or signs of visual disturbances.* Consider peritoneal dialysis if haemodialysis not available. • Folinic acid 50 mg IV every 4 hours for 6 doses.
Petrol, kerosene and other volatile hydrocarbons – ingestion	Nausea, vomiting, abdominal pain, haematemesis, coughing, shortness of breath, tachypnoea, pulmonary oedema, coma.	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 33–35). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 40 and Section 3.1). • Do NOT induce vomiting, attempt gastric lavage, or give activated charcoal. • If acute lung injury, see Section 3.2. • Observe for at least 6 hours for respiratory symptoms. If asymptomatic, discharge. • Immediate chest X-ray if symptomatic.

Paracetamol nomogram[5]

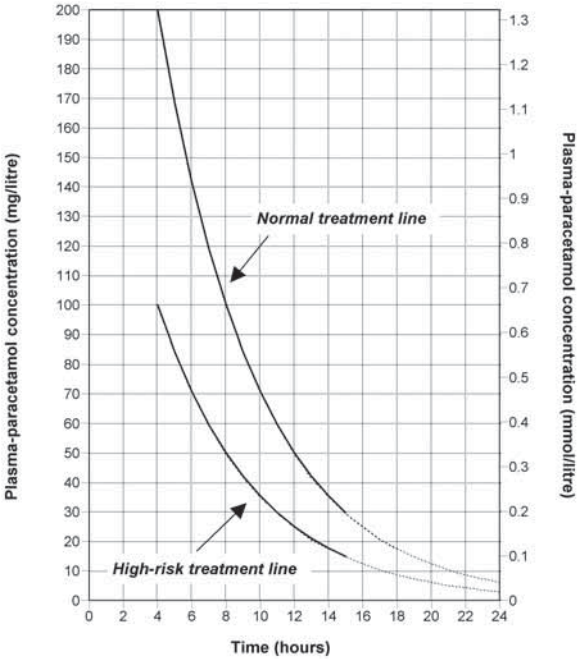


Table: Agrochemicals and pharmaceuticals that are unlikely to lead to adverse clinical outcomes

Agrochemicals		Pharmaceuticals
• acephate • acetamiprid • azadirachtin • beta-cyfluthrin • bispyribac • carbendazim • chlorfluazuron • chlorothalonil • cyhalothrin • cypermethrin • deltamethrin • d-trans allethrin • edifenphos • etofenprox	• fenoxaprop-ethyl • fenvalerate • hexaconazole • imidacloprid • mancozeb • permethrin • propiconazole • propineb • pyrethroids (others) • tebuconazole • tebufenozide • thiophanate • thiram	• antibiotics • diuretics and ACE inhibitors • oral contraceptive pills • nonsteroidal anti-inflammatory agents (excluding salicylates and mefenamic acid) • acid suppressants (proton pump inhibitors, H2 receptor blockers • lipid-lowering agents

5 Used with permission from All Wales Therapeutics and Toxicology Centre, Cardiff, UK..

3.8.2 Inhaled poisons

Inhaled poisons may take the form of gases, vapours, or aerosols. These may cause systemic toxicity (e.g. carbon monoxide, mercury vapour) or respiratory irritation (e.g. chlorine).

Table: Inhaled poisons or toxins, symptoms of toxicity, and brief guidance on specific management

Poison or toxin	Symptoms	Management
Carbon monoxide	Mild to moderate toxicity: dizziness, headache, nausea, vomiting, weakness, and confusion. Severe toxicity: syncope, tachypnoea, dyspnoea, respiratory failure or pulmonary oedema, coma, seizures, cerebral oedema, cardiac dysrhythmias, myocardial ischemia, bullous lesions of the skin, muscle necrosis, rhabdomyolysis, compartment syndrome. There may be delayed neuropsychiatric complications.	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • Give high-flow oxygen aiming at 100% for 6–24 hours (see Quick Check pages 33–35 and Section 3). Give regardless of oxygen saturation and do not titrate. • *Cardiac monitoring* and perform 12-lead ECG. • Monitor urea, electrolytes and renal function, blood gases, and pH. • *Measure carboxyhaemoglobin level, if possible.* • Treat seizures (see Section 3.5). • Give supportive care. • If cerebral oedema is suspected, consider advanced airway management for hyperventilation (see Quick Check page 62). • The benefits of hyperbaric oxygen therapy in preventing neurological complications are uncertain. • Check if there are other victims.
Chlorine	Mild to moderate poisoning: cough, shortness of breath, chest pain, burning sensation in the throat and substernal area, nausea or vomiting, ocular and nasal irritation, choking, muscle weakness, dizziness, abdominal discomfort, headache. Severe poisoning: upper airway oedema, laryngospasm, severe non-cardiogenic pulmonary oedema, pneumonia, persistent hypoxemia, respiratory failure, acute lung injury.	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • Consider early intubation if stridor is present. • If severe respiratory distress or SpO_2 <90, give oxygen. • Give salbutamol for wheezing (see Quick Check page 37). • Irrigate the eyes. • Check peak flow. • Do chest X-ray if symptomatic. • Monitor SpO_2 and electrolytes. • Treat non-cardiogenic pulmonary oedema (see Section 3.2.3).

Poison or toxin	Symptoms	Management
Cyanide	Headache, dyspnoea, confusion, coma, convulsions, cardiovascular collapse, metabolic acidosis	• Manage airway and assist ventilation as needed (see Quick Check pages 29–32, 62). • Give high-flow oxygen aiming at 100% (see Quick Check pages 33–35 and Section 3). Give regardless of oxygen saturation and do not titrate. • Measure lactate. • *Correct persistent metabolic acidosis with sodium bicarbonate.* • Severe toxicity (comatose patients): ° Give sodium nitrite: 300 mg (10 ml of 3% solution) by slow IV injection over 5–20 minutes. ° Then give sodium thiosulphate: 12.5 g (50 ml of 25% solution) by slow IV injection over 10 minutes. ° If no response after 30 minutes, give further dose of sodium nitrite 150 mg followed by sodium thiosulphate 12.5 g. • Alternatively, hydroxocobalamin 5 grams IV over 15 minutes can be given, if available. • Moderate toxicity (recovered from a period of unconsciousness, convulsions, cyanosis), smoke inhalation victim, or a presumed cyanide poisoning: ° give sodium thiosulphate 12.5 g (83 ml of 15% solution) by slow IV injection over 10 minutes.

3.8.3 Chemicals on the skin or in the eye

Health worker protection

It is very important that the person administering first aid wears appropriate protective clothing, e.g. gloves and apron to avoid exposing themselves to the chemicals.

Remember, emergencies of the airway, breathing, and circulation take precedence.

Manage chemicals in the eye

- Hold the eyes open (the patient may need a local anaesthetic to prevent blepharospasm).
- Wash any chemicals out with cool, clean water for 15–20 minutes. Take care that run-off does not enter the other eye. In the case of acids or alkalis, check the pH of the conjunctival fluid and continue irrigation until the pH is 7.4.
- Do not let the patient rub the eyes.
- Treat pain.
- If light causes pain, cover the eye with a sterile pad.
- Examine the eye (see Section 10.12).

Manage chemicals on the skin

- Remove the patient's clothing or ask the patient to do it. Avoid pulling clothes over the head. Cut clothing off if necessary.
- Rinse the skin for about 15 minutes with large amounts of water.

- In the case of alkali burns, rinse with water until the pH of the skin is neutral.
- Watch for signs of poisoning from an absorbed chemical.
- Consult a poison reference or a poison centre for advice on specific chemicals.
- Put contaminated clothes in a sealable bag to protect against secondary contamination.

Manage organophosphates or carbamate on skin

- Prevent further absorption by moving the patient to fresh air, removing contaminated clothing, and washing contaminated skin with soap and water.

Manage exposure to tear gas (e.g. CN or CS gas)

- Tear gas is also called a 'lacrimator' because it irritates the mucous membranes of the eyes, causing a stinging sensation and tears. It may also irritate the upper respiratory tract , causing coughing, choking, and general debility.
- Contaminated clothing may continue to emit gas for some time, affecting other people nearby. Therefore, if possible, have the victim remove clothing before entering the treatment area.
- Follow the advice above for decontaminating eyes and skin. However, wash the skin with soap and water and then rinse with tepid water for 15 minutes.[6] Soothing lotions such as calamine can be applied to irritated skin once decontamination has been done.

6 *Public health response to biological and chemical weapons.* WHO Guidance, 2004. Available at http://www.who.int/csr/delibepidemics/biochemguide/en/

3.9 Snake-bite[1,2]

In this section:

Snake venoms vary considerably in their effect, ranging from venoms that produce no effects or minimal effects to venoms that are potentially life-threatening. Usually, there is a history of snake-bite, but snake-bite should also be considered in any patient with severe pain or swelling of a limb of unknown origin and when a patient with any unexplained illness presents with bleeding or abnormal neurological signs.

3.9.1 Snake-bite assessment

Establish the circumstances of the bite

In most snake-bite victims the bite marks are obvious, and the majority of patients will experience significant local pain. However, bites by neurotoxic snakes may be virtually painless and, in some cases, the bite site may be difficult to detect. In addition, not all snake-bites lead to significant envenoming: 10–50% of bites may be "dry bites", i.e. insufficient venom was injected to cause clinical effects. If there is any doubt, observe the patient closely.

If a bite occurred, consider the following:

- Time since the bite
- Can the snake be identified? Local knowledge is important to help identify the correct species. Also, some snakes change considerably in appearance during their life cycle. If there is any doubt, treat the bite as if it is from an unknown species.
- Are there any obvious symptoms of envenoming? In some regions particular species may be associated with characteristic clinical syndromes (see Table: Some snakes of medical importance and major features of envenomation).

1 *Guidelines for the prevention and clinical management of snake-bite in Africa.* Chapters 10, 12, 15. WHO Regional Office for Africa, 2010. Available at http://www.afro.who.int/en/clusters-a-programmes/hss/essential-medicines/highlights/2731-guidelines-for-the-prevention-and-clinical-management-of-snake-bite-in-africa.html

2 *Guidelines for the management of snake-bites.* WHO Regional Office for South-East Asia, 2010. Available at http://www.searo.who.int/LinkFiles/BCT_snake_bite_guidelines.pdf

Clinical features and diagnosis

Clinical assessment should be directed towards determining whether envenoming has occurred. Clinical features may not be apparent until many hours after the bite. Therefore, repeat serial assessment is required.

Serial assessment includes the following:

- Perform the Quick Check looking at Airway, Breathing, and Circulation (see Quick Check pages 17–19).
- Examine the site of the bite for signs such as fang marks, local necrosis, blister formation, or bleeding.
- Regional lymph nodes may be tender or enlarged.
- Local swelling may gradually extend up the bitten limb. This may lead to a compartment syndrome.
- Non-specific symptoms of systemic envenomation include nausea, vomiting, abdominal pain, dizziness, and headache.
- Assess for bleeding
  - external, from gums, wounds, or ulcers, needle puncture sites;
  - internal, especially intracranial, haematuria, and a prolonged whole blood clotting time. The 20-minute whole blood clotting time test (see below) should be performed routinely. Also see Sections 7.2.18 and 10.19.
- Assess for signs of neurotoxicity, including:
  - ophthalmoplegia (ptosis), double vision, difficulty swallowing (bulbar palsy) and talking, muscle weakness, difficulty breathing, and flaccid paralysis with respiratory failure.
- Assess for signs of muscle breakdown, including muscle pains and black urine (a urine dipstick test positive for blood is indicative of muscle breakdown resulting in myoglobinuria).

It is difficult to give advice that can be generalized to all regions and situations, and local knowledge and adaptation of the management plan are important.[3]

Note: Due to the wide spectrum of toxic components in snake venoms, a combination of clinical syndromes is common in individual snake-bite victims. See the table below with some snakes of medical importance and the major features of envenomation).

Twenty-minute whole blood clotting test

2–3 ml of whole blood should be collected into a new, clean, dry, glass tube and allowed to stand at room temperature for 20 minutes. Tilt the tube gently to see if a clot has formed. The test is positive if blood has not clotted. The vessel must be glass rather than plastic in order to activate blood coagulation. Glass vessels may not activate coagulation, however, if they have been cleaned with detergent or are wet.

3 Updated snake distributions maps are available at http://apps.who.int/bloodproducts/snakeantivenoms/database/

Table: Some snakes of medical importance and major features of envenomation[4]

	Local effects	Clotting disorders	Weakness	Muscle breakdown	Low BP	Renal failure
South America						
• *Bothrops spp* (lance-headed vipers)	+++	++		+	+	++
• *Crotalus durissus terrificus* (South American pit viper)	±	++	++	+++		+++
North America						
• *Crotalus spp* (pit vipers)	++	++	+	+	++	+
• *Micrurus spp* (coral snakes)	±		++	++	±	
Australia and the Pacific						
• *Pseudonaja spp* (brown)	±	+++	±			±
• *Notechis spp* (tiger)	+	+++	+++	++		+
• *Pseudechis australis* (mulga)	++	++	±	+++		
• *Pseudechis porphyriacus* (red-bellied black)	+	+		+		
• *Acanthophis spp* (death adders)	±		+++			
• *Oxyuranus spp* (taipan)	+	+++	+++	+		
• Sea snakes	±		+++	+++	+	++
East and South-East Asia						
• *Daboia russelii* (Russell's viper)	++	+++	±	+++	++(+)	++(+)
• *Naja spp* (cobras)	+++		+++		++	
• *Naja philippinensis* (Philippine cobra)	+		+++		+	
• *Echis carinatus* (saw-scaled viper)	+++	+++			+	+
• *Bungarus spp* (Kraits)			++			
• *Hypnale spp* (hump-nosed vipers)	+++	+		+		+
• Sea snakes	±		+++	+++	+	++
Africa						
• *Bitis arietans* (puff adder)	+++	++				
• *Echis ocellatus* (carpet viper)	++	+++			+	+
• *Naja spp* (African spitting cobras)	+++					

4 Adapted from Meier J, White J. *Clinical toxicity of animal venoms and poisons*, 1995. CRC Press. Boca Raton FL. and http://www.toxinology.com/

• *Naja spp* (African neurotoxic cobras)	+++	±				
• *Atractaspis spp* (burrowing asps)	++	±			+	
• *Dendroaspis polylepis* (mamba)	+		+++		+	
Europe						
• *Vipera spp* (European adders)	+	±	±		++	++

Note: This table provides a general guide only since there may be interspecies differences in the spectrum and severity of clinical effects. Key: + mild, ++ moderate, +++ severe, ± may or may not be present

3.9.2 Snake-bite treatment

Snake-bite victims are generally extremely anxious and restless. First aid measures include reassurance of the victim, immobilization of the bitten limb, and rapid transport to a medical facility.

Some snake-bites lead to rapid onset of respiratory failure and cardiovascular collapse. Use Quick Check pages 17–18 for regular assessment of airway, breathing, and circulation. It is important to remove rings and bangles, as the swelling of limbs may worsen. Once the patient is in a medical facility, the most important aspect of management is to determine the need for antivenom and, if indicated, to administer it as soon as possible.

Treatment of systemic envenomation

Antivenom is required if there is evidence of systemic envenomation (clinical or biochemical) from a venomous snake. Such evidence may include:

- neurotoxicity
- clotting disorder (spontaneous bleeding or a positive 20-minute whole blood clotting time)
- muscle breakdown – muscle pains or black urine or a 3+ result for blood on a urinary dipstick
- hypotension, shock, arrhythmia that persists
- local necrosis or extensive swelling (more than half the bitten limb), rapidly progressive local swelling, bites on fingers and toes.

If these symptoms and signs are not present, continue to observe the patient closely. On an hourly basis check the patient for weakness (including droopy eyelids and difficulty swallowing), muscle strength, any breathing difficulty and for signs of bleeding. Carry out a 20-minute whole blood clotting test if there is suspected bleeding or in suspected haemostatic snake-bite.

In general, antivenom administration should not be started until there is evidence of systemic envenomation or local necrosis. If antivenom is not available, consider transferring the patient to a facility where antivenom is available (see Quick Check page 70). In the interim fluid replacement, *administration of fresh frozen plasma or initiation of dialysis* (see Section 11.31) should be considered in such situations. If the patient is in severe respiratory distress, see Quick Check pages 17−18 and consider advanced airway management (see Quick Check pages 62−67).

Administration of antivenom

Clinical points

- The dose required depends on the quantity of venom injected; therefore, the dose is not related to whether the patient is an adult or a child.
- Antivenom should always be given intravenously.
- Epinephrine (adrenaline) should be available for use immediately in case of anaphylaxis. For management of anaphylaxis, see Quick Check page 17 and Section 3.1.3.
- Antivenoms are more effective if given early (within hours of envenomation). However, improvement is possible even days after envenomation from some snakes.

Expected response to an antivenom

- Systemic symptoms usually improve over hours.
- Clotting usually corrects itself over a number of hours (depending on the type of snake). Repeat a 20-minute whole blood clotting test after 3–6 hours.
- Weakness tends to stop worsening, but may not immediately get better.
- Local necrosis will not be reversed but should not progress.
- Muscle breakdown may stop progressing, but kidney failure may still occur.

Reasons for a patient's failure to respond to an antivenom

- It could be the wrong type of antivenom (particularly if monospecific).
- The antivenom could be inactive or not efficient.
- There was an insufficient dose.
- There was an excessive delay after envenomation in administration of the antivenom.

Manage complications

All patients with snake-bite envenomation should be monitored for development of complications. This requires regular clinical examination (respiratory rate, breath volumes by observation or with *spirometry*, pulse and blood pressure; signs of compartment syndrome and gangrene), review of charts (urine output and urine colour, temperature) and biochemical investigations (serum potassium, creatinine, and clotting profile).

Prevention of renal failure requires adequate fluid intake. A deteriorating level of consciousness may be an indicator of intracerebral haemorrhage.

Manage local necrosis and compartment syndrome

The degree of local necrosis depends on the type of venom. Early administration of antivenom is the best way to prevent muscle damage. Compartment syndrome is rare and is difficult to distinguish from local tissue necrosis.

- Give analgesia for pain.
- It is important to involve a surgeon if there is significant swelling of digits or a limb.
- Fasciotomy should be considered only if:
  - there is clinical evidence of compartment syndrome (disproportionately severe pain, weakness of intracompartmental muscles, pain on passive stretching of intracompartmental muscles, hypoaesthesia of areas of skin supplied by nerves running through the compartment, and obvious tenseness of the compartment on palpation); and
  - the intracompartmental pressure has been measured and is >40 mmHg (in adults); and
  - clotting disorders have been corrected with antivenom.
- Infection is uncommon
  - Antibiotics should be given only if there is a necrotic wound or signs of an established infection (e.g. local area is red, hot, swollen, and fluctuant).
- Tetanus toxoid vaccine should be given routinely to unvaccinated patients.

Snake venom ophthalmia (cobra-spit)

Following venom contact with the eye, the cornea should be irrigated with large volumes of clean water, and a clean pad and topical antibiotic ointment (e.g. tetracycline) applied. If necessary, use a single dose of a topical local anaesthetic to help open the eyelid so as to properly cleanse the eye. Consider the use of 0.1% epinephrine eye drops to relieve the burning sensation. Diluted antivenom is not recommended.

Manage muscle weakness (neurotoxicity)

The use of polyvalent antivenom usually will not prevent the progression of neurotoxic effects in the acute phase, in particular respiratory paralysis, and the patient will not survive without life support. Late administration of antivenom may reverse weakness after envenomation by some snakes. If antivenom is not available, respiratory failure should be managed with assisted ventilation until spontaneous recovery occurs.

Monitor the patient closely for signs of progressive muscle weakness

- Early signs of neurotoxicity include droopy eyelids, double vision, difficulty swallowing, and drooling of saliva. These may indicate impending respiratory paralysis.
- Late signs of neurotoxicity include generalized weakness and weakness of the respiratory muscles. As the respiratory muscles become weak, the patient will breathe at a faster rate, take small shallow, and eventually use accessory muscles to breathe.
- Hypoxaemia is an ominous sign; usually, it is due to inadequate ventilation or oxygenation (see Section 3.2.1). When SpO_2 is <90, give oxygen (see Quick Check pages 33−35). This is a temporary measure, as giving oxygen alone will NOT improve ventilation.

If ventilation is inadequate, assist ventilation with BVM (see Quick Check page 31). For cases that are easily reversible, BVM can continue until antivenom takes effect. In neurotoxic snake-bite, anticipate a prolonged course of weakness and consider advanced airway management with tracheal intubation (see Quick Check pages 62−67) if local manual ventilation is feasible or transfer to a hospital where mechanical ventilator is available.

Advanced airway management should be considered if there are signs of bulbar palsy (drooling, difficulty swallowing, aspiration), as these are signs that the patient can no longer properly protect the airway.

Patients with neurotoxic symptoms, except those thought to have been bitten by mambas, should be given an anticholinesterase test. Ideally, edrophonium is used for this because it is short-acting; however, edrophonium is rarely available, and neostigmine can be used as an alternative. Neostigmine is widely used by anaesthetists to reverse non-depolarizing (competitive) neuromuscular blockade.

Steps in the anticholinesterase test

1. Take baseline observations for comparison.
2. Then give atropine sulphate (0.6 mg for adults) by slow intravenous injection to block the unpleasant and potentially serious muscarinic effects of acetylcholine (such as colic).

3. Then give *edrophonium chloride* (10 mg in adults) by slow intravenous injection, or, if edrophonium is not available, use neostigmine bromide by intramuscular injection – 0.02 mg/kg for adults.

4. A convincing response is increased muscle power or improvement in ptosis.

If the patient has a convincing positive response, maintain on neostigmine, 0.5–2.5 mg every 1−3 hours up to 10 mg/24 hours maximum for adults by IV/IM or SC injection, together with atropine as above.

Manage bleeding from clotting factor defects

(See Section 10.19 Abnormal bleeding and bruising)

- Spontaneous systemic bleeding usually stops within 15–30 minutes, and blood coagulation is restored within about 6 hours if an adequate dose of antivenom has been given. The 20 minute whole blood clotting test should be used to monitor the dose of antivenom in patients with coagulopathy. If the blood remains uncoagulated 6 hours after the first dose, the dose should be repeated every 6 hours until blood coagulation is restored.
- If the patient starts bleeding excessively, correct with *fresh frozen plasma, platelets or cryoprecipitates* in addition to antivenom. If these blood products are not available, use fresh whole blood (see Section 10.19).
- Heparin should not be given.
- Central venous lines and surgery should not be attempted unless clotting has been corrected with antivenom.

Manage muscle breakdown (rhabdomyolysis)

- An early sign includes muscle pain and a positive urine dipstick test for blood (cross-reacting with myoglobin from muscle).
- Late signs include dark urine and renal failure.
- Give IV LR or NS fluids (more than 3 litres per day). Keep patient very well hydrated by maintaining the JVP (visually) to be slightly higher than normal, and use furosemide when appropriate (see Section 11.31).
- Urine output should be monitored, and the rate of fluid administration adjusted accordingly.
- Correct acidosis and electrolyte disturbances.
- Haemodialysis or peritoneal dialysis may be required to treat acute renal failure and associated complications such as hyperkalaemia and acidosis (see Section 11.31).

Important myths

1. "Any antivenom will do" – FALSE.

   Antivenoms are very specific to the type of snake. For example, antivenom made for snakes in India will not be effective for snakes in Papua New Guinea. However, many antivenoms are polyvalent. This means that the venoms of more than one snake (there may be 10 or more) are used in their preparation.

2. "Cut the bite out" – FALSE.

   This may result in more extensive injuries than caused by the snake. If clotting problems are present, the patient may bleed to death.

3. "Tying a tourniquet stops the poison spreading" – FALSE.

   Cutting off the blood supply may not stop the venom spreading, and it may endanger the limb through lack of blood.

4. "Snake-bite pills" and other herbal remedies are effective in treating snake-bites – FALSE.

   Intravenous antivenom is the only specific treatment for snake-bite. No oral tablets, plant extracts, or treatments applied directly on the skin have been shown to reverse the effects of venom. This includes the use of special "black stones", coals, or ash.

Other false myths include the use of scarification, injection of the wound with Condy's crystals, the use of electric current, and sucking on the wound.

3.10 Burns[1]

In this section:

Burns are a severe form of trauma that can cause significant soft tissue injury as well as metabolic changes affecting fluid balance. Extensive burns are a life-threatening emergency. The extent of the burn, extremes of age, co-morbidities, and the circumstances surrounding the injury all will influence patient outcome.

3.10.1 Initial management and stabilization of burns using Quick Check

Airway and breathing

- Consider early intubation or tracheotomy for any burns of the face, anterior neck, and upper chest to protect from laryngeal swelling.
- Administer oxygen to all patients with Quick Check emergency signs, severe burns (>15% of total body surface area (TBSA) or airway involvement), altered mental status, SpO_2 <90, or suspicion of carbon monoxide poisoning (smoke inhalation, fire in enclosed space).

Circulation

- Insert IV. Calculate amount of fluids according to the Parkland formula for patients with severe burns and Quick Check emergency signs.

Parkland formula
calculates the amount of fluid to be administered
over the first 24 hours post-burn; 4 ml x body
weight in kg x percentage burns per TBSA

1 *Surgical care at the district hospital.* WHO, 2003. Available at www.who.int/child_adolescent_health/documents/9241545755/en/index.html and *Integrated management for emergency and essential surgical care.* WHO, 2003. Available at www.who.int/surgery/publications/imeesc/en/index.html

Remove all burned clothing, and cool skin with water.

- If the burn is acute, apply cool, wet towels for 30 minutes to cool the burn.
- Beware of hypothermia.

Manage associated trauma.

Cover the burn to reduce pain, and provide appropriate analgesia.

3.10.2 Assess and classify the burn

Determine the degree of the burn

The degree of the burn indicates its depth and severity and determines if surgery will be required.

1st degree	superficial	red or pink, painful, skin intact, no blisters
2nd degree	superficial or deep partial thickness	red, blisters, wet, painful, blanches
3rd degree	full thickness	white or black/leathery, no sensation, dry

Experienced burn doctors often reserve judgement on the definitive classification of the burn until they have examined the wounds at 72 hours after the injury.

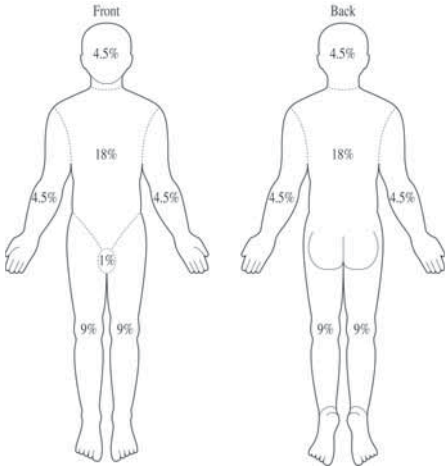
- First-degree burns usually will heal with minimal sequelae, even without treatment.
- Second-degree burns will heal, but often with significant scarring and contractures.
- Third-degree burns will heal (if at all) by contracture and cause severe scarring and disability. Third-degree burns also may include injury to the muscles or tendons.

Skin grafting is indicated for deeper second-degree burns and third-degree burns to improve cosmetic and functional outcome. If the wound is not epithelialized by 21 days, it should be grafted.

Estimate the extent of the burn (relative to TBSA)

- Determine the percentage of area burned using the "rule of 9s", whereby the body is divided into 9 areas or parts.
- If the burns do not fully cover a body part or cover more than one part, the percentage can be calculated by using the patient's palm as approximately equal to 1% of the TBSA.
- If a second- or third-degree burn involves the face, neck, hands, feet, or perineum or is circumferential (encircles a limb), it should be treated as a severe burn, and surgical referral is indicated, even if the TBSA is small.

Estimating the burned surface area in adults
The rule of 9s



Types of burns

Flame burns are the most common. A history of a flame burn in an enclosed space suggests inhalation injury. Look for soot in the mouth and burned hairs in the nose. Strongly consider airway protection before laryngeal swelling makes intubation too difficult. Flame burns often are deep, with feathered edges of partial-thickness burn. Clean off soot and loose skin with soap and water.

Scald burns. It can be very difficult to assess the full depth of a scald burn in the first few hours. It may not be apparent until the third day.

Contact burns usually are small but very deep, down to muscle, and likely to require excision and grafting.

Grease burns. Cooking oil is usually very hot. These are typically deep, partial-thickness or full-thickness wounds.

Electrical flash burns. These occur when a screwdriver or other conductive tool is inserted into a live electrical box. There is an extremely hot flash, but electricity does not travel through the body. Such burns typically involve the face and hands. Examine the patient's eyes with fluorescein and blue light for corneal damage. If corneal damage is present, treat with antibiotic eye drops or ointment. Even if there is no smoke involved, electrical flash burns can cause laryngeal swelling, and airway protection needs to be considered. Otherwise, treat as a thermal burn.

Electrical conduction burns. These result from conduction of high voltage electricity through the body. If the patient is conscious, there may be a history of the "can't let go" phenomenon: The patient was unable to let go of the electric wire or other source. On the surface, burns are typically only small entrance and exit wounds, but suspect massive underlying tissue injury. Look for cardiac arrhythmias and fractures. Destruction of muscle leads to myoglobinuria and renal

failure (see Section 11.31). In all cases insert a urinary catheter. If the urine is dark, raise the pH of the urine by giving large volumes of 5% dextrose with 150 mEq sodium bicarbonate per litre. (Putting bicarbonate in normal saline will yield a very hypertonic solution.) Give mannitol boluses and furosemide. Assess compartment pressures in the affected limbs and perform early fasciectomy. Remember that compartment pressures will rise with fluid resuscitation, and so re-examine the patient frequently.

Chemical burns. While caused by a wide variety of chemicals, acid and alkali burns are the most common. Always protect staff first! First, dust off any dry chemical, then wash the whole body for 40 minutes or more in running water to dilute the chemical. Irrigate the eyes thoroughly.

Classify the burn to decide how to manage it

SIGNS	CLASSIFY AS	TREATMENTS

• Any full-thickness burn
• Partial-thickness burn
  ° ≥15% TBSA in adults
  ° ≥10% TBSA in children
  ° Special regions (hands, face, feet, perineum)
• Any circumferential burn
• Inhalation injury
• Significant associated trauma OR
• Any burn in the very young or elderly OR
• Significant pre-burn illness (diabetes, HIV)
	SEVERE BURN	• Protect airway (consider laryngeal oedema with or without inhalation injury).
		• Cool burn if acute.
		• Fluid resuscitation
		  ° Give fluid according to Parkland formula, and insert urinary catheter to monitor urine output.
		• Consider escharotomy for circumferential burns.
		• Give tetanus toxoid.
		• Burn skin care (see below)
		• Prophylactic antibiotics are not recommended. Reserve antibiotics for clinical indications of infection.
		• Manage acute pain (see Section 20).
		• Place a nasogastric tube for feeding and give medication for gastric acid suppression (H2 blocker or proton pump inhibitor).
		• Admit to hospital.

Second degree burns
• <15% of body (adults)
 	
First degree burns
• >50%
	MODERATE BURNS	• Burn skin care (see below)
		• Give tetanus toxoid.
		• Some will require admission for pain control and dressings. Others may be managed at home with close follow-up.
		  ° Change dressing daily.
		  ° Mobilize joint twice daily and especially at each dressing change (move through range of motion).
		  ° Manage acute pain: pre-medicate for dressing changes
		• Schedule follow-up the next day and regularly thereafter. The burns must be seen by a doctor on the third day to determine full extent of the burn and whether surgical referral is required for skin grafting.

Small burns of non-critical areas	**MILD BURN**	• Burn skin care (see below) • Give tetanus toxoid. • Manage acute pain. • Patient can be managed at home. • Advise to return if fever, purulent drainage, or increased pain or redness.

3.10.3 Burn management

Manage inhalation injury

Suspect airway injury in all those who were burned in an enclosed space. Look for facial burns, soot in the mouth, and singed nasal hairs. Airway oedema may progress rapidly in the first hours to days after injury; frequent re-assessment is required for any patient with suspected airway injury.

There are 3 components to consider in inhalation injury.

1. Laryngeal oedema may be caused by inhalation of hot gas or by any burn involving the face, anterior neck, and upper chest, including scald and electrical flash burns. Burns larger than 30% TBSA, so called "metabolic burns", will likely swell; it is prudent to protect the airway.
2. Carbon monoxide poisoning should be suspected in anyone who lost consciousness in a fire. Intubate and provide 100% oxygen where possible if patient is confused or unconscious.
3. True smoke inhalation causes a pneumonitis that may not become apparent on chest X-ray until 72 hours after the injury.

Protect the airway before stridor develops. Stridor is a very late sign of life-threatening airway oedema. Where there is no capacity to manage the patient on a ventilator, consider early tracheotomy. Call for help if not skilled in airway management.

WARNING SIGNS: face and neck burns, black sputum, wheezing, hoarse voice, burned hair in the nose.

Fluid resuscitation in patients with severe burns

Patients with significant burns will require intravenous hydration.

- Place a large-bore IV X 2 in an area away from the burned skin.
- Use lactated Ringer's solution or normal saline.
- Consider using a bladder catheter to follow urine output.
- Use the Parkland formula to estimate fluid needs:
  - half in the first 8 hours and remainder in the next 16 hours (starting from the time of the burn, not the time at which fluid resuscitation is begun)
- Monitor urine output in all burn patients and adjust intravenous fluids to ensure adequate urine output (0.5–1 cc/kg/hour). Do not over-resuscitate.

Example: Parkland calculation using 4 ml

60 kg adult with 30% partial-thickness burns.
ml x kg x % = ml fluid required
4 x 60 x 30 = 7200 ml (7.2 litres)

The patient requires a total of 7200 ml of IV fluid in first 24 hours.
Give 3600 ml over the first 8 hours and 3600 over the next 16 hours.

Burn skin care

- Use sterile techniques for cleaning and debridement.
- Remove loose, necrotic skin and broken, tense, or infected blisters.
- Apply a non-adherent dressing and provide a moist healing environment.
  - In resource-limited settings topical antibiotics may need to be reserved for infected wounds. Bland dressings, such as paraffin gauze or honey and ghee (clarified butter), are an acceptable alternative for uninfected burns. Make honey and ghee dressings by mixing equal parts honey and either ghee or oil and spread the mixture over sterile gauze in a flat pan.
  - If infection of the burn is suspected, apply a topical antibiotic (for example bacitracin, silver sulfadiazine). IV or IM antibiotics may also be indicated if there is evidence of a wound infection.
- Change the dressing daily.
- Mobilize any burned joints twice a day and at dressing changes (move through range of motion, medicate for pain as needed).
- If a burn encircles a limb, there can be marked swelling and decreased circulation.
  - Elevate any burned extremity and monitor it frequently.
  - Escharotomy is indicated for limb cyanosis, decreased pulses, or worsening neurological status.
- Consider escharotomy in the severe burn patient with difficulty ventilating secondary to burned skin that limits chest movement.

Special issues

For all burns investigate any suspected cases of **domestic or child abuse.**

Large burns. Patients with large burns (>30% TBSA) should be referred to a specialized burn centre as soon as possible. But first:

- cool the burn to stop ongoing tissue destruction, but preserve and monitor body temperature - beware of potential hypothermia;
- protect the airway;
- start resuscitation fluid;
- place a urinary catheter and a nasogastric feeding tube;
- give tetanus toxoid;
- give omeprazole[2];
- do escharotomy if indicated;
- dress the burns.

Then transfer the patient promptly to a burn centre.

Delayed presentation. Many patients will present late. Carefully assess hydration and nutritional status. Give fluid to restore euvolaemia. Debride the wound (with adequate analgesia). Treat infection and malnutrition.

Hand burns are common and can be severely disabling. After cleaning the hand and considering escharotomy of the dorsum and fingers, apply topical antibiotic

2 Ranitidine is an alternative.

and cover with either a plastic bag or loose-fitting surgical glove taped or wrapped above the wrist. Splint the hand in the "safe position" (see figure below), elevate the arm, and range the joints twice a day, with adequate analgesia.

Blisters. Small blisters may be left intact, but those that are large, flaccid, blood- or pus-filled, and those restricting joint movement should be un-roofed and the base covered with a dressing.

Bathing. It is helpful to thoroughly wash the patient with soap and water at the time of admission. Showering is a good way to help remove debris from the wound. However, the routine immersion of burn patients in non-sterile bathtubs is unhelpful and spreads infection.

Face burns. It is difficult to keep dressings on the face. Open, uncovered treatment is preferred, with frequent, gentle cleaning and the application of topical antibiotic ointment. Shave facial hair every 2 days to prevent accumulation of exudate and infection. Examine eyes with fluorescein and, if keratitis or corneal ulceration is found, apply antibiotic eye ointment frequently. Eyelid contractures expose the surface of the eye; early surgical referral should be made for grafting of the lids. Keep the eye well protected with ointment. Blepharoplasty (suturing together the lids) is seldom indicated, as the sutures pull out, compounding the problem.

Circumferential, partial-, and full-thickness burns. Burned skin does not stretch and, thus, as the underlying tissue swells, pressure may cut off circulation to the extremity. This may not be apparent at the time of presentation; the swelling will increase as fluid is given, however. Escharotomy is performed by cutting through the burned skin in the mid-lateral and mid-medial axes of the extremity. A full-thickness burn has no sensation, but the edges of the burn may have exquisitely tender partial-thickness burn, so a local anaesthetic is helpful. Cut through the burn down to fat, and you will see the skin spread apart. Put a little "T" at the end of the incision where burn meets normal skin to allow more expansion. Never cut un-burned skin. Cover with dressings.

Surgical referral. All significant burns should be evaluated by a surgeon. Burns heal by a combination of re-epithelialization and contraction. The appearance of white epithelial pearls in the wound indicates re-epithelialization from nests of un-burned epithelium at the bottom of hair follicles and sweat glands. Red granulation tissue, however, clean as it may be, is granulating dermis and fat; if it ever heals, it will be by wound contraction. Any burn that does not heal by 3 weeks needs a skin graft.

Nutrition. Patients with a major burn may require more than twice their normal protein and calorie intake. Large amounts of protein are lost through the burn, and healing requires a lot of protein as well. The metabolic rate is elevated, and carbohydrate requirements are elevated as well. Because of pain and associated illness, few burn patients feel hungry. The best strategy is to insert a nasogastric feeding tube and give enteral feeds. Standard feeding solutions are good but expensive. Perfectly adequate solutions can be made from commonly available local foods and administered by the patient's relatives. In limited-resource settings good nutrition may be the most important intervention that can help a burn patient survive and heal. Oral rehydration solution (ORS) may be given by nasogastric tube instead of IV fluid resuscitation where IV access is difficult. ORS should be given freely to patients who are able to tolerate oral intake.

Analgesia. Burns are exceedingly painful, and so adequate analgesia is very important. Use a multimodal approach with different classes of analgesic.

Paracetamol and morphine provide good basal analgesia but should be supplemented with short-acting agents for dressing changes and daily physiotherapy.

Splinting and positioning. It is vitally important to splint burned hands in a position with the wrist dorsiflexed, the metacarpophalangeal (MCP) joints flexed at 90°, and the fingers straight. Splints can readily be fashioned from plaster of Paris and secured with a rolled bandage outside the plastic bag or glove. In general, splint other joints against the force of contracture. Do not let someone with a neck burn sleep with a pillow (which flexes the neck); take away the pillow so that the neck remains extended as much as possible. Position a burned shoulder at 90°. It is easier to prevent contractures than to treat them later.

Figure: The "safe position" for splinting a burned hand

3.11 Severely ill patient monitoring form

Careful monitoring of critically ill patients is important. After initially assessing the patient for emergency signs using Quick Check and giving appropriate emergency treatments, reassess the patient for response and respond accordingly. Throughout Section 3 there is an emphasis on how to *monitor–record–respond*. Section 3.0 describes the clinical parameters that should be monitored and recorded as well as the frequency of monitoring. This section provides a sample patient monitoring form that can be used to record the patient's clinical parameters by time since arrival.

A patient monitoring form gives quick access to clinical information required to track the patients' progress (Are they getting better, or are they getting worse?) and to easily review a patient's status at a point in time. Also, it allows the clinician to see what medications or other interventions have been given so that further treatments can be given at the appropriate times. The form includes is an area for laboratory tests that allows the clinician to keep track of what tests have been done, what are the results (if completed), and what tests are pending.

The clinician should start filling out this form as soon as the patient arrives. However, emergency treatment should not be delayed to fill out the form. Complete the form as follows:

1. Fill in the patient's name, age, sex, patient clinic number, admission date and time.
2. Fill in the working diagnosis.
3. Fill in investigations. Circle the appropriate tests, if sent, and record the results.
4. For all women check if pregnant and, if so, note expected date of delivery (EDD).
5. Record any history of drug allergy and type of reaction.
6. Record the time of day at each monitoring point, starting with the time of arrival. The form specifies time monitoring intervals in minutes, starting at time 0. Alternatively, if the patient monitoring form is started after a patient has already been admitted, record the time of day at the start of the resuscitation.

   Record the following clinical parameters every 30 minutes until stable, then every 60 minutes;

   - SpO_2
   - systolic BP in mmHg
   - pulse
   - respiratory rate per minute
   - consciousness level – use AVPU scale: Alert – Responds to Voice – Responds to Pain – Unresponsive. If trauma patient, fill in an initial Glasgow Coma Scale; repeat if head injury.

7. Record the following every 6 hours in column corresponding to time since arrival:
    - temperature in degrees Celsius
    - urine output** in ml per hour. Record volume if Foley catheter used. If not, just enter checkmark (✓) if noted.
    - Repeat glucose and haemoglobin if initial values abnormal.
8. Record results of glucose, haemoglobin.
9. Exam – record findings of patient examination.
10. Assess – record clinical assessment of major problems plus likely or differential diagnosis.
11. Response − indicate which treatment was given and at what time.
12. Initials − always write your initials after recording patient information.
13. Any additional notes − document any additional information about clinical history, examination, interventions, and response as necessary to communicate clinical course to other health workers.
14. Benchmarks achieved − these are a targeted list of interventions that should be completed within certain time frames. They serve as markers of delivering high-quality care to severely ill patients. For example, a patient with septic shock should be given empiric antimicrobials within 1 hour. Using a checklist like this can help health workers to deliver high-quality care.

Severe illness monitoring form (first 6 hours)

Name: Patient No.: Birth date: ___/___/___ Age: Sex: M / F Admission date: Admission time:															
Diagnosis:						*Circle if test sent and record result:*		Electrolytes _____ Urine dipstick _____ Malaria _____ AFB _____ Blood culture _____ Gram stain _____ CXR _____ Other _____							
Pregnant:	Yes/No EDD:					Allergies:									
	Time of day														
	Monitoring interval (minutes) from arrival or start	0	30	60 (1 hr)	90	120 (2 hrs)	150	180 (3 hrs)	210	240 (4 hrs)	270	300 (5 hrs)	330	360 (6 hrs)	390
Q30 – 60 min (until normal)	SpO_2														
	Heart rate														
	Systolic BP														
	Respiratory rate														
	Conscious level (AVPU)														
Q1 – 6 hours, repeat if abnormal	Temperature (°C)														
	Glucose														
	Urine output*														
	Haemoglobin														
Exam															
Assess															
Response	Fluids (type, rate)														
	Oxygen (method/flow)														
	Salbutamol														
	Vasopressor (type/rate)														
	Glucose														
	Antibiotics														
	Antimalarial														
	Antiviral														
	Furosemide														
	Blood														
	Other														
Clinician (initials)															

Severe illness monitoring form (hours 7-24)

Name:	Patient No.:	Birth date: ___/___/___	Age:	Sex: M / F	Time of transfer:	Ward:
Diagnosis:		*Circle if sent and record result:*	Electrolytes _____ Urine dipstick _____ Malaria _____ AFB _____ Blood culture _____ Gram stain _____ CXR _____ Other _____			
Pregnant:	Yes/No EDD:	Allergies:				

	Time of day																		
	Monitoring interval (hours)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Q 1 hour if SBP<90 or if on pressors, otherwise Q 2 hours	SpO_2																		
	Heart rate																		
	Systolic BP																		
	Respiratory rate																		
	Conscious level (AVPU)																		
Q 6 hours	Urine output*																		
	Temperature (°C)																		
Repeat if initial value abnormal	Glucose																		
	Haemoglobin																		
Exam																			
Assess																			
Response	Fluids (type, rate)																		
	Oxygen (method, flow)																		
	Salbutamol																		
	Vasopressor (type, rate)																		
	Glucose																		
	Antibiotics																		
	Antimalarial																		
	Antiviral																		
	Furosemide																		
	Blood																		
	Other																		
Clinician (initials)																			

Additional notes (please note any changes from standard protocol).

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BENCHMARKS – circle the relevant condition(s), then check if achieved

If severe respiratory distress, suspect pneumonia, or acute lung injury, within 30 minutes: ❑ Oxygen started ❑ SpO_2 measured ❑ IV started ❑ If wheezing, salbutamol given ❑ Appropriate infection control **Within 1 hour:** ❑ Broad-spectrum antibiotics ❑ If malaria possible, antimalarial given ❑ If influenza possible, antiviral given	**If acute pulmonary oedema, within 30 minutes:** ❑ Oxygen started ❑ SpO2 measured ❑ Furosemide 20 mg IV given ❑ If hypertensive, isosorbide dinitrate given ❑ If ischaemia (chest pain), aspirin given **If wheezing, within 30 minutes:** ❑ Salbutamol given ❑ If asthma/COPD, steroid given	**If shock, within 30 minutes:** ❑ IV line and rapid fluids started ❑ 1000 ml fluid bolus given **Within 1 hour, if fever or suspect septic shock:** ❑ Antibiotics given ❑ If malaria possible, antimalarial given ❑ If influenza possible, antiviral given **Within first 2 hours:** ❑ 3 litres IV fluids given	**If altered level of consciousness/ convulsing:** ❑ Oxygen started ❑ Oxygen saturation measured ❑ Recovery position ❑ Glucose checked and given ❑ If convulsing, diazepam given ❑ If convulsing and pregnant, magnesium sulphate given **If trauma, within 30 minutes:** ❑ Oxygen started ❑ Oxygen saturation measured ❑ Spine immobilized until clear ❑ If shock, IV line and rapid fluid bolus ❑ If shock, surgical consult ❑ Hb and type and cross sent

4. Trauma: approach to the acutely injured patient

Table of contents

4. Trauma: approach to the acutely injured patient[1]

This manual covers only the initial emergency assessment and management of an acutely injured adolescent or adult patient, prior to surgery. See Surgical Care at the District Hospital for additional information on definitive surgical treatment and inpatient hospital care.

4.0 General principles of trauma care

Correct management of the trauma patient in the first few hours is critical. Many deaths can be prevented if rapid care is given, including treatment of pneumothorax, abdominal haemorrhage, and pelvic and long bone injuries. Early identification and treatment of injuries can prevent late complications and death from infection or multiple organ failure. Hospitals with limited resources face additional challenges when caring for the trauma patient. Patients often must travel long distances to reach the hospital, and delays in presentation can lead to increased morbidity from untreated wounds, abdominal injuries, and fractures. Other challenges include a lack of trauma care specialists, equipment, and supplies. In addition, prolonged transport times may undermine safe transfer to a higher level of care.[1,2]

Despite these obstacles, an organized team approach will greatly improve the care of trauma patients in resource-limited settings. Practice frequently using the team system during routine care, and during scheduled training drills. Use the Quick Check to identify and treat patients with immediately life-threatening injuries leading to emergency signs. Early priorities for the trauma patient include managing airway emergencies, stabilizing the spine, controlling haemorrhage, and treating shock. Trauma patients identified using Quick Check emergency signs (airway and breathing, circulation, altered consciousness or convulsions) are seriously ill and may rapidly deteriorate. Any trauma patient with abnormal vital signs (SBP <90, pulse >110, SpO_2 <90) is considered unstable. Common mechanisms causing serious trauma include motor vehicle accidents, falls from a significant height, and gunshot or stab wounds. As with all seriously ill patients, frequent monitoring, recording, and responding to clinical changes is of vital importance.

When caring for the seriously ill trauma patient:

- Identify and immediately treat airway obstruction, tension pneumothorax, or haemorrhagic shock.
- Immediately immobilize the cervical spine. Only move the patient using the log roll technique until a spinal injury is excluded clinically or by X-ray. See page 44 Quick Check.
- Stop any visible haemorrhage with manual pressure or a compression dressing.
- Insert at least 2 large bore IVs (14 or 16 gauge), and send blood for haemoglobin and type and cross-match. Blood may be needed quickly and in large quantities for some trauma patients.

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1 Adapted from *Surgical Care at the District Hospital*. WHO, 2003. Available at http://www.who.int/surgery/publications/scdh_manual/en/index.html with updates based on the evidence review

2 For additional information on assessment and treatment of the trauma patient, see this manual and the IMEESC toolkit that can be accessed at http://www.who.int/surgery/publications/imeesc/en/index.html

- Only use isotonic crystalloid fluid (normal saline (NS) or Lactated Ringer's solution (LR)) for resuscitation in the trauma patient. If possible, warm IV fluids are preferred.
- If significant haemorrhage is ongoing, or there is a risk of significant haemorrhage, give tranexamic acid.[3] Administer an intravenous loading dose of 1 g of tranexamic acid over 10 minutes, followed by an intravenous infusion of 1 g over 8 hours. Tranexamic acid should be given as soon as possible. The effect of tranexamic acid depends on the time interval between injury and the onset of treatment. A new analysis of the 2010 CRASH-2 study shows that tranexamic acid should be given to bleeding trauma patients as early as possible. If treatment is not given until 3 hours or later after injury, it is less effective.[4]
- If after 2–3 litres of IV fluids the patient is still in shock (SBP <90), identify and control source of haemorrhage and transfuse packed red blood cells. Blood transfusion protocols should follow national or regional guidelines. Safe blood transfusion procedures should be followed for all patients, including emergency patients.
- As soon as possible after any emergency signs are treated, examine the patient thoroughly from head to toe to identify any other injuries. Fully expose all trauma patients on arrival (all clothing removed, and look at both front and back of patient) to identify injuries. After the complete assessment, cover and keep the patient warm.
- Reassess the patient frequently in the first few hours, and after any treatments are given. Monitor and record vital signs (BP, HR, RR, SpO_2) and mental status (both Glasgow Coma Scale (GCS) and AVPU) on arrival, and at least every 15 minutes for the first hour. Continue to check Glasgow Coma Scale for patients with head injury. For other patients with major trauma, recheck the GCS until stable, then use AVPU.
- If the patient deteriorates, repeat Quick Check and perform a thorough examination to identify any missed injuries. If the patient is in shock (SBP <90 mm Hg) and no visible bleeding is present, assume the patient has internal bleeding.
- Treat pain as soon as possible.
- If the patient requires referral for specialized care, and if the patient has been stabilized to the extent possible within the local capabilities for safe transfer, transport the patient without delay.

Note the special considerations in Quick Check for trauma patients. Knowledge of the mechanism of injury can help identify at risk patients who require immediate assessment and treatment. In addition to the presence of obvious visible trauma or emergency signs, triage patients as a Quick Check emergency if there is a high-risk mechanism of injury or specific injury patterns present that indicate the patient was injured by a considerable force. Patients who initially appear uninjured may have life-threatening occult injuries, such as internal bleeding. Monitor trauma patients

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3 Added to WHO Essential Medicine List at the March 2011 expert meeting http://www.who.int/selection_medicines/committees/expert/18/applications/TRANEXAMIC_ACID_10_2.pdf based on the clinical trial Shakur H, Roberts I, Bautista R, et al. *Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage* (CRASH-2): a randomised, placebo-controlled trial. Lancet. 2010;376(9734):23-32. Available at www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)60835-5/abstract

4 The CRASH-2 collaborators. *CRASH-2: tranexamic acid and trauma patients.* Lancet, 2011. Available at http://www.thelancet.com/crash-2

frequently, at a minimum for the first hour, and until life-threatening injuries have been excluded. If unstable, continuously monitor the patient until the condition is stabilized and definitive care is arranged.

High-risk mechanism of injury

Fall more than 3 metres
Road traffic accident at speed more than 30 km/hour or with significant damage to vehicle
Thrown from a vehicle or trapped in a vehicle
Pedestrian or cyclist hit by a car
Motorcycle crash with separation of rider from bike
Death of another person in the same accident
Injury from a high- or low-velocity weapon

High-risk injuries

Penetrating injuries to head, neck, torso, and extremities proximal to elbow and knee
Flail chest
Combination of trauma with burns
Two or more proximal long-bone fractures
Pelvic fractures
Limb paralysis
Amputation proximal to wrist or ankle

Patients with chronic medical conditions or at the extremes of age are at increased risk for complications from traumatic injuries. Have a high index of suspicion for occult injury in patients with high-risk co-morbid conditions. These patients often will require admission for observation, even in the absence of significant obvious injuries.

High-risk co-morbid conditions

Age <5 years or >55 years
Cardiac or respiratory disease
Insulin-dependent diabetes
Cirrhosis
Morbid obesity
Pregnancy
Immunosuppression
Known bleeding disorder or on anticoagulants

4.1 Working as a clinical team to care for the trauma patient

Preparation

It is important to check that the resuscitation area is ready at all times, before a trauma patient arrives.

- Emergency trolley in the resuscitation area with necessary emergency medications and equipment (Quick Check page 72)
- Adequate supply of resuscitation fluid (LR or NS) and safe blood for transfusion
- Equipment to stabilize the cervical spine and a spinal board to move the patient, if necessary
- A plan and equipment to transport the patient to the operating theatre, if required.

Assign responsibilities within the clinical team

Caring for a critically injured trauma patient requires multiple tasks to occur simultaneously, such as protecting the airway and cervical spine, completely undressing the patient, checking vital signs, obtaining IV access and starting IV fluids, obtaining the history and performing a physical examination, and sending laboratory investigations and documentation. Keeping the situation calm and controlled is important for delivering quality care. If possible, designate tasks ahead of time. Regardless of how many people make up the clinical trauma team, treating emergency signs of airway, breathing, and circulation will always take first priority.

During all trauma resuscitations, one person should be in charge as the "team leader." The team leader is usually the most senior member present. The team leader's responsibilities include coordinating and controlling the resuscitation, ordering any procedures and diagnostic tests, and deciding on transfer to the operating theatre or a higher level of care. Although in many district hospitals there may only be 1 or 2 people to care for the patient, all hospitals should develop a trauma team plan ahead of time based on their available personnel and resources. This plan may vary depending on the time of day if there are fewer health workers available during night hours or weekends.

Sample division of roles on the clinical team caring for a trauma patient at a district hospital[5]

Team leader
Coordinate and control resuscitation
Designate tasks for others
Ensure treatment of any Quick Check emergency signs
Ensure protection of the cervical spine and appropriate movement of the patient
Order all medications, IV fluids, blood
Order all procedures and diagnostic tests
Perform any specialized procedures if necessary (i.e. securing the airway, treating tension pneumothorax, splinting fractures) or delegate to another skilled team member
Monitor progress
Decide on referral to the operating theatre or a higher level of care

Primary nurse
Obtain IV access
Monitor and record vital signs and urine output
Give IV fluids, blood, and medications

Nursing assistant
Completely undress patient
Help with obtaining vital signs
Assist with moving patient and patient transport
Transport blood to lab
Help gather any necessary equipment and supplies

Following a trauma resuscitation, restock any used equipment, medications, and intravenous fluids. Check the emergency trolley and oxygen cylinder at least twice daily and record all supplies on a log.

5 Adapted from: Krantz B. *Field triage in resources for optimal care of the injured patient.* Chicago: American College of Surgeons, 1993.

Referral to a higher level of care

It may be necessary to refer critically injured trauma patients to a higher level of care for specialty treatment. Agreed patterns of referral should be worked out ahead of time between facilities and include written criteria for when a patient should be referred and the referral procedure. Communication between the hospital referring the patient and the receiving hospital is critical to quality patient care. In addition to the general recommendations for referral for all patients (see Quick Check p. 71), do not delay transport for additional diagnostic testing if the testing can be performed at the receiving facility. For example, if a patient needs transport to a hospital with an operating theatre based on a high suspicion of an intra-abdominal injury, do not delay transport to obtain a confirmatory ultrasound of the abdomen. A follow-up system that relays the outcome of referred trauma patients should be established between facilities as a means of continuing education and quality improvement.

Many critically injured patients may not be stable enough for transport and all reasonable efforts should be made to stabilize patients. Patients with serious injuries to the head and neck may develop a life-threatening compromise of the airway. If skilled personnel and appropriate equipment are available and it is clinically indicated, secure the airway with endotracheal intubation prior to transport. Transport critically injured patients with a health worker who is appropriately trained to assess the patient and respond to emergency conditions. If it does not delay care, give the first dose of IV antibiotics for open fractures prior to transport. Treat pain prior to transport. Document all treatments given and send any reports or diagnostic tests with patient.

4.2 Assessing and treating the trauma patient

Assessment of the trauma patient includes the following:

- Quick Check (triage and primary survey)
- secondary exam (secondary survey)
- ongoing assessment and monitoring.

Simultaneously with the assessment, management steps should be initiated including:

- emergency treatments
- resuscitation and stabilization
- definitive care and treatments.

Time	Assessment	Management
0–10 minutes (repeat if patient deteriorates)	Quick Check Secondary survey	Emergency treatments Resuscitation
After 10 minutes	Monitor using patient monitoring form Assess and record every 15–30 minutes until stable	Ongoing resuscitation Stabilize Definitive care and treatments (transfer for diagnostic testing, operating theatre, referral to a higher level of care)

Specific emergency treatments for trauma patients are described in Quick Check including:

- airway management (page 29–32)
- management of tension pneumothorax or massive haemothorax (page 46)
- management of sucking chest wound (page 46)
- spine immobilization and clearance of the cervical spine (page 44)
- management of serious head injury (page 45)
- management of visible haemorrhage (page 47)
- initial management of suspected intra-abdominal injury (page 20).

Oxygen therapy for trauma patients

Patients with traumatic injuries may have multiple mechanisms that result in deficient oxygen transport. For example, a patient involved in a motor vehicle accident may have an obstructed airway due to coma, impaired gas exchange due to lung contusion, pneumothorax or rib fractures, or inadequate oxygen delivery due to anaemia or hypotension.

During the initial assessment (primary survey), give oxygen to all patients with significant trauma, particularly in suspected head injury patients. Increasing the inspired oxygen concentration reduces the risk of tissue hypoxia while diagnosis and treatment of the underlying injuries is carried out.

Some injuries, such as bruising to the lungs, will get worse as time progresses and there is more tissue swelling and damage. These patients may have increasing oxygenation requirements from hours to days after the injury (delayed hypoxia). Oxygen therapy in major trauma normally should be started at a high concentration, and then titrated as a result of frequent reassessment (Quick Check pages 33–35).

Immediately following Quick Check and the initiation of any emergency treatments, complete a full secondary examination (also known as a secondary survey) looking from head to toe for any other injuries.

Obtain further information including:

- detailed history of the injury
- past medical history
- medications
- drug allergies
- social history.

First assess and treat immediately life-threatening injuries

Quick Check and emergency treatments for trauma patients (do not move neck if cervical spine injury possible)

Assess	Look, listen and feel for	Suspect injuries and treat
Airway	Airway obstruction (risk factors include obtundation, obvious trauma to airway, expanding neck haematoma)	Open airway using jaw thrust. Place oral or nasal airway (avoid nasal airway if suspected mid-face fracture). Secure airway with endotracheal tube if clinically indicated and appropriate equipment and personnel are available (Quick Check page 30).
Breathing	Central cyanosis Severe respiratory distress Tracheal deviation Decreased breath sounds	Give oxygen. Treat suspected tension pneumothorax or haemothorax. Treat sucking chest wound. Give bag valve mask ventilation, if ventilation inadequate.
Circulation	Weak or fast pulse Capillary refill longer than 3 seconds Heavy bleeding from any site Severe trauma – systolic BP <90, HR >110	Insert 2 large IV cannulas and give 1 litre bolus LR (or NS). Keep warm. If pregnant, place on side (preferably left). Apply pressure to stop any active bleeding. Send Hb and Hct, and type and cross-match. Splint suspected femur or pelvic fracture. Arrange for surgery if suspected intra-abdominal injury or occult haemorrhage. If the patient remains hypotensive after 2 litres bolus (LR or NS) or suspect ongoing heavy blood loss, transfuse blood as per national or local guidelines and consider giving tranexamic acid. Perform ultrasound exam (focused assessment of sonography in trauma – FAST) to assess for free fluid in abdomen (see Section 7.2.20).
Altered consciousness and convulsions	Altered level of consciousness Convulsing Deformity of skull Pupils not equally reactive to light Blood or fluid from ear or nose	Protect from further injury. Manage airway. Give oxygen. Give glucose. Give diazepam if convulsing. Suspect spinal injury or closed head injury and treat (see emergency treatments).
Life-threatening causes of pain	Severe abdominal pain or abdomen hard on palpation (distended, tense, guarding, rebound) Penetrating wound to abdomen	Suspect intra-abdominal injury. Nothing by mouth (NPO). Give IV fluids. Send blood for type and cross-match. Surgical consult Treat pain. Perform ultrasound – FAST exam to assess for free fluid in abdomen (see Section 7.2.20)

Assess	Look, listen and feel for	Suspect injuries and treat
	Trauma to head or neck	Suspect head and spinal injury. Immobilize cervical spine. Monitor airway. Call for help.
	Chest pain Ecchymosis to chest wall Air under the skin	Suspect pneumothorax or haemothorax. Suspect rib fractures. Treat pain. If available, obtain upright chest X-ray.

Then look for and treat other injuries (see over).

Secondary exam: Check the patient from head to toe and look for the following

Assess	Look, listen and feel for	Suspect injuries and treat
Consciousness	Confusion, agitation, coma, convulsions	**Head injury** If decreasing level of consciousness, agitation or seizures, suspect and manage serious head injury (see Quick Check). Manage airway. Record AVPU . Record Glasgow Coma Scale. Give glucose if known or suspected hypoglycaemia. Manage seizures.
Head and pupils	Size, shape, and reactivity of pupils Inspect scalp for lacerations and skull fractures Palpable defects	**Head injury** Monitor mental status and manage airway. Treat any soft tissue injury, open fracture, or laceration. If patient is confused, agitated, seizing, or vomiting, manage as a serious head injury (see Quick Check page 45). **Eye injury** Protect eye. Check visual acuity. If suspect globe penetration, call for surgical help.
Maxillofacial	Visual deformity Mid-face stability Malocclusion Palpate for crepitus	**Facial fracture** Monitor airway. Check and document cranial nerves. Avoid nose blowing. Give antibiotics for open facial fracture. If major facial trauma or malocclusion, call for surgical help.
Neck	Visible trauma Subcutaneous emphysema Haematoma Pain or tenderness of cervical spine	**Injury to larynx, trachea or oesophagus** Manage airway. NPO. Call for surgical help. Vascular injury Manage airway. NPO. Control any active bleeding. Call for surgical help. **Cervical spine injury** Immobilize cervical spine (Quick Check page 44). Arrange for radiographic evaluation.

Assess	Look, listen and feel for	Suspect injuries and treat
Thorax	Bruising, deformity Uneven chest wall movement Subcutaneous air Decreased breath sounds Muffled heart tones Severe back pain	**Pneumothorax or haemothorax, flail chest, sucking chest wound** (see Quick Check page 46) Rib fracture Treat pain. Check for associated pneumothorax. Deep breathing exercises. If sub-acute, check for secondary pneumonia. Vascular injury Manage airway. Send Hb, and type and cross-match. Call for surgical help. **Pericardial tamponade** If haemodynamically unstable (SBP <90 mm Hg), emergent pericardiocentesis. FAST ultrasound to confirm diagnosis if patient stable and equipment and personnel available. **For all serious injuries to thorax obtain chest X-ray.**
Abdomen or flank	Abdominal pain or tenderness Abdominal distension Abdominal rebound or guarding Visible abdominal wound Ecchymosis back or abdomen, mark of seatbelt across lower abdomen	**Liver or spleen injury, pancreatic injury, bowel injury, retroperitoneal haemorrhage, aortic injury** NPO. Give IV fluid bolus. Send Hb, and type and cross-match. Give pain medication. Call for surgical help. **Perform FAST ultrasound if diagnosis equivocal and equipment and personnel immediately available.**
Pelvis or GU	Look for ecchymosis Palpate bony pelvis for tenderness. Palpate pubic symphysis for widening. If no obvious injury, check pelvis for stability. Inspect perineum and look for blood at urethral meatus. Perform rectal and vaginal exam.	**Pelvic fracture** If suspect unstable pelvic fracture, wrap tightly with pelvic binder or bed sheet (Quick Check page 47). NPO. Give IV fluid bolus. Send Hb and Hct, and type and cross-match. Give pain medication. Obtain pelvic X-ray. Call for surgical help. **GU tract, rectal, vaginal, perineal injury** If the patient is conscious and if can void spontaneously, check for gross blood. **Do not place Foley catheter if high-riding prostate or blood at urethral meatus. Catheter should pass easily, do not force.**
Spine	Palpate for any bony tenderness of spine or step offs. Motor function Rectal tone, saddle anaesthesia Pain and sensation	**Vertebral injury or spinal cord injury** Keep spine immobilized (see Quick Check page 44). Monitor airway. Treat pain. Document and monitor neurovascular exam. Obtain radiographic evaluation. **Call for surgical help.**

Assess	Look, listen and feel for	Suspect injuries and treat
Extremities	Swelling, bruising, or tenderness Deformity Open fracture (open wound in the vicinity of a fracture) Absent or diminished pulses Pallor or cold extremities Neurological deficits Tense muscular compartments	**Fracture** Check and document neurovascular status. If any neurovascular compromise, reduce immediately. Splint. Treat pain. If open fracture, also: • give antibiotics and tetanus toxoid • copiously irrigate and splint • call for surgical help. If femur fracture, also: • send Hb and type and cross-match • NPO • IV fluid bolus • call for surgical help. **Compartment syndrome** Perform decompressive fasciotomy. Vascular injury Document exam. NPO. **Call for surgical help.**
Skin	Bruising, abrasion, laceration	**Laceration, abrasion** Irrigate wound Suture and splint, if indicated. Give pain control. Give tetanus toxoid. Contusion Give pain control, elevation, and ice, if available.

Following the secondary survey and the initiation of urgent treatments, document all findings, investigation results, medications, or treatments given.

Resuscitation and stabilization

Assume that any trauma patient in shock (SBP <90 mmHg, pulse >110) is haemorrhaging. The priority is to rapidly identify and stop any ongoing blood loss. Control visible bleeding with manual pressure. Immediately send blood for type and cross-match and Hb. Keep the patient warm. Place a Foley catheter and monitor urine output. A rapid FAST ultrasound exam can be used to identify free fluid in the abdomen or pericardial effusion (see Section 7.2.21). If the patient is unstable with suspected internal bleeding, do not delay treatment for these diagnostic tests. Transport the patient to the operating theatre for an exploratory laparotomy. If no source of bleeding is identified, and the patient remains hypotensive after intravenous fluids and blood, consider other sources of shock, such as septic, cardiogenic, and neurogenic shock.

Intravenous fluid

- Only isotonic fluids should be used (LR or NS).
- Administer IV fluids rapidly in response to abnormal vital signs.
- If the SBP <90 mm Hg, HR >110, or there is suspected ongoing blood loss, administer 1000 ml LR or NS rapidly and monitor vital signs.
- Monitor urine output.

Blood
(for complete information on blood transfusion see WHO's *The Clinical Use of Blood Handbook.*[6])

If 2 litres of IV fluids are given, or if significant blood loss is suspected, arrange for a blood transfusion as soon as possible. If the patient requires a transfusion, continue resuscitation with IV fluids until the blood is available to keep the SBP >90 mm Hg.

- Use national or local guidelines when transfusing blood.
- Blood should be warmed when possible. Cross-matched blood is always preferred, but may not be immediately available in an emergency situation:
  - uncross-matched blood (O-negative) generally available in 0–5 minutes
  - uncross-matched group-specific blood generally available within 10–20 minutes
  - cross-matched blood generally available within 60 minutes.
- If the patient has severe ongoing haemorrhage and is very unstable (SBP <90 mmHg, signs of poor perfusion), start a transfusion of packed red blood cells (PRBC) within 5 minutes and infuse the blood as fast as possible. Give O-negative blood to women of childbearing age, or if male, give O-positive or O-negative.
- If the patient has severe ongoing haemorrhage, but the SBP is >90 and the patient is not yet showing any signs of poor perfusion, it is acceptable to wait for uncross-matched group-specific blood to be available. A transfusion of PRBC should be started at least within 30 minutes and infused as quickly as possible. Frequently re-assess the patient. If the patient becomes very unstable and group-specific blood is not yet available, give O-negative (women), and if male, give O-positive or O-negative.
- If the patient is stable or cross-matched blood is available, give cross-matched blood.
- Observe for transfusion reaction (see Section 10.18).
- If the patient requires a massive blood transfusion, defined as replacement of blood loss equivalent of greater than the patient's total blood volume (70 ml/kg) in less than 24 hours, then transfusion of other blood products (e.g. fresh frozen plasma and platelets) should be given to help the blood clot.
- Calcium is depleted when multiple transfusions are given and should be replaced.

Tranexamic acid
Treatment with tranexamic acid has been shown to safely reduce the number of deaths in bleeding trauma patients. The indications for treatment include evidence of significant haemorrhage (SBP <90, HR >110) or those considered by the clinician to be at risk for haemorrhage. Because the effect of tranexamic acid on death due to bleeding depends importantly on the time interval between injury and the onset of treatment, it should be given as early as possible and within 3−4 hours of the injury.

Monitoring
For any unstable patient, frequently monitor vital signs, mental status, and urine output, and perform frequent physical examinations. Patients who are stable but have been injured by a high-risk mechanism, such as a fall from a significant

6 *The Clinical Use of Blood Handbook*. WHO, 2002 (in revision). Available at http://www.who.int/bloodsafety/clinical_use/en/

height, also should be monitored closely for the first few hours. Use the patient monitoring form, introduced in Section 3.11, to monitor trauma patients. For the first hour, monitor patients, including vital signs and mental status, at least every 15 minutes. After the first hour, use the same monitoring intervals as when caring for other seriously ill patients, such as patients in septic shock. Continue resuscitation until the patient is stabilized or transferred for definitive operative management.

Initial laboratory and diagnostic examinations	**Initial and every 15 minutes for 1st hour then every 30–60 minutes until improved**	**Initial then every 1–2 hours**	**Repeat every 4 hours**
Glucose Hb and Hct Blood type and cross-match Urine for pregnancy (if indicated) Urinalysis AVPU and, if head injury, Glasgow Coma Scale If indicated and available: • X-ray: chest, pelvis, spine, suspected long-bone fractures • diagnostic peritoneal lavage • abdominal ultrasound (FAST – see Section 7.2.20)	Pulse (normal: 60–100 bpm) BP (normal: systolic >90) Respiratory rate (normal 12–16; respond if >20) SpO_2 (normal >95, give oxygen if <90)	Temperature (normal <38oC) Urine output Physical exam: lungs, CV, peripheral circulation Mental status: AVPU (repeat GCS if head injury)	Hb and Hct if initial value abnormal or suspect ongoing blood loss

Glasgow Coma Scale

Use the Glasgow Coma Scale to assess and monitor patients with head injury. The patient is assessed for eye opening, verbal response, and motor response. The lower the score, the more severe the head injury:

- severe head injury – GCS 8 or less
- moderate head injury – GCS between 9 and 12
- minor head injury – GCS between 13 and 15.

Glasgow Coma Scale (GCS)		
Function	**Response**	**Score**
Eyes (4)	Open spontaneously	4
	Open to command	3
	Open to pain	2
	None	1
Verbal (5)	Normal	5
	Confused talk	4
	Inappropriate words	3
	Inappropriate sounds	2
	None	1
Motor (6)	Obeys command	6
	Localizes pain	5
	Flexes limbs normally to pain	4
	Flexes limbs abnormally to pain	3
	Extends limbs to pain	2
	None	1

If at any point the patient deteriorates, reassess the patient using Quick Check and give any necessary emergency treatments. Repeat a secondary survey to look for occult or missed injuries.

Normal vital signs and improving mental status may suggest that the patient is stabilizing. Some critically injured trauma patients will not stabilize until their injuries are repaired in the operating theatre. The decision whether to rush a patient to the operating theatre needs careful consideration and good communication between the trauma team, surgeon, anaesthetist, and the patient's family. Once the decision is made that the patient requires emergency surgery it should not be delayed.

If a patient remains unstable despite resuscitative efforts, or the patient has a non-survivable injury, consider whether further treatment is futile.

Definitive care and treatment

Following Quick Check, secondary examination and initial resuscitation, transfer the patient to where they can receive definitive care (ward, operating theatre, referral to higher level of care). If stable, the patient may also be transferred at this time to the radiology department for any necessary tests.

Major trauma patients are at a high risk of complications during their hospitalization, such as pulmonary infections, pressure ulcers, gastric ulcers, and deep vein thrombosis (DVT). See Section 3.0 for more details regarding the general principles in caring for the severely ill patient.

Trauma patients have high nutritional requirements early in the hospital course, and nutrition should be started within 1–2 days. If the patient is unable safely to take food by mouth, start nasogastric feeds slowly and advance as tolerated if there is no contraindication (e.g. severe ileus).
For multi-trauma patients, begin gastric ulcer prophylaxis with a proton pump inhibitor or H2 antagonist (blocker) within 1–2 days.

Major trauma patients with spinal cord injury, or pelvic or long-bone fractures are at high risk for the development of DVT. Start prophylaxis within the first 24 hours:

- If not bleeding and not at high risk of a bleeding event, give heparin 5000 units subcutaneously 3 times daily to prevent DVT. *When available, enoxaparin 30 mg subcutaneously twice daily should be used as it has been shown to be more effective.*
- For patients who are bleeding or at high risk of a bleeding event, place graduated compression stockings or intermittent pneumatic compression devices to prevent DVT.

See IMEESC for complete management of traumatic injuries.[7]

4.3 Violence and injury prevention

Interpersonal violence
Once emergency conditions are identified and stabilized, obtain a thorough history of the events surrounding the injury. Interpersonal violence is a common cause of injuries. Health workers should always be aware of possible injuries caused by interpersonal violence. In cases of domestic abuse, counsel the patient and make sure that, if discharged, the patient has a safe place to stay. Enquire about other victims who may be at risk in the home, particularly children. Many patients may be reluctant to volunteer information about interpersonal violence. Interview the patient in a private, comfortable, and safe place. Sometimes the abuser may come to the hospital with the patient. Be cautious in these situations. Directly confronting the abuser or accusing the abuser may put the patient at additional risk, particularly if the patient chooses to return to the home. Try to get some time alone to talk with the patient and to develop a plan so that the patient will be safe.

Violence and injury prevention
The best way to treat trauma is to prevent it. Medical and nursing teams are in a unique position to educate patients and health workers about effective ways of

7 *Integrated Management for Emergency and Essential Surgical Care (IMEESC) tool kit.* WHO, 2009. Available at http://www.who.int/surgery/publications/imeesc/en/index.html

preventing injury. Preventive strategies include:

- improvements in road safety
- pedestrian and cyclist awareness
- wearing of seatbelts in cars or helmets for motor cyclists
- preventing drivers from drinking alcohol
- promoting safety in the workplace
- identifying and treating victims of inter-partner violence
- teaching about firearms safety
- violence interruption programmes.

Ask in all cases of trauma:

- Was alcohol a contributor? If yes, counsel about harmful alcohol use.
- Was drug use a contributor? If yes, counsel and arrange for treatment.
- Was this a suicide attempt? If possible, ask the patient, were you trying to harm yourself?
- Was sexual abuse or violence involved?
- Was interpersonal violence a contributor? Is there a risk of further violence in retaliation? If yes, get help to interrupt this and prevent further violence.

4.4 Manage rape or abuse in adolescents and adults[8]

Provide immediate comfort

- Do not leave a woman alone.
- Encourage contact with a friend who can come and help.
- Conduct yourself in a compassionate, calming, and professional manner ("You are safe now").
- If possible, the health worker should be of the same sex as the patient. A male health worker should have a female attendant if the patient is female.
- Try to create a climate of trust.
- Do not display curiosity, do not moralize, and avoid statements that blame the victim.
- Assure confidentiality.

Special considerations for the examination

- Examine in private.
- Obtain verbal consent before the examination.
- Assure the patient that information given and examination findings will be kept confidential.
- Explain what you are going to do as you go through the examination – the patient needs to feel in control.

8 *Clinical management of rape survivors.* WHO, UNFPA and UNHCR, 2004. Available at http://www.who.int/reproductivehealth/publications/emergencies/924159263X/en/

- Allow the patient to keep covered areas of the body that already have been examined.
- Try to understand the patient's emotional state. Talk to the patient before starting the examination.
- Look for complications of abuse (head to toe) such as:
  - bites, punch marks, haematomas, marks of restraints on the hands or wrists;
  - trauma to the genital region (tears, bruises, abrasions, redness, swelling) and rectal region (look for fissures and bleeding), head, chest or abdomen;
  - check for internal injuries (introitus, hymen, cervix) if trained, and it is acceptable to the patient.
- There may be no physical injuries.
- For country adaptation
- If trained, collect forensic evidence following local legal requirements and involve suitably trained and legally recognized staff.
- Follow reporting requirements and document notes thoroughly:
  - record details of injuries and actual or attempted sexual activity.
  - use the victim's words in quotes in the record.
  - advise the patient to go to specific forensic services, if available.

Management

Manage any injuries

- If there are breaks in the skin or mucosa:
  - give wound care.
  - give tetanus toxoid or immunoglobulin following local protocols.
- Give pain relief and manage symptoms.
- Give presumptive treatment for sexually transmitted infections.[9] Recommended medications should be adapted based on the country. For example, give (for presumptive treatment of gonorrhoea, syphilis, and Chlamydial infection) in a woman:

  Option 1:
  - cefixime 400 mg orally or ceftriaxone 250 mg IM; PLUS
  - azithromycin 1 g orally; PLUS
  - metronidazole 2 g orally single dose, if trichomonas is prevalent (avoid alcohol when taking metronidazole).

  Option 2: (if not pregnant and not allergic to penicillin)
  - cefixime 400 mg or ceftriaxone 250 IM: PLUS
  - benzathine benzylpenicillin 2.4 million IU IM; PLUS
  - doxycycline 100 mg orally, twice daily for 7 days or azithromycin 1 g orally; PLUS
  - metronidazole 2 g orally single dose, if trichomonas is prevalent (avoid alcohol when taking metronidazole).
- Give HIV post-exposure prophylaxis within 72 hours.
- Recommend baseline HIV testing and counselling.
- Offer emergency contraception if new pregnancy possible (see Section 14.5 –

9 *Guidelines for the management of sexually transmitted infections.* WHO, 2003. Available at http://whqlibdoc.who.int/publications/2003/9241546263.pdf

the regimen is the same for HIV-positive and HIV-negative women).

- Inform women that:
  - emergency contraception can decrease the risk of pregnancy if taken within 3–5 days of the assault (depending on the regimen);
  - the medication is not 100% effective;
  - (if she is concerned) emergency contraception pills do not cause abortion (they delay or prevent ovulation or implantation);
  - to avoid nausea and vomiting, eat before taking the pills and, if vomiting occurs within 1 hour, take an antiemetic pill and repeat the dose;
  - the IUD is very effective, as both as emergency and ongoing contraception, if a woman is interested in ongoing contraception.
- Admit or refer as needed.
- Arrange follow up if discharged home.

4.5 Wounds (soft tissue injuries)

Wounds and lacerations are common injuries and all health workers should be familiar with the basic principles of wound management.

The goals of wound management are to:

- avoid infection
- achieve normal function of the injured area
- achieve a cosmetically acceptable result (minimize scarring).

Avoiding infection is the single most important principle of wound care, and will directly affect the ability to achieve a good, functional, and cosmetic result.

Table: Factors that increase the risk of infection and poor healing

Host factors	Wound factors
Extremes of age Diabetes mellitus Anaemia Immunosuppression • HIV • cancer, chemotherapy, and radiation therapy • chronic steroid use Chronic renal failure Malnutrition Inability to care for wound at home	Location of wound • area with limited blood supply (e.g. hands and feet) • involvement of joint or open fracture • tendon involvement Mechanism of wound • crush injury • bite • puncture wound Duration of the injury (how long ago did the injury occur) Likelihood of contamination • foreign body • dirt or debris in wound

General approach to wound management

This is the same for all patients with wounds and lacerations.

- Stabilize the patient and assess and treat any life-threatening injuries (Quick Check).
- Apply pressure to any active bleeding.
- Check and record perfusion distal to the wound (distal pulse, capillary refill). Call for help if circulation is compromised.
- Treat pain (see Section 20).
- Take a history and identify factors that increase the risk of infection or poor healing (see table above).
- Examine the wound.
  - Document findings (often it is helpful to draw a picture of the wound).
  - Explore and remove any foreign body.
  - Document any motor or sensory deficit. If there is a deficit, the patient may require consultation or referral.
- Give tetanus toxoid or immunoglobulin for a tetanus-prone wound according to local protocols (see Section 11.39).
- Thoroughly flush the wound with normal saline or clean water. This is the critical step in managing a wound. Irrigation reduces the chance of infection by washing bacteria and debris out of the wound. It is important to use a large volume of fluid to remove all visible dirt and debris from a wound. For contaminated wounds, use at least 2 litres of fluid to irrigate the wound.
- Debridement: if wound edges look dead, remove the dead tissue. Healthy skin should look pink, moist, and bleed easily. Dead skin will be black or grey, may have a white film, and will not bleed easily. Dead skin makes it difficult for the wound to heal and increases the risk of infection.
  - Call for help if not familiar with debridement technique.
  - Inject local anaesthesia. Debridement of a large area of necrotic skin may need to be performed under general anaesthesia in the operating theatre.
  - Using aseptic techniques and scissors or blade, cut dead skin away in thin layers until pink, bleeding tissue is visible.
  - Re-assess the wound.

- Determine final wound care based on the location and extent of the wound, available resources, and the likelihood of infection (see table above).
  - Primary closure
    - This method is indicated for clean wounds less than 8 hours old with a low risk of infection. If clean, a wound on the face or scalp may be closed up to 24 hours.
    - Close the wound with sutures to bring wound edges together, preventing wound contamination and facilitating healing.
    - The goal is to bring the sides of the wound close together (good approximation) and limit tension or pulling on the skin. It may be necessary to use both deep sutures (the lower skin level and muscle) and superficial sutures (at the surface) to reduce tension on the wound.
  - Delayed primary closure
    - This method may be chosen if the patient presents with a wound that is more than 8 hours old, or there is concern for contamination.
    - Clean and debride the wound as described above.
    - Pack the wound with damp saline gauze.
    - Give oral antibiotics for 5–7 days (e.g. first generation cephalosporin).

- ◊ Have the patient return in 2 days to evaluate for closure. Alternatively, for patients who are being admitted, lay down closure sutures at the time of debridement, but do not tie them; tie the closure sutures at the bedside during the first dressing change 48–72 hours later, if the wound is clean.
- ° Secondary healing
  - ◊ This method should be used for:
    - grossly contaminated or infected wounds
    - wounds with large gaping holes when there is not enough skin at the edges to close the wound
    - puncture wounds
    - gunshot wounds
    - bite wounds.
  - ◊ The wound remains open and is packed with saline soaked gauze.
  - ◊ The gauze is removed every 48–72 hours and the wound is copiously irrigated, reassessed, and the dressing replaced.
  - ◊ The wound gradually becomes smaller, and heals from "inside-out".

Key points

- Not all wounds will need to be closed. After cleaning, small wounds and abrasions can be treated with topical antibiotic ointment and a clean dressing.
- Before closing a wound with sutures, determine that wound closure will not increase the risk of infection based on the patient's co-morbidities, the timing and mechanism of the wound, contamination, and location.
- NEVER close an infected wound with sutures. Pus will accumulate under the closed skin and the infection will worsen. If there is concern about the risk of infection, conservative management is recommended. Allow the wound to close by secondary healing.
- Educate all patients on appropriate wound care including the signs and symptoms of infection and when they should return for follow-up care.
- Consider suturing a wound if:
  - ° the wound is large (usually greater than 1 cm);
    - ◊ large wounds may need to be considered for eventual consultation or referral for skin grafting;
  - ° the wound continues to bleed;
  - ° the wound is over a joint;
  - ° the wound is in a location where the cosmetic result is important (e.g. face).
- Antibiotic use
  - ° Antibiotics are not routinely indicated for all wounds.
  - ° Consider antibiotics if there is a risk of infection (see Table: Factors that increase the risk of infection and poor healing).
  - ° If there is a suspected open fracture or joint or tendon involvement, give an initial dose of IV or IM antibiotics (e.g. first generation cephalosporin). Consider consultation or referral if a higher level of care is necessary.
  - ° All patients with wounds should receive appropriate discharge instructions to recognize signs and symptoms of infection. If a wound appears infected, or there is a high risk of infection, or an infected wound is worsening when the patient is already on oral antibiotics, consider admission for IV antibiotics and observation. Reconsider the possibility of a retained foreign body.

Suture techniques

Before debridement and suturing, provide adequate pain control using local anaesthesia.

When using local anaesthesia:

- Ask about any medication allergies.
- Give the anaesthesia solution through a small needle and inject slowly to minimize pain.
- Inject the solution through the edges of the wound where there is no or minimal contamination.
- Do not use a solution containing epinephrine on the fingers, toes, ears, penis, or tip of nose.

Refer to *IMEESC* guidelines for wound management, burns, suturing techniques, tendon injuries, management of specific lacerations, gunshot wounds, and land mine injuries.

4.6 Fractures

Refer to *Surgical Care at the District Hospital manual*[1] (Sections 17 and 18) for specific splinting techniques, cast application, and traction methods.

General principles

- In the multiple-injured trauma patient, address all life-threatening injuries before any non-critical orthopaedic injuries.
- A fracture is a break in the continuity of a bone or cartilage.
- Fractures can take from 2–4 months to heal. Healing is affected by the type of bone, age, and other co-morbidities. Treat severe sprains and strains as fractures.
- Goals of fracture management
  - Treat and reduce pain.
  - Prevent infection.
  - Re-align bony fragments so that healing and union can take place and normal function is restored.
- Diagnosis of fractures
  - Suspect a fracture if there is loss of function, pain, swelling, discoloration, or deformity following trauma.
  - Most fractures can be diagnosed clinically.
  - If X-rays are available, at minimum 2 views perpendicular to each other should be obtained prior to reduction.
    - ◊ If there is any compromise of circulation, the limb should be immediately reduced before X-rays.
  - If X-rays are not available and a fracture is suspected, treat the patient as though a fracture is present.
  - Even if X-rays do not show a fracture, if a fracture is suspected clinically, the patient initially should be treated for a fracture with immobilization.
- Treatment
  - Always assess and record vascular status of the limb distal to the fracture.
    - ◊ If no perfusion (limb cold, pale, no pulse, slow or no capillary refill),

urgent correction (reduction) of gross deformities is required to restore circulation.
    - ◊ If still no perfusion after re-alignment of the limb, splint and consider urgent orthopaedic consultation or referral.
    - ◊ If perfusion is now good following re-alignment, splint the injured segment and obtain X-rays, if available.
  - ° Reduction (bones are manually re-aligned to put the limb back into its normal position).
    - ◊ Reduction initially causes pain, and a patient should always be told what is happening and treated for pain.
    - ◊ Fractures that are not properly reduced will result in non-union and a poor functional outcome.
    - ◊ Always check neurovascular status before and after any reduction.
    - ◊ Relocate any dislocated joints as soon as possible.
  - ° Immobilization (keep the fracture site from moving).
    - ◊ Splints and casts are used for immobilization.
    - ◊ Splints are usually more appropriate for acute injuries because they allow for continued swelling.
    - ◊ Splints prevent the motion of broken bone ends, decrease pain, and minimize further damage to soft tissue, nerves, and blood vessels.
    - ◊ Generally, the joint above and below the fracture site should be immobilized.
    - ◊ Skeletal traction is required for temporary stabilization of certain fractures, such as the hip or femur. Definitive treatment will be dependent on the environment, resources, and other injuries.
- Consider any patient to have an open fracture if there is a wound (more than just a skin abrasion) near a fracture site.
  - ° Open fractures are orthopaedic emergencies.
  - ° If an open fracture is suspected:
    - ◊ control haemorrhage with a sterile pressure dressing
    - ◊ perform immediate reduction if any neurovascular compromise
    - ◊ treat pain
    - ◊ carefully remove any gross debris
    - ◊ splint
    - ◊ irrigate with saline and cover the wound with saline soaked gauze
    - ◊ begin IV antibiotics (example first generation cephalosporin)
    - ◊ administer tetanus prophylaxis based on immunization status and local protocols
    - ◊ consider consultation or referral for irrigation and fracture repair in the operating theatre.

Splints and casts

Key points about splints and casts

- Splints and casts support and protect injured bones and soft tissue, reducing pain, swelling, and muscle spasm.
- Splints are rigid material used to immobilize acutely injured extremities (fractures, strains and sprains, soft tissue injuries). Splints (usually only on one side of the arm or hand) offer less support and protection than a cast and may not be a treatment option in all circumstances, but may be useful for initial management while there is acute swelling.
- Casts are usually made of plaster and are wrapped circumferentially around the extremity, moulded to support and protect the extremity, providing more

rigid fixation than splints, but allow less room for swelling than splints. They are often used for definitive treatment of a fracture, and usually applied a few days after the injury when some of the swelling has resolved.

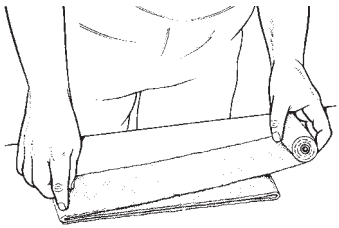
- Construct splints with plaster.
  - If necessary, wood and cardboard will serve as temporary splints.
- As a general rule, immobilize joints in their "functional position"
- (i.e. 90° flexion at the elbow, neutral position at the ankle). Metacarpophalangeal joints (where fingers attach to the hand) should always be immobilized in flexion, never straight.
- Apply plaster when the joint is held in the desired position.
- Avoid moving the joints once the plaster has been rolled, as this movement may cause flexion creases inside the casts and result in pressure sores.
- Always re-assess circulation and perfusion once the plaster is hard.

Splint application

- Materials
  - stockinette and padding – protect the skin and allow swelling
  - support material – plaster, pre-formed splints, modified local materials
  - elastic bandages secure the splint in place
  - adhesive tape
  - knife or scissors to cut the splint to the proper length:
  - bucket or pail of wet plaster
  - apron and gloves.
- Procedure

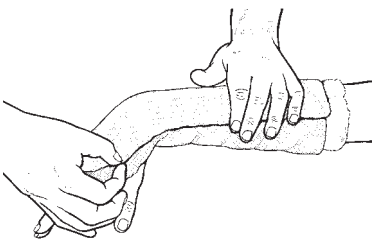
1. Always explain to the patient what you are doing and why.
2. Treat pain prior to applying a splint.
3. Remove clothing to adequately visualize the injured extremity.
4. Check and document neurovascular status (circulation, motor, sensory) before and after application of the splint.
5. Cover open fractures or joints with saline moistened sterile gauze.
6. Apply a splint to immobilize a joint above and below the suspected fracture site.
7. If the injured extremity is visibly deformed, first straighten (reduce) prior to the application of the splint.
8. Place the joint in the desired position prior to splinting.
9. If the injury involves the digits, apply padding between the fingers and toes.
10. If available, place a stockinette over the skin:
    - the stockinette should extend 10–15 cm beyond the area to be splinted at each end;
    - make sure the stockinette is smooth and there are no wrinkles;
    - it may be necessary to cut a slit to avoid wrinkling at the bony prominences.

11. Wrap padding around the entire area to be splinted:
    - wrap at least 2–3 layers thick
    - each turn should overlap the previous turn by 25%
    - extend 5 cm beyond the edge of the splint at each end
    - use extra padding over the bony prominences
    - avoid wrinkling.
12. Measure the length of material needed to secure the limb:
    - the plaster width should be slightly greater than the diameter of the limb to be splinted;
    - use 6–12 layers depending on the area to be splinted.



13. Soak the plaster roll in a pail containing water at room temperature. Do not use warm water as the heat given off by the plaster as it sets may burn the patient. Leave the plaster in the water until it is completely soaked and the air bubbles cease to rise.

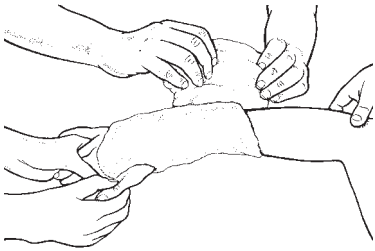
14. Grasp the plaster layer at each end. Smooth the wet plaster with the palm into a homogeneous layer. Always hold wet plaster with the palm of the hand, not the finger tips, as this may create pressure points and subsequent sores:
    - plaster becomes hot when wet and can cause skin burns;
    - apply plaster quickly, or it will dry.



15. Place the plaster splint over the area to be immobilized. Keep the area to be splinted steady and in the desired position.

16. Fold the padding and stockinette back to secure the splint in place and form smooth rounded edges.

17. While still wet, mould the plaster to the limb contours and secure with an elastic bandage or gauze wrap.



Patient instructions
Give oral and written instructions to the patient or to accompanying relatives or other attendants. Use non-technical language that the patient can understand. Explain the following instructions.

- Keep the splint dry at all times.
- Do not try to scratch your skin under the cast or splint with any object, sharp or blunt.
- For acute injuries, elevate the injured part for 24–48 hours and wiggle your fingers or toes frequently.
- Return to the health clinic immediately if:
  - your splint gets wet or becomes soft or broken;
  - you have increasing pain;
  - you experience numbness or tingling, or have difficulty moving your fingers or toes;
  - you see a change in skin colour of the extremity;
  - your cast or splint has a foul odour.

Complications
Most problems are caused by improper initial application.

Pressure sores result from skin necrosis caused by localized pressure. They occur over prominent bony areas, from ridges formed during improper application and from foreign bodies placed under the cast. Common sites are:

- heel
- ankle
- dorsum of the foot
- distal ulna at the wrist.

Areas under pressure begin as painful spots but, if ignored, the underlying skin becomes anaesthetised as an open wound develops. Drainage follows, often with

a foul smelling odour. Patients who complain of pain under their splint, particularly if away from fracture site or over a known bony prominence, should have their splint removed, the skin under the area examined, and the splint re-applied.

Compartment syndrome

This is a serious acute emergency caused by swelling in the compartments of an injured limb, which cannot expand. The increasing pressure in the compartment can result in reduced circulation to the limb and nerve and muscle damage. If you suspect compartment syndrome, and are not comfortable with the management, call for assistance.

Increased compartment pressure is commonly caused by:

- tight casts or dressings
- external limb compression
- burn eschar
- fractures
- soft tissue crush injuries
- arterial injury

The most common areas involved are the anterior and deep posterior compartment of the leg and the volar forearm compartment. Other areas include the thigh, the dorsal forearm, the foot, the dorsal hand, and, rarely, the buttocks. Diagnostic physical findings include:

- tense muscle compartments to palpation
- weakness of the involved muscle groups
- pain with passive stretch of the involved muscle
- pain out of proportion to the injury
- decreased sensation (late finding)
- pallor and decreased capillary refill (late finding)
- elevated compartment pressure (if measurement is possible).

Compartment syndrome is a surgical emergency and requires decompression. See *IMEESC*[7] for further management of compartment syndrome.

Considerations when caring for the pregnant patient with severe illness and trauma

- The priorities of trauma management are the same as with non-pregnant patients.
- Treat the pregnant patient with the most effective treatment available.
- Place the pregnant patient with shock or severe respiratory distress on their side (preferably the left) to improve uteroplacental blood flow. (Log roll if suspected spine injury – see Quick Check page 44.)
- Watch for trauma-related complications such as premature labour, uterine rupture, placental separation.
- Monitor the fetus (e.g. fetal pulse) frequently, according to local practice.

5. Approach to laboratory investigations

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5. Approach to laboratory investigations

5.1 Interpreting laboratory results

Evidence-based medicine: steps to using laboratory results
After taking a pertinent history and performing a physical examination, use your knowledge and the appropriate differential diagnosis tables to develop a relevant differential diagnosis, ranked both by what can be common causes and by what can be life-threatening causes.

- Laboratory tests are useful to confirm or rule out a diagnosis (or differential diagnoses); to establish the severity of disease (e.g. CD4 cell count); to monitor treatment outcomes; or to screen for disease (active TB case finding). The tests you choose to order are based on evidence-based health care, national guidelines, and your clinical judgement.
- Order the "best tests" you have available in your setting to either "rule in" or "rule out" a diagnosis that you are considering. Very few tests in medicine are perfect, so it is important that, as the clinician you know how accurate a test is before interpreting a result. For example, how accurate is a single expectorated sputum to diagnose pulmonary tuberculosis in someone with a lung cavity? How accurate is this test in someone without a lung cavity?
- The accuracy of a test can be described by its sensitivity, specificity, and predictive value:
  - **Sensitivity** refers to the ability of the test to correctly identify individuals who truly have the disease. If you perform a test that is highly sensitive for a particular disease and the result is negative, it is very unlikely that that disease is present; hence, the test has been helpful in ruling out the disease in question.

    Example: the malaria Rapid Diagnostic Test (RDT) is a very sensitive test. Therefore, if the result is negative, the possibility of malaria has been ruled out. The patient does not have malaria.

  - **Specificity** refers to the ability of the test to correctly identify individuals who do not have the disease. If you perform a test that is highly specific for a given disease and the result is positive, you can now be more certain that you have made the correct diagnosis; hence, the test has been helpful in ruling in the disease in question.

    Example: an AFB smear on CSF is a very specific test. Therefore, if the result is positive, the possibility of tuberculous meningitis has been ruled in. The patient has tuberculous meningitis.

  - **The predictive value** of a test (also called the post-test probability of disease) refers to the ability of the test to correctly identify the disease. Unlike sensitivity and specificity, which do not vary within populations, the predictive value of a test depends on age, gender, geographic location, and disease prevalence.

Test your knowledge of evidence-based decision-making by considering a clinical case.

- A 36-year-old man started ART (AZT + 3TC + EFV) in April.
- His pre-treatment CD4 was 15. He is at WHO clinical stage 3, with oral thrush.
- In June, two months after starting ART, he presented with severe headache, confusion, a stiff neck, and fever.
- His chest X-ray was normal.
- The CSF indicated:
  - 19 polys, 253 lymphs
  - protein 0.92
  - glucose 2.6
  - Gram stain – no bacteria

Question:

- What is your differential diagnosis for meningitis?

Differential diagnosis:

- Tuberculous meningitis
- Cryptococcal meningitis
- Bacterial meningitis (partially treated)
- Lymphomatous meningitis

You decide to perform an AFB smear on the CSF. What is the probability that the meningitis of this patient is due to tuberculosis 1) if the test is positive? 2) if the test is negative?

These probabilities depend on the sensitivity and specificity of the test, as described above, and also on how frequent the disease is in your region (prevalence of the disease in the general sick population, also called "pre-test probability", as it is the probability that the patient has the disease before any testing).

Situation A

Let us say that evaluation of a cohort of AIDS patients living in your region has shown that 20% of meningitis is due to tuberculosis. You can draw the following 2-by-2 table:

Step 1: Among 1000 patients, 200 (20%) have the disease and 800 do not have the disease.

		Tuberculous meningitis		
		Present	**Absent**	**Total patients**
Result of AFB smear of CSF	Positive			
	Negative			
	Total patients	**200**	800	**1000**

Step 2: The **sensitivity** of AFB smear on CSF is 60%. Thus, among 200 patients having the disease, 120 tests (60%) will be positive.

The **specificity** of AFB smear on CSF is 99%. Thus, among 800 patients not having the disease, 792 tests (99%) will be negative.

		Tuberculous meningitis		
		Present	**Absent**	**Total patients**
Result of AFB smear of CSF	Positive	**120**	8	120 + 8 = 128
	Negative	80	**792**	80 + 792 = 872
	Total patients	200	800	1000
		⇩	⇩	
		120/200 =	792/800 =	
		sensitivity = 60%	specificity = 99%	

Step 3:

(a) The Positive Predictive Value (PPV) is 120/128 = 0.94. Thus, if the AFB smear on CSF is positive, the (post-test) probability that the patient has tuberculous meningitis is 94%.

(b) The Negative Predictive Value (NPV) is 792/872 = 0.91. Thus, if the AFB smear on CSF is negative, the (post-test) probability that the patient actually has tuberculous meningitis is only 9% (100%−91%).

		Tuberculous meningitis			
		Present	**Absent**	**Total patients**	
Result of AFB smear of CSF	Positive	**120**	8	128	⇨ 120/128 = 94% = PPV
	Negative	80	**792**	872	⇨ 792/872 = 91% = NPV
	Total patients	200	800	1000	

Situation B
If the cohort of AIDS patients living in your region has shown that in fact only 2% of meningitis is due to tuberculosis, the 2-by-2 table will change in the following way:

		Tuberculous meningitis			
		Present	**Absent**	**Total patients**	
Result of AFB smear of CSF	Positive	**12**	9	21	⇨ 12/21 = 57% = PPV
	Negative	8	**871**	879	⇨ 871/879 = 99% = NPV
	Total patients	20	880	1000	
		⇩	⇩		
		12/20 =	871/880 =		
		sensitivity = 60%	specificity = 99%		

In this situation:

(a) If the AFB smear on CSF is positive, the (post-test) probability that the patient has tuberculous meningitis is only 57%. Hence, the etiology of the meningitis might be tuberculosis, but it might also be a disease other than tuberculosis. Further investigations are necessary.

(b) If the AFB smear on CSF is negative, the (post-test) probability that the patient has tuberculous meningitis is only 1% (100−99%). The possibility of tuberculous meningitis is thus fully excluded.

Table: Sensitivity and specificity for selected diagnostic tests			
Disease	**Test**	**Sensitivity**	**Specificity**
HIV	HIV ELISA	100%	98%
HIV	HIV rapid tests	99%	98%
Malaria	Malaria smear	52.5%	77%
Syphilis	RPR/VDRL	91%	95%
	FTA-ABS	92%	96%
Pulmonary tuberculosis – culture positive	3 expectorated sputum smears[1]	70%	96%
	Antibiotic trial to rule out pulmonary TB in smear negative[2]	55%	77%
Cryptococcal meningitis	CSF India ink[3]	72.6%	99%
	CSF cryptococcal antigen[4]	94.1%	99%
	Serum cryptococcal antigen[5]	91.4%	83.3%

1 Crampin AC, et al. Comparison of two versus three smears in identifying culture-positive tuberculosis patients in a rural African setting with high HIV prevalence. *International Journal of Tuberculosis and Lung Disease,* 2001, 5(11):994–9.

2 Wilkinson D et al. Trial-of-antibiotic algorithm for the diagnosis of tuberculosis in a district hospital in a developing country with high HIV prevalence. *International Journal of Tuberculosis and Lung Disease,* 2000, 4(6):513–8.

3 Chen S et al. Epidemiology and host- and variety-dependent characteristics of infection due to Cryptococcus neoformans in Australia and New Zealand. *Clinical Infectious Diseases*, 2000, 31(2):499–508.

4 Antinori S et al. The role of cryptococcal antigen assay in diagnosis and monitoring of cryptococcal meningitis. *Journal of Clinical Microbiology,* 2005, 43(11):5828–9.

5 Asawavichienjinda T, Sitthi-Amorn C, Tanyanont V. Serum cyrptococcal antigen: diagnostic value in the diagnosis of AIDS-related cryptococcal meningitis. *Journal of the Medical Association of Thailand*, 1999, 82(1):65–71.

5.2 Management of sodium, potassium, and calcium abnormalities

5.2.1 Abnormalities of sodium (Na) concentration

Hypernatraemia (high Na)

Hypernatraemia is an electrolyte disturbance that is defined by an elevated sodium level in the blood. It may occur in patients who are unwell from other causes (such as diarrhoea, diabetic ketoacidosis, or sepsis). The patient may present with symptoms of thirst, fatigue, weakness, or those of the underlying cause. In severe cases, hypernatraemia may present with **emergency signs** such as confusion, coma, or convulsions (see Section 3.5). **Always consider hypernatraemia in each of these situations.**

A history and a clinical evaluation and, in particular, an assessment of the patient's hydration or volume status will help establish the cause of hypernatraemia and guide initial management.

Diagnosis
Serum sodium >145 mmol/litre.

Causes

- Hypernatraemia usually is not caused by an excess of sodium, but rather by a relative deficit of free water in the body. It may occur in the following cases:
  - excessive water loss
    - gastrointestinal losses − diarrhoea, vomiting
    - cutaneous losses − high fever, sweating, burns
    - renal losses − hyperglycaemia (by osmotic diuresis), diabetes insipidus (low ADH secretion that may occur with meningoencephalitis or from drugs such as lithium).
  - insufficient water intake
    - lack of availability
    - decreased intake due to decreased level of consciousness.
  - excessive sodium administration
    - excessive IV normal saline (NS) replacement in hospitalized patients.

Management

- Avoid rapid correction of serum sodium as this can result in cerebral oedema and permanent neurological damage.
- Assess the volume status (hydration) of the patient.
- Calculate volume of fluid to be replaced. In the dehydrated hypernatraemic patient, the volume of water required to correct the deficit can be calculated from the following equation.

$$\text{Water deficit (in litres)} = \frac{(\text{serum Na concentration} - 140)}{140} \times 0.5 \times \text{body weight (kg)}$$

E.g. if the serum sodium is 160 mmol in a 70 kg patient, then the total water deficit is (160–140)/140 x 0.5 x 70 = 5 litres. This volume should be replaced over 48–72 hours. Ongoing losses also need to be factored into fluid replacement.

- Give water orally if the patient is haemodynamically stable and alert, or by nasogastric tube.
- If unable to give water orally, use IV fluid replacement. This is required if the patient is hypovolaemic (increased heart rate, low BP, or postural drop, low JVP, cool peripheries, dry mucosa, decreased skin turgor, or low urine output) or unable to take fluids orally due to decreased level of consciousness. Use normal saline (0.9%) until the patient is haemodynamically stable, then change to 5% dextrose to replace the water deficit. Stop IV fluids when adequate oral intake is established.
- Monitor sodium and other electrolytes twice daily initially, if possible. The serum sodium concentration should be lowered by a maximum of 10 mmol/litre over the first 24 hours.
- Diagnose and treat the underlying cause when possible, and correct other electrolyte abnormalities.

Hyponatraemia (low Na)

Hyponatraemia is an electrolyte disturbance in which the sodium concentration in the blood is lower than normal. It can be a manifestation of a variety of disorders. It is usually only symptomatic when it is severe, or if the onset has been rapid, leading to the development of cerebral oedema. Hyponatraemia may present with nausea, lethargy, confusion, muscle weakness and cramps, and in extreme cases seizures and coma. The signs and symptoms of the underlying cause are likely to be apparent.

Diagnosis

Mild:	Na 130–135 mmol/litre
Moderate:	Na 120–129 mmol/litre
Severe:	Na less than 120 mmol/litre

Causes

Hyponatraemia can be caused by many conditions and an assessment of the patient's volume status, used in combination with the calculated osmolality (using the equation below), can indicate the underlying cause and guide management.

Osmolality (mmol/l) = 2 x (Na + K) + urea/2.8 mg/dl + glucose/18 mg/dl)
(normal range = 280–300 mmol/l)

See summary table below for more details on causes and management. Most causes of hyponatraemia will be associated with a low serum osmolality.

Table: Assessment and management of hyponatraemia according to volume status and serum osmolality		
Volume status	**Possible causes**	**Management**
Dehydrated or hypovolaemic (increased pulse rate, low BP, or postural drop, low JVP, cool peripheries, dry mucous membranes, decreased skin turgor, low urine output) Classify dehydration according to section 10.7d.2.	**Renal losses** Diuretics (especially thiazides) Hyperglycaemia (due to osmotic diuresis) Addison's disease **Non-renal losses:** Gastrointestinal losses (vomiting, diarrhoea, bowel obstruction) Burns	Cautious intravenous hydration using the principles below, and treatment of the underlying cause when possible.
Euvolaemic (normal pulse rate, BP, JVP, peripheries, and urine output)	**Serum osmolality <260 mmol/l** Syndrome of inappropriate ADH release (SIADH)* Chest disease: TB, pneumonia, abscess CNS disorder: head injury, meningoencephalitis, brain abscess, stroke Malignancy	Treat the underlying cause if possible, and restrict total fluid intake to 50–60% of daily fluid requirement (500–1000 ml on average).
Hypervolaemic (raised JVP, peripheral oedema)	Nephrotic syndrome Cirrhosis Congestive cardiac failure	Treat the underlying cause if possible, and restrict total fluid intake to 50–60% of daily fluid requirement (500–1000 ml on average). May require diuresis.

*Syndrome of inappropriate ADH release (SIADH) is an important cause of low Na but is frequently over-diagnosed; many patients are inappropriately fluid-restricted due to this misdiagnosis. Patients with SIADH are euvolaemic (not dehydrated or oedematous, and not on diuretics). Investigations of a concentrated urine (urine Na >20 mmol/l) in the presence of hyponatraemia (<125 mmol/l) or low plasma osmolality (<260 mmol/kg) confirms this.

Management

Management should be guided by:

- the volume status of the patient
- the likely duration (chronic hyponatraemia is usually symptomatic)
- symptom severity.

Correct Na abnormalities slowly to minimize the risk of permanent neurological deficits or death, which may occur as a consequence of rapid fluid shifts. The increase in serum sodium should be <10 mmol/litre in the first 24 hours and <18 mmol/litre in the first 48 hours.

- In all cases, treat the underlying cause if possible. No further treatment measures are required for asymptomatic or mild hyponatraemia.
- Repeat electrolytes every 12 hours initially to monitor sodium rise, as well as to check for other electrolyte abnormalities.
- In hypovolaemic patients, cautiously hydrate with 0.9% NS to replace the fluid deficit. Use the table in Section 10.7d.2 as a guide to estimate the degree of dehydration. Discontinue fluids when the blood pressure is restored and the patient is euvolaemic.

- In the euvolaemic patient, consider giving a low dose of furosemide (e.g. 40 mg IV) in order to prevent fluid overload while treating the hyponatraemia
- In hypervolaemic patients, treat with 500–1000 ml a day fluid restriction and IV furosemide (40–80 mg). Recheck electrolytes at 4 hours, and then every 6 hours.

In emergency presentations of seizures or coma, the initial correction should be aggressive. Consider using hypertonic saline. If this is not available, use normal saline. Aim for an initial correction of 6 mmol/litre over 4 hours, then a more gradual correction as described above. The rate at which fluid should be given in the initial 4 hours can be calculated from the formula below. The rate of replacement should not exceed 70 mmol/hour.

Emergency infusion rate (ml/hour) = 4 x weight (kg) / Na concentration of infusion fluid (%)

E.g. the infusion rate of 0.9% normal saline in a 70 kg patient should be 4 x 70/0.9 ≈ 300 ml/hour. However, do not exceed 70 mmol/hour. 1 litre of normal saline (0.9%) contains 154 mmol/l NaCl, i.e. the maximum amount of normal saline that can be given in 1 hour is approximately 450 ml. Hypertonic saline, 3%, has 513 mmol/l of NaCl.

5.2.2 Abnormalities of potassium (K) concentration

Similar to most other electrolyte abnormalities, mild hyperkalaemia and hypokalaemia are often asymptomatic, and are clinically undetectable without a blood test. Severe potassium disturbance may manifest as severe arrhythmia necessitating urgent correction, and may be associated with general lethargy and muscle weakness. Always consider concurrent electrolyte abnormalities.

Hyperkalaemia (high K)

Hyperkalaemia is high serum potassium. It is usually asymptomatic and may be encountered in patients unwell from other causes (diabetic ketoacidosis, septic shock), and is usually diagnosed on routine blood tests or ECGs. Severe hyperkalaemia may be associated with muscle weakness, and can cause sudden serious cardiac arrhythmias and death.

Diagnosis

Mild to moderate:	K 5.5–6.5 mmol/l
Severe:	K more than 6.5 mmol/l or symptomatic or ECG changes

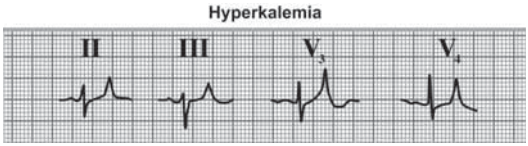
Causes

- Falsely high K reading: haemolysed sample commonly causes an elevated reading as potassium leaks from the cells. Repeat the blood test.
- renal failure
- shock (from any causes)
- diabetic ketoacidosis (hyperglycaemia, insulin deficiency)
- medications: potassium supplements, potassium-sparing diuretics (e.g. spironolactone), ACE inhibitors, non-selective beta-blockers (e.g. atenolol), NSAIDs, heparin
- other: rhabdomyolysis (muscle breakdown), metabolic acidosis, Addison's disease.

Management

- If available, obtain an ECG. Changes occur most markedly in lead V6 and S1. Consider cardiac monitoring or serial ECGs if any of the changes shown below are present.

ECG changes: peaked T waves, prolonged PR interval, small or loss of P waves, widening of the QRS complex progressing to sinusoidal wave, and potentially ventricular tachycardia (VT) or ventricular fibrillation (VF).



- Obtain a repeat sample to check the result, especially if there are no ECG changes.

Treat urgently if ECG changes are present, or if K more than 6.5 mmol/litre.

- Give IV calcium gluconate 1000 mg (10 ml of 10% solution) or calcium chloride 500–1000 mg (5–10 ml of 10% solution) over 2 minutes, to stabilize the cardiac membrane first if ECG changes are present. This can be repeated after 5 minutes if ECG changes persist.
- Give short-acting insulin 10–15 units IV in 50 ml D50 (50% dextrose water) infused over 2 hours, to activate intracellular transfer of K, followed by a dextrose infusion and regular blood glucose monitoring.
- Give salbutamol 10-20 mg by nebulizer or 0.5 mg (500 micrograms) IV. IV administration should be slow, over 15-20 minutes.
  - If these are not available, give salbutamol 1200 micrograms by metered-dose inhaler with spacer (this is 12 puffs).
  - Repeat if necessary, especially if other options are not available.
- Hyperkalaemia associated with severe oliguric renal failure may only be correctable with dialysis, in patients with acute or end-stage renal failure (see Section 11.31), and when the above measures fail. These patients may not have any ECG changes as the increase has been over a long period of time.
- Treat the underlying cause.
- Re-check the serum K to monitor response every 12 hours.
- Repeat all above if necessary.

Note: Most treatment options mentioned here will have little effect in cases of advanced or oliguria renal failure.

Ongoing management and management of mild hyperkalaemia

- Investigate and treat the cause.
- Stop drugs that increase serum K concentration.
- Diuretics, e.g. 20–40 mg furosemide once daily, or a thiazide diuretic, will increase K excretion, and gradually lower K levels over days. Higher doses will be required in renal failure. Except for those who are fluid overloaded, fluid losses should be replaced.

- Kayexelate 15–30 g in 50–100 ml of 20% sorbitol orally or rectally. Be aware of excess Na absorption.
- Avoid potassium-rich foods (e.g. bananas, oranges, mangoes, potatoes, yams, beans, peas, cabbage, and spinach).

Hypokalaemia (low K)

Hypokalaemia is low serum potassium. It is usually asymptomatic but may be symptomatic if the fall in serum potassium is sudden. It may be encountered in patients unwell for other reasons (e.g. diarrhoea, diabetic ketoacidosis, septic shock), and is usually diagnosed on routine blood tests or ECGs. It may also present with muscle weakness and cramps. Severe hypokalaemia may cause sudden serious cardiac arrhythmias and death.

Diagnosis

Mild:	K 3.0–3.5 mmol/litre
Moderate:	K 2.5–3.0 mmol/litre
Severe:	K <2.5 mmol/litre, symptoms or ECG changes

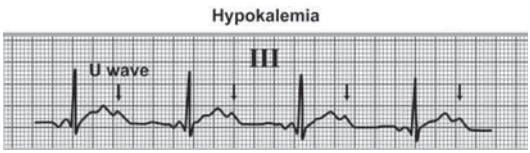
Causes

- gastrointestinal losses (diarrhoea, vomiting)
- medications: diuretics (e.g. furosemide) and chloroquine intoxication
- diabetic ketoacidosis
- other causes: stress response (increased β adrenergic activity), metabolic alkalosis.

Management

- If available, obtain an ECG to help determine the severity

ECG changes: ST depression, flattened or absent T waves, U waves (positive deflection after the T wave), prolonged PR interval, variety of atrial or ventricular arrhythmias.



Mild to moderate hypokalaemia:

- Oral potassium supplements in any preparation (salts, tablet, liquid) should be given at a dose of 10–20 mmol every 6–12 hours. If available, potassium chloride is preferable to citrate or bicarbonate preparations.
- If potassium supplements are not available, encourage the patient to eat potassium-rich foods such as tomatoes, bananas, oranges, melons, mangoes, potatoes, yams, beans, soya beans, peas, cabbage, or spinach.

Severe hypokalaemia:

- Consider cardiac monitoring, especially in patients with ECG abnormalities.
- Use higher doses of oral potassium preparation such as 40 to 60 mmol/l every 6–8 hours.
- In addition, in patients with worrying symptoms, or those who are unable to take oral supplements, give intravenous potassium in saline (dextrose can worsen hypokalaemia initially). **NEVER give a bolus dose of intravenous K as this can cause death.** In most cases, concentrations of 20–40 mmol/l should be used. Caution: more concentrated solutions 100–200 mmol/litre can be used in small volume preparations e.g. 100 ml in patients who are unable to tolerate large infusion volumes. (Particular care should be taken, including ECG monitoring, when concentrated solutions are being infused, as errors in calculating infusion rates may be fatal.)
- The maximal rate of infusion should not exceed 10–20 mmol/hour.
- In all cases, regularly re-check the serum potassium when giving replacements, and look for and treat the underlying cause.

5.2.3 Abnormalities of calcium (Ca) concentration

Hypercalcaemia (high Ca)

Hypercalcaemia is a high serum calcium level. It is most commonly associated with malignancy or parathyroid disease. In mild cases, it is usually asymptomatic; however, when severe, it can present with confusion, coma, or a cardiac arrhythmia. The patient may also present with any of the following symptoms:

- gastrointestinal – abdominal pain, dysphagia, constipation, nausea, vomiting
- renal – dehydration, polyuria, renal stones and renal failure
- neuropsychiatric – anxiety, depression, confusion, seizures, coma
- musculoskeletal – bone pain, weakness.

Diagnosis

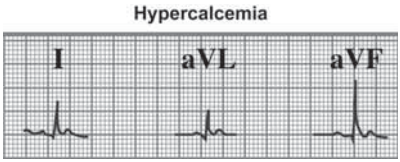
If *serum albumin* can be measured, calculate the more physiologically relevant ionized calcium.

Ionized calcium = Ca + (40 – serum albumin (g/l) x 0.02

Mild:	2.65–3 mmol/litre
Moderate:	3–3.5 mmol/litre and asymptomatic
Severe:	>3.5 mmol/litre or >3.0 and symptomatic or dehydrated

If available, obtain an ECG.

ECG changes: shortened QT interval, widened QRS, flat T waves, AV block, occasional fatal arrhythmias.



Causes

- malignancy
- hyperparathyroidism (primary or tertiary in known renal failure)
- granulomatous disorders − TB, sarcoidosis
- drugs − vitamin D, thiazide diuretics, lithium, indigestion remedies
- other − adrenal failure, hyperthyroidism, immobilization, rhabdomyolysis (muscle breakdown)

Management

Severe hypercalcaemia with CNS symptoms requires urgent treatment.

- Check renal function and electrolytes. Association with hypokalaemia is common and increases the risk of arrhythmias.
- Rehydrate the patient with 0.9% NS at an initial rate of 200–300 ml/hour until urine output >200 ml/hour, then 3–6 litres over 24 hours.
- Determine the rate according to the degree of initial dehydration, medical history (cardiac or renal failure), as well as regular monitoring of urine output, and hydration status (pulse, lying and standing BP, JVP, peripheral perfusion, and oedema). If equipment is available, a urinary catheter may be useful to monitor urine output and fluid balance.
- In a patient with known cardiac or renal impairment, or once the patient is hydrated, use a loop diuretic, e.g. 40 mg furosemide every 4–6 hours with continued IV saline. Electrolytes, especially K and Mg, are likely to fall, and should regularly be checked and supplemented when necessary.
- Steroids (e.g. prednisolone 20–40 mg/day) can be effective in certain etiologies (lymphomas, sarcoidosis, TB, metastases, and vitamin D intoxication).
- Once the patient is stable, aim to investigate and treat the underlying cause.

6. Infection prevention and control

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6. Infection prevention and control

6.1 Principles of hospital infection prevention and control

Infection prevention and control (IPC)[1,2] are integral to the provision of safe health care. Hospital IPC aims to prevent transmission of communicable diseases including TB,[3,4] blood-borne and enterically transmitted pathogens, acute respiratory diseases,[5] as well as to prevent infection during medical procedures (see Section 7 Procedures) or surgery (covered in other sources).

The purpose of IPC includes preventing the transmission of both endemic and epidemic infections. Community-acquired infections can be amplified by transmission within the health facility in the absence of effective IPC practices, with transmission to other patients, visitors, and health workers. These practices are ongoing requirements that apply every day, as well as when there are novel organisms causing an acute respiratory disease or a hemorrhagic fever. This manual for limited-resource settings assumes middle or high TB burden, requiring consistent attention to TB infection control.

Hospital managers should refer to other sources on developing, implementing, and monitoring an IPC programme[6], training health workers in IPC, providing adequate infection control commodities, assuring a safe blood supply, managing a sterilization section within the hospital,[7] and improving the infrastructure to make the hospital a safer work environment.

Hospital infrastructure should be arranged and improved as necessary to facilitate hand hygiene, safe waste management, and patient placement. Triage and waiting areas should be well ventilated (open air shelters with a roof are recommended for patient waiting areas), and narrow, poorly ventilated corridors avoided as patient waiting areas. Improving air ventilation[8] in rooms for patient care includes leaving windows and doors open when possible to maximize cross ventilation. Prioritize

1 *Core components for infection prevention and control programmes. Report of the Second Meeting of the Informal Network on Infection Prevention and Control in Health Care.* WHO, 2008 (WHO/HSE/EPR/2009.1). Available at http://www.who.int/csr/resources/publications/WHO_HSE_EPR_2009_1/en/index.html

2 *Operations Manual for Delivery of HIV Prevention, Care and Treatment at Primary Health Centres in High-Prevalence, Resource-Constrained Settings.* WHO, 2008 (under revision). Available at http://www.who.int/hiv/pub/imai/operations_manual/en/index.html

3 *WHO policy on TB infection control in health care facilities, congregate settings and households.* WHO, 2009. Available at http://whqlibdoc.who.int/publications/2009/9789241598323_eng.pdf

4 *Implementing the WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households. A framework to plan, implement and scale-up TB infection control activities at country, facility and community level.* TBCTA, 2010. Available at http://www.stoptb.org/wg/tb_hiv/assets/documents/TBICImplementationFramework1288971813.pdf

5 *WHO interim guidance: infection prevention and control in health care for confirmed or suspected cases of pandemic (H1N1) 2009 and influenza-like illnesses.* WHO, 16 December 2009 (updated from 29 April 2009 and 25 June 2009 versions). Available at http://www.who.int/csr/resources/publications/swineflu/swineinfinfcont/en/index.html

6 *Core components for infection prevention and control programmes.* WHO, 2008. Available at http://whqlibdoc.who.int/hq/2009/WHO_HSE_EPR_2009.1_eng.pdf

7 *Sterilization Manual for Health Centers*. AMRO-PAHO and USAID, 2009 http://new.paho.org/hq/index.php?option=com_content&task=view&id=2106&Itemid=229&lang=en

8 *Natural Ventilation for Infection Control in Health-Care Settings.* WHO, 2009. Available at http://whqlibdoc.who.int/publications/2009/9789241547857_eng.pdf

IPC recommendations based on assessment of the risk of nosocomial infection in the specific health-care facility and in specific patient care areas.

This Section is aimed at health workers who should refer to the IPC guidelines and use appropriate precautions in their clinical work.

Health worker role in hospital infection prevention and control

- **Ensure a safe working environment.** A safe hospital environment is a high priority for the well-being of staff, patients and visitors. Each health worker should promote a climate of safety to prevent transmission of pathogens in the hospital.
- Standard infection control precautions[9] should be used, as a minimum, in the care of all patients, staff, and visitors. Standard precautions are meant to reduce the risks of transmission of pathogens from both recognized and unrecognized sources.
- **Assess the risk** of exposure to body substances or contaminated surfaces BEFORE any health-care activity. **Make this a routine!** Risk assessment is critical. Assess all health-care activities to determine the level of risk then use appropriate personal protection equipment (PPE) (see Section 6.3).
- Implement source control measures for all persons with respiratory symptoms through promotion of respiratory hygiene and cough etiquette (see Section 6.4).
- Triage, early detection, or suspicion of particular diseases can lead to appropriate seating, hospitalization, and isolation precautions, which can reduce transmission.

Standard precautions for all patients include:[10,11]

- hand hygiene (see Section 6.2)
- appropriate personal protective equipment (PPE) (see Section 6.3):
  - gloves
  - facial protection (eyes, nose, and mouth)
  - gown
- respiratory hygiene and cough etiquette (see Section 6.4)
- prevention (and management) of injuries from sharp instruments (see Section 6.5)
- environmental cleaning (see Section 6.6)
- appropriate handling of contaminated linens (see Section 6.7)
- waste disposal (see Section 6.8)
- patient care equipment (see Section 6.9).

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9 *Infection control standard precautions in health care.* WHO, 2006. Available at http://www.who.int/csr/resources/publications/4EPR_AM2.pdf

10 *WHO interim guidelines on infection prevention and control of epidemic and pandemic-prone acute respiratory diseases in health care.* WHO, 2007. Available at http://www.who.int/csr/resources/publications/swineflu/WHO_CD_EPR_2007_6/en/index.html

11 *Infection control standard precautions in health care.* WHO, 2006. Available at http://www.who.int/csr/resources/publications/4EPR_AM2.pdf

6.2 Hand hygiene[12]

- Ensure availability of hand-washing facilities with clean running water.
- Ensure availability of hand hygiene products (clean water, soap, single-use clean towels, and alcohol-based hand rub). Alcohol-based hand rubs should be made available at every point of care and are the standard of care.
- When to wash hands with soap and running water:
  - when hands are visibly dirty.
- When to use alcohol-based hand rub:
  - when hands appear clean (i.e. are not visibly soiled).

Indications for hand hygiene

- Before and after any direct contact between a health worker and a patient and contact between patients, whether or not gloves are worn. Hands should be washed before gloves are put on.
- Immediately after gloves are removed.
- Before handling an invasive device.
- After touching blood, body fluids, secretions, excretions, non-intact skin, and contaminated items, even if gloves are worn.
- During care, e.g. when moving from a contaminated to a clean body site of the same patient.
- After contact with inanimate objects in the immediate vicinity of the patient.
- Ensure that hands are dry before starting any activity.
- Dry hands with single-use towels.

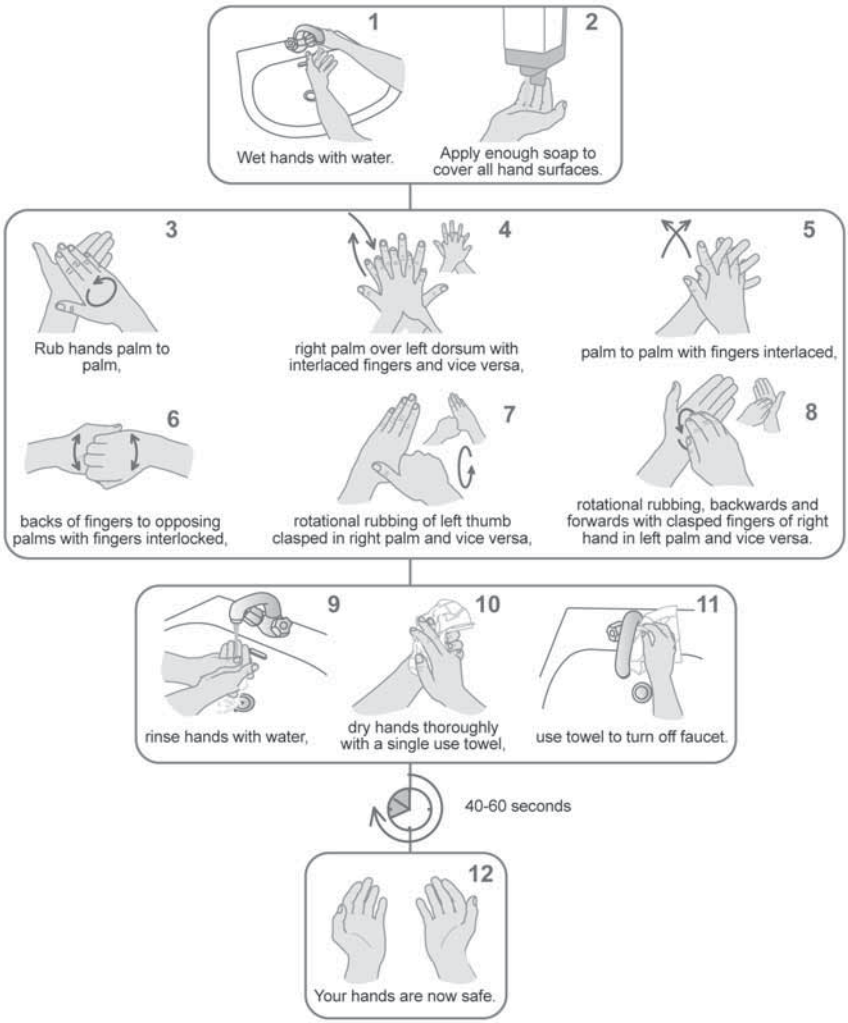
12 *WHO Guidelines on Hand Hygiene in Health Care*. WHO, 2009. Available at http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

Techniques for hand hygiene

Hand washing (40–60 seconds)

- Wet hands and apply soap; rub all surfaces; rinse hands and dry thoroughly with a single use towel; use towel to turn off faucet and dispose of the used towel.

Figure: How to wash the hands with soap and water[13]



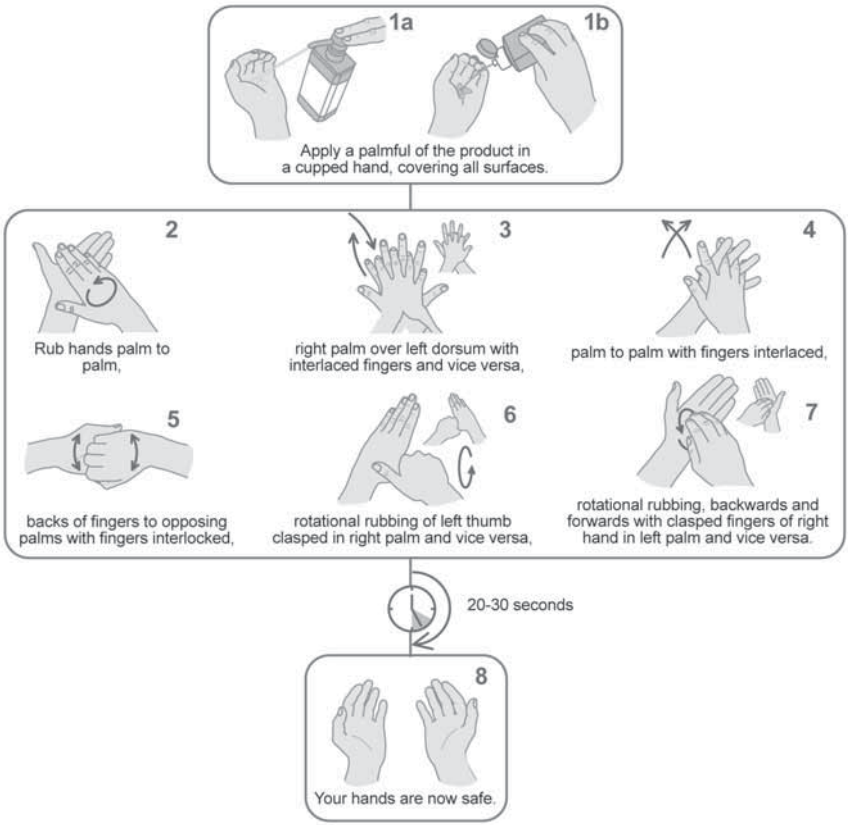
13 *WHO Guidelines on Hand Hygiene in Health Care*. WHO, 2009. Available at http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.07_eng.pdf

Techniques for hand hygiene

Hand rubbing (20–30 seconds)

- Apply enough product to cover all areas of the hands; rub hands until dry.

Figure: How to cleanse the hands with an alcohol-based formulation[14]



14 Sterilization Manual for Health Centers. AMRO-PAHO and USAID, 2009. Available at http://new.paho.org/hq/index.php?option=com_content&task=view&id=2106&Itemid=229&lang=en

6.3 Appropriate personal protective equipment (PPE)

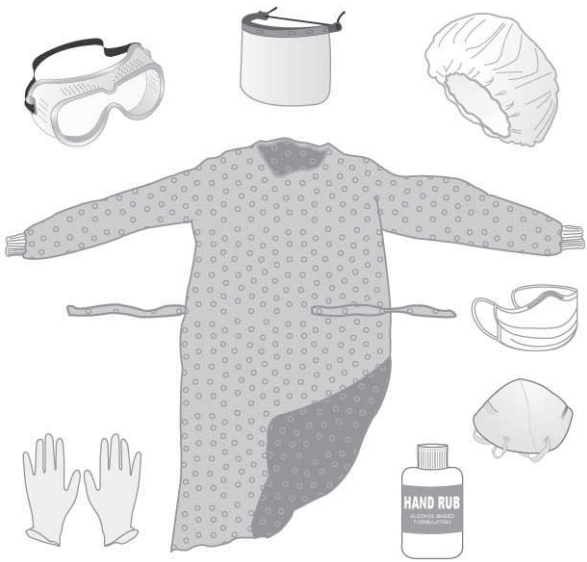
Assess the risk of exposure to body substances or contaminated surfaces BEFORE any health-care activity. **Make this a routine!**

- Select PPE based on the assessment of risk:
  - clean, non-sterile gloves
  - clean, non-sterile fluid-resistant gown
  - mask and eye protection or a face shield.
- Ensure that there is a continued supply of PPE.
- Educate and train hospital staff how to wear, remove, and dispose of PPE.

Some PPE is used based on the procedure or type of patient care, no matter what organism (these are part of standard precautions). Additional PPE may need to be added based on the patient's likely diagnosis and suspected pathogen (e.g. if suspect acute respiratory disease of concern, see Section 6.1).

Pathogens differ as to whether they are spread by contact, by large droplets (requiring droplet precautions) or by very small droplet nuclei which can travel more than a meter and stay suspended in the air (requiring airborne precautions).

Figure: Personal protective equipment



PPE to use for any patient according to likely exposure to blood, secretions, non-intact skin

Gloves

- Wear gloves if there is any chance of touching blood, body fluids, secretions, excretions, mucous membranes, or skin, especially skin that is not intact.
- Change between tasks and procedures on the same patient after contact with potentially infectious material, to prevent further contamination.
- Remove after use, before touching non-contaminated items and surfaces, and before going to another patient. Perform hand hygiene immediately after removal.

Facial protection (eyes, nose, and mouth)

- Wear a surgical or procedure mask and eye protection (eye visor, goggles), or a face shield, to protect mucous membranes of the eyes, nose, and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.
- Masks should been used only when it is useful and recommended.

Gown

- Gowns protect the skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays.
- Wear a gown whenever there is any risk of splashes of blood or body fluids.
- If splashing with blood or other body fluids is anticipated and gowns are not fluid-resistant, wear a waterproof apron over the gown.
- Remove soiled gowns as soon as possible, and perform hand hygiene.

Steps to wear PPE

1. Assess risk

2. Select and gather the necessary PPE

3. Put on the gown

4. Put on the mask

5. Put on eye protection

6. Put on gloves (over cuff)

Steps to remove PPE

1. Peel off gown and gloves and roll inside-out

2. Dispose of safely

3. Perform hand hygiene

4. Remove cap and eye protection (from behind head)

5. Put eye protection in a separate container for reprocessing

6. Remove mask from behind head

7. Perform hand hygiene

6.4 Respiratory hygiene and cough etiquette

- Educate all staff, health workers, patients, and hospital visitors on respiratory hygiene and cough etiquette.
  - Covering mouth and nose when coughing or sneezing.
  - Hand hygiene after contact with respiratory secretions.
  - Spatial separation of persons with acute febrile respiratory symptoms.
- Have tissues available in the waiting area or provide a medical mask.
- When tissues, cloths, or face masks are not available, all staff, health workers, patients, and visitors need to be instructed to lift their arm up and cover their nose and mouth with the inner surface of the arm or forearm when they cough or sneeze.
- Remind all staff, health workers, patients, and visitors to dispose of the tissues and masks in no-touch receptacles and to wash their hands.
- Have posters, at least, in patient waiting areas to remind patients and health workers.

Persons with respiratory symptoms should apply source control measures

- Such persons need to cover their nose and mouth with a tissue or mask when coughing or sneezing, dispose of used tissues and masks appropriately, and perform hand hygiene after coughing or sneezing.

Actions for health-care facilities

- Place patients with acute febrile respiratory symptoms at least 1 metre (3 feet) away from others in common waiting areas.
- Post visual alerts at the entrance to health-care facilities instructing persons with respiratory symptoms to practice respiratory hygiene and cough etiquette.
- Make hand hygiene resources, tissues, and masks available in common areas and areas used for the evaluation of patients with respiratory illnesses.

6.5 Prevention of needle-stick and injuries from other sharp instruments[15]

Unsafe injection practices can transmit blood-borne pathogens, including hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV.

Use care when handling, using, cleaning, and disposing of needles, scalpels, and other sharps.

- Do not bend, break, or otherwise manipulate used needles, scalpels, or other sharp instruments.
- Do not recap needles.
- Keep a sharps container nearby when giving injections. Discard single-use needles and syringes immediately after use and directly into the sharps container, without recapping and without passing to another person.
- Close, seal, and send sharps containers for incineration before they are completely full (follow your facility protocol carefully).

Indications for glove use when giving injections	Precautions
Wear non-sterile, well-fitting, single-use gloves: • When there is a likelihood of coming into direct contact with a patient's blood or other potentially infectious materials (e.g. body fluids, moist body substances, and saliva), mucous membranes, and non-intact skin; • When performing venepuncture or venous access injections, because of the potential for blood exposure at the puncture site; • If the health worker's skin is NOT intact or if the patient's skin is NOT intact (e.g. through eczema, cracked or dry skin).	Do not use gloves: • When undertaking routine intradermal, subcutaneous, and intramuscular injections: ° if the health worker's skin is intact ° if the patient's skin is intact. • Gloves do not provide protection against needle-stick or other puncture wounds caused by sharp objects. • Needles, scalpels and other sharps should be handled with extreme caution.

15 *WHO best practices for injections and related procedures toolkit.* WHO, 2010. Available at http://whqlibdoc.who.int/publications/2010/9789241599252_eng.pdf

Summary of best practices for injections

DO	DO NOT
• Carry out hand hygiene (use soap and water or alcohol rub), and wash carefully, including wrists and spaces between the fingers, for at least 30 seconds. • Use one pair of non-sterile gloves per procedure or patient. • Use a single-use device for blood sampling and drawing. • Disinfect the skin at the venepuncture site. • Discard the used device (a needle and syringe is a single unit) immediately into a robust sharps container. • If recapping a needle is unavoidable, use the one-hand scoop technique. 1. Leave the needle cap on a flat surface, placed against a firm, upright surface with the cap opening facing towards you. 2. Lift the needle and syringe vertically and guide the tip of the used needle into the cap using only one hand. 3. Once the tip is covered, use the other hand to fix the cap into place. 4. Clean the surface with disinfectant afterwards to avoid leaving any blood. • Seal the sharps container with a tamper-proof lid. • Place laboratory sample tubes in a sturdy rack before injecting into the rubber stopper. • Immediately report any incident or accident linked to a needle or sharps injury, and seek assistance. • Assess for need then start post-exposure prophylaxis (PEP) as soon as possible (see Section 19.6).	• DO NOT forget to clean your hands. • DO NOT use the same pair of gloves for more than one patient. • DO NOT wash gloves for reuse. • DO NOT use a syringe, needle, or lancet for more than one patient. • DO NOT touch the puncture site after disinfecting it. • DO NOT leave an unprotected needle lying outside the sharps container. • DO NOT recap a needle using both hands. • DO NOT overfill or empty sharps from a container. • DO NOT inject into a laboratory tube while holding it with the other hand. • DO NOT delay PEP after exposure to potentially contaminated material. Beyond 72 hours, PEP is NOT effective.

6.6 Environmental cleaning

- Use adequate procedures for the routine cleaning and disinfection of environmental and other frequently touched surfaces.
  - Floors and horizontal work surfaces should be cleaned at least once a day.
  - Cleaning should always be carried out from "clean" areas to "dirty" areas, in order to avoid contaminant transfer.
  - Dry sweeping with a broom should never be done.
  - Rags with dust should not be shaken out and surfaces should not be cleaned with dry rags. Cleaning with a moistened cloth helps to avoid contaminating the air with air-born particles.
- Clean BEFORE you disinfect.
- Change cleaning solutions and equipment frequently, as these items will get contaminated quickly (follow your hospital protocols).

Table: Cleaning, disinfecting, or sterilizing[16]

Setting	Manual cleaning with water and detergent	Disinfection (sodium hypochlorite 1% in-use dilution, bleaching powder, alcohol (70%)	Sterilization (steam under pressure, dry heat sterilization, automated chemical)
Floors, work tops	✓		
Spillage – of blood, body fluids, secretions, and excretions	✓	✓	
Commode, toilet seats	✓	✓	
Mops, wash mops	✓		
Dressing trolleys	✓	✓	
Mattress and pillows (always cover with plastic covers)	✓	✓	
Reusable instruments	✓		✓
AMBU bag and mask	✓		✓

16 *Core components for infection prevention and control programmes.* WHO, 2008. Available at http://whqlibdoc.who.int/hq/2009/WHO_HSE_EPR_2009.1_eng.pdf

6.7 Linens[17]

Handle, transport, and process used linen so as to:

- Prevent skin and mucous membrane exposure and contamination of clothing.
- Avoid transfer of pathogens to other patients or the environment:
  - All used linen and waste should be placed in bags or containers that are able to withstand transportation without being damaged.
  - Any solid matter on soiled linen should be removed and flushed down a toilet.
  - Used linen should be handled carefully to prevent contamination of surrounding surfaces or people.
  - Used linen should be washed according to normal routines.

6.8 Waste disposal

- Ensure safe waste management.
- Treat waste contaminated with blood, body fluids, secretions, and excretions as clinical waste, in accordance with local regulations.
- Human tissue and laboratory waste that is directly associated with specimen processing should be treated as clinical waste.
- Segregate at the point of generation the 4 categories of waste:
  1. sharps
  2. non-sharps infectious waste
  3. non-sharp non-infectious waste
  4. hazardous waste.
- Discard single use items properly.

17 *Sterilization Manual for Health Centers.* AMRO-PAHO and USAID, 2009. Available at http://new.paho.org/hq/index.php?option=com_content&task=view&id=2106&Itemid=229&lang=en

6.9 Patient care equipment

- Handle equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposure, contamination of clothing, or transfer of pathogens to other patients or the environment.
- Clean, disinfect, sterilize, and reprocess reusable equipment appropriately before use with another patient.

Table: How to set up 3 colour-coded waste containers for most rooms in the hospital (plus a hazardous waste container in the pharmacy and laboratory only)

Waste category	Segregate using colour-coded waste containers	Collect	Dispose
Sharps (needles, scalpels) – infectious or not	**YELLOW** • Safe sharps container must be: • puncture-proof • covered • closable • upright and stable during use • leak-proof at sides and bottom • clearly labelled for user	• Close lid or cover, seal with tape, and submit for waste pickup when they are no more than ¾ full. • Never overfill or force items into these containers. • Collect regularly for disposal.	• Sharps should be disposed of in a sharps pit (a buried drum in small centres or emergency structures, a concrete-lined sealed pit in other settings). • Off-site disposal may be necessary for safe incineration or other safe treatment at the district level (if available) or a private facility in charge of collection and treatment.
Non-sharps infectious waste* (anatomical waste, pathological waste, dressings, used syringes, used single-use gloves)	**YELLOW OR RED** • Bags or containers • 15–40 litre capacity, with lids	• Containers should be collected, emptied, cleaned, disinfected, and replaced after each intervention (e.g. in an operating or maternity unit) or twice daily. • Bags should not be cleaned and reused but disposed of as sharps infectious waste.	• Non-sharps infectious waste should be buried in a pit fitted with a sealed cover and ventilation pipe for on-site treatment in small health centre settings. • Otherwise, treat on-site or off-site with high-temperature incineration or steam sterilization. • Special arrangements may be needed for disposing of placentas, according to local custom.
Non-sharp, non-infectious waste (paper, packaging)	**BLACK** • Containers 20–60 litre capacity	• Should be collected, emptied, cleaned and replaced daily. • Alternatively, plastic bags may be used inside the containers for easy removal and disposal.	• May be included in the municipal waste stream or buried in a pit or landfill site. • Non-food and non-medical items may be recycled. • If space is limited, this waste should be incinerated. Ashes and residues should be buried in a pit.

Hazardous waste**	Appropriately labelled containers placed in secure locations.	• These may be stored in a small, labelled container at the pharmacy.	• Follow specific and appropriate treatment protocol and dispose of at the facility or send to a central health facility. • Manage stock of chemicals and pharmaceuticals well to reduce waste quantities and save on purchase costs.

* Cholera stools, body fluids from other highly infectious diseases.
** Hazardous waste includes some outdated drugs, laboratory reagents, strong disinfectants; radioactive waste, batteries, mercury, etc. Each hazardous waste requires specific treatment and disposal methods based on national regulations.

6.10 Select additional infection control interventions including PPE, based on the risk assessment, epidemiology, or likely pathogen.

Droplet precautions

Additional precautions for infections transmitted by large droplets
A respiratory aerosol of certain infections produces large particles or droplets (>5 µm in diameter) that typically remain suspended in the air for a limited period of time and settle within 1 m (3 feet) of the source.

What to do in addition to standard precautions when such droplet transmission is possible.

- All health workers for all patient care within 1 meter of the patient should wear a medical mask or surgical mask (tight fitting).
- Use single rooms for infectious patients. Otherwise, cohort patients with same suspected etiology. If not possible, place patient beds at least 1 m apart and arranged to keep a distance between patients.

Airborne precautions

Additional precautions for infections transmitted by small droplet nuclei
Smaller particles (small droplet nuclei ≤5 µm in diameter) evaporate quickly; the resulting dried residues settle slowly from the air, and remain suspended in the air for variable lengths of time.

What to do in addition to standard precautions when airborne transmission is possible.
Particulate respirator, e.g. N-95 or similar

- Use adequately ventilated single rooms (≥12 ACH). If single rooms are not possible, cohort patients with the same diagnosis. Airborne precaution rooms can be naturally or mechanically ventilated, with adequate air exchange rate of at least 12 ACH and controlled direction of air flow.

Contact precautions

Additional precautions for infections transmitted by contact

Contact transmission can be direct (direct body surface to body surface contact and physical transfer of micro-organisms) or indirect (e.g. contaminated hands or equipment that carry and transfer the micro-organisms).

What to do in addition to standard precautions

- Gloves and gowns for all patient care.
- Use disposable equipment or dedicate equipment for patient care. If equipment must be shared among patients, clean and disinfect it between each patient use.
- Use single rooms. Otherwise, cohort patients with the same diagnosis. If not possible, place patient beds at least 1 m apart. For pathogens of potential international concern, a single room is more important.

Table: Precautions by suspected organisms – examples

Precaution	Disease or organisms include
Droplet precautions – transmitted by large droplets (in addition to standard precautions)	Any patient with acute respiratory diseases (ARD) transmitted through large droplets. These include human influenza (seasonal, pandemic) and ARD with no pathogen identified (influenza-like illness); pathogens of potential international concern (avian influenza A (H5N1)), SARS*). See Section 6.11.
Airborne precautions – transmitted by small droplet nuclei (in addition to standard precautions)	• Infectious TB – see Section 6.12 • Measles • Varicella
Contact precautions (in addition to standard precautions)	• Adenovirus, para-influenza, RSV • Pathogens of potential international concern (avian influenza A (H5N1)), SARS*) • Vibrio cholera, Shigella species
Standard precautions only (includes all blood-borne pathogens)	There are many known pathogens that do not require additional precautions; however, these still require risk assessment and use of standard precautions. These include common bacterial respiratory infections caused by organisms such as *Streptococcus pneumoniae, Haemophilus influenzae, Chlamydia spp., Mycoplasma pneumoniae.* Most blood-borne pathogens including HIV and HBV.

* Note that some organisms require both droplet and contact precautions (in addition to standard precautions).

6.11 Special precautions for acute respiratory diseases (ARDs) that are prone to result in epidemics or pandemics

Separate and fast track patients with or suspected to have ARDs of potential concern

- ARDs of potential concern include SARS-CoV, new influenza viruses causing human infection, and novel ARDs that can cause large-scale outbreaks and outbreaks with high morbidity and mortality.
- Place patients who are coughing or have a suspected ARD of concern in an area separate from other patients and "fast-track" for rapid diagnosis and treatment.
  - They should move to the front of the queue for all services and be assessed promptly.
  - They should wait near an open window or in a comfortable area separate from the general waiting room.
- Accommodate ARD patients at least 1 metre away from other patients.
- For suspected ARDs of concern, prevent contact with contaminated equipment and the environment.
  - Place the patient in a single room or cohort with similarly infected patients.
  - Limit patient unprotected movement and have them wear a mask when moving about.

Table: Precautions for ARDs according to specific clinical settings and procedures[18]

Setting or procedure	Infection control measures							
	Hand hygiene	Gloves	Govn	Simple surgical mask	Respirator N95	Eye protection	Respiratory etiquette	Adequately ventilated single room with >12 ACH
Reception (without direct patient contact)							✓	
ER Quick check Physical exam	✓	✓	✓					
Patient waiting area	✓						✓	
General nursing care	✓			✓			✓	
Blood collection	✓	✓		✓			✓	
Nebulization	✓			✓			✓	
Induced sputum	✓	✓	✓		✓	✓		✓

18 *Infection control strategies for specific procedures in health-care facilities: Quick reference guide.* WHO, 2008. Available at http://whqlibdoc.who.int/hq/2008/WHO_HSE_EPR_2008.2_eng.pdf

Table: Precautions for ARDs according to specific clinical settings and procedures[18]								
	Infection control measures							
Setting or procedure	Hand hygiene	Gloves	Gown	Simple surgical mask	Respirator N95	Eye protection	Respiratory etiquette	Adequately ventilated single room with >12 ACH
Aerosol-generating procedures associated with pathogen transmission, e.g. intubation or extubation, and manual ventilation, suctioning, autopsy, or surgery involving the use of high-speed devices	✓	✓			✓	✓		✓

6.12 Special precautions for infectious TB patients

- As for Acute respiratory diseases, place patients who are coughing or have suspected TB in an area separate from other patients and have them "fast-tracked" for rapid diagnosis and treatment.
  - They should move to the front of the queue for all services and be assessed promptly.
  - They should wait near an open window or in a comfortable area separate from the general waiting room.
  - "Fast-track" aims to minimize time spent in the hospital for patients suspected of having TB.
- Community-based approaches for the management of TB patients (including MDR-TB) should be prioritized over hospitalization
  - Complement with education of household members and other close contacts on TB infection control.
- Avoid unnecessary admissions of TB patients to health-care facilities.
  - Open doors and windows to use the natural air flow in the hospital.
- On TB wards, the infectious TB patient should wear a medical mask, especially if correct cough etiquette is not observed.
  - The health care workers should wear an N-95 mask when taking care of an infectious TB patient in a close environment.
- Patients with known or suspected drug-resistant TB (DR-TB) should be separated from other patients, including other TB patients.

6.13 Precautions when caring for patients with suspected or confirmed Filovirus (Ebola, Marburg) haemorrhagic fever[19]

Careful application of standard precautions should prevent Filovirus haemorrhagic fever transmission.

Current WHO recommendations for direct patient care for known or suspected Filovirus haemorrhagic fever patients

- Restrict all non-essential staff from patient care areas.
- Maintain a log of persons entering the patient's room.
- Limit the number of visitors allowed access to the patient to include only those necessary for the patient's well-being and care, such as a child's parent.
- Ensure that all visitors use PPE according to the facility guidelines. Prior to entering the isolation area, provide all visitors with instructions on using PPE correctly, and instructions for correct hand hygiene practices,
- Do not allow other visitors to enter the care area, and ensure that any visitors wishing to observe the patient do so from an adequate distance from the care area (approximately 15 m).
- Apply infection control precautions to avoid any possible unprotected direct contact with blood and body fluids when providing care to any Filovirus patient, including suspected cases.
  - Perform hand hygiene before and after direct patient care, after any contact with potentially contaminated surfaces, and after removal of PPE. Neglecting to perform hand hygiene after removing PPE will reduce or negate any benefits of the protective equipment.
  - Wear gloves when entering the patient care area.
  - Wear a disposable, impermeable gown to cover clothing and exposed skin. Wear a waterproof apron over any permeable gown or when undertaking any strenuous activity (e.g. carrying a patient).
  - Wear facial protection to prevent splashes to the nose, mouth, and eyes. Facial protection can be achieved by means of (1) medical mask and eye protection (eye visor or goggles), or (2) with a face shield.
- Before exiting the isolation area of a patient with suspected Filovirus infection, carefully remove and dispose of protective equipment.
- When removing protective equipment, be careful to avoid any contact between the soiled items (e.g. gloves, gowns) and any area of the face (eyes, nose, or mouth).
- Ensure that clinical and non-clinical personnel are assigned exclusively to Filovirus patient care areas and that members of staff do not move freely between the isolation areas and other clinical areas during the outbreak.
- Limit the use of needles and other sharp objects as much as possible.
- Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care.

See Section 19 for TB and HIV prevention and care services for health workers.

19 *Interim Infection Control Recommendations for Care of Patients with Suspected or Confirmed Filovirus (Ebola, Marburg) Haemorrhagic Fever.* WHO, 2008. Available at http://www.who.int/csr/bioriskreduction/filovirus_infection_control/en/

7. Procedures

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7. Procedures[1,2]

7.1 General considerations in performing procedures

7.1.1 Patient consent

Before performing a procedure, it is important to receive consent from the patient. If the patient is unable to give consent (e.g. the patient is comatose or similarly incapacitated), a proxy (a family member or legal guardian) may do so on behalf of the patient. In such situations, the proxy should make the decision he or she believes the patient would make if they were able and competent. The decision to obtain consent involuntarily should not be taken lightly, and the patient should have the right to appeal.

Explain what will be done before doing the procedure:

- Explain why the procedure is necessary:
  - What are the benefits?
  - What are the risks, including pain associated with the procedure?
- Ask if the patient has questions or concerns and address them.
- Check that the patient has understood.
- Obtain permission to proceed.
- Document on the patient chart the discussion and consent.
- Be mindful of the comfort and privacy of all patients and their families.

7.1.2 Safety considerations, precautions and anaesthesia

For most of the procedures in this Section, it can be helpful to have an assistant who can help prepare, position, and comfort the patient in addition to assisting with the procedure. A female chaperone or assistant should be present during some procedures in women including those described in Sections 7.2.8, 7.2.9, 7.2.10, 7.2.11, 7.2.12, 7.2.13, 7.3.2, 7.3.3, and 7.3.4.

Some health facilities prepare a trolley that is kept stocked with instruments and materials used to perform common procedures. The contents will vary depending on the types and frequency of procedures at a given health facility.

Standard precautions, safe injection practices, and safe waste management should be used before, during, and after all procedures. See Section 6.

- These include hand hygiene and gloves for all procedures, and face protection and a gown when relevant.
- Always use care when handling, using, cleaning, and disposing of needles, scalpels and other sharps.
- Treat waste contaminated with blood, body fluids, secretions, and human tissue as clinical waste in accordance with local regulations.
- Sterile gloves should be used and a sterile field maintained for:
  - excision skin biopsy

1 *Surgical Care at the District Hospital.* WHO, 2003. Available at www.who.int/surgery/publications/en/SCDH.pdf

2 *Comprehensive cervical cancer control: a guide to essential practice.* WHO, 2006. Available at whqlibdoc.who.int/publications/2006/9241547006_eng.pdf

- lymph node biopsy
- thoracocentesis
- chest tube placement
- lumbar puncture
- paracentesis, arthrocentesis, pericardiocentesis
- bone marrow biopsy
- urinary catheter insertion
- IUD placement
- suprapubic urinary catheter placement.

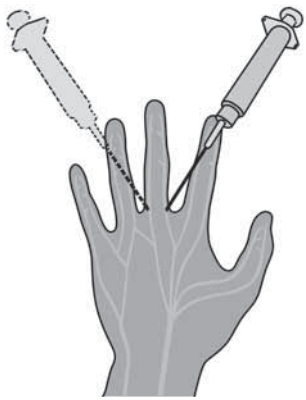
- A sterile field requires the careful application of an antiseptic and draping with sterile drapes, such as towels or paper drapes.
- Always remember to sterilize or disinfect all reusable equipment after a procedure.

Anaesthesia using lidocaine

Most of the procedures below can be done with anaesthesia using lidocaine in one of two ways:

- Locally
  - Lidocaine is injected into the area to be anaesthetized; larger areas can be covered with a field block by injecting widely around the area in a diamond pattern.
- Digital block
  - Lidocaine is injected at the base of the digit or penis at the 2, 6, and 10 o'clock positions, in order to anaesthetize the entire digit (do not use epinephrine (adrenaline) here). Digital block is preferable, where possible, as it requires smaller doses of anaesthetic for a given area.
- The dose of lidocaine will vary widely by procedure and size of the area to be anaesthetized.

The table below gives maximum doses for lidocaine with and without epinephrine.



Maximum drug doses for lidocaine			
Agent	**Concentration %**	**Maximum safe dose mg**	**Maximum volume ml**
Lidocaine	0.5	300	60
	1.0	300	30
	2.0	300	15
Lidocaine-epinephrine	0.5	500	100
	1.0	500	50
	2.0	500	25

* Clinical Procedures in Emergency Medicine, 4th Edition (adapted). James R. Roberts, Jerris R. Hedges (Eds). Saunders, Philadelphia, 2004.

- Avoid using lidocaine with epinephrine on the digits, penis, or other extremities. This can lead to vasoconstriction and gangrene.
- Using a small needle (25- to 30- gauge) for injecting lidocaine will reduce pain and bleeding. Also, small needles slow the speed of the injection and reduce tissue distortion. They should be used with a small syringe, usually 10 ml.
- When using lidocaine for local anaesthesia, always draw back the plunger before injecting, to make sure the needle is not in a blood vessel.
- Try to minimize the number of punctures (and associated pain) by not withdrawing the needle completely after the initial puncture. Instead, redirect it along a separate path.
- Lidocaine jelly may be used for certain procedures (e.g. urinary catheter insertion, IUD placement).

7.2 Diagnostic procedures

7.2.1 Skin biopsy – shaving or scraping

Indications

- Best used for raised lesions or those on convex surfaces.

Contraindications

- Do not perform shave biopsy of pigmented lesions – melanoma is more difficult to stage if shaved.

Equipment

- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel blade and handle
- culture media
- microscope slides
- formalin.

Procedure

1. Cleanse the area of the biopsy with skin antiseptic.
2. Anaesthetize the area with 1–2% lidocaine.
3. If flat, inject anaesthetic or saline under the lesion to raise it slightly.
4. Hold the scalpel parallel to the skin and begin. Complete the incision in one stroke. The aim is to take only a specimen of superficial tissue.

5. If done for the diagnosis of cutaneous leishmaniasis, the slit-skin technique should be used. Incise several millimetres outward from the active border of a lesion, making sure to go deep enough to penetrate the dermis. This should be followed by a scrape as above.
6. Dress the wound with simple dry gauze dressing. If the subcutaneous tissue is encountered, the technique for an excision biopsy should be used to close the wound.

Diagnosis of cutaneous leishmaniasis (see Section 11.20)

- The diagnostic yield for cutaneous leishmaniasis will be increased by:
  - using several techniques (needle aspirate, punch biopsy, scraping)
  - taking several specimens with each technique
  - biopsying multiple areas of the lesion, including edges.

Note that scrapings should be taken last to avoid contamination.

- Needle aspirates should be sent for culture.
- Punch biopsy samples should be divided into three parts and sent for:
  - culture
  - impression smear (similar to thin smear)
  - histopathology (poor for diagnosis, but useful for excluding other causes).
- Scrapes should be sent for histopathology.

Investigations

- If suspicion is for neoplasm, and enough biopsy material is available, send in formalin. If not much material, perform a thin smear, allow to air dry, and fix with methanol.

7.2.2 Skin biopsy – punch

Indications

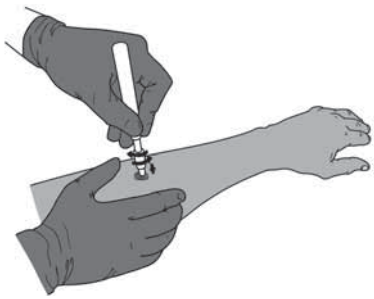
- any inflammatory lesions or suspected Kaposi sarcoma
- leishmaniasis.

Equipment

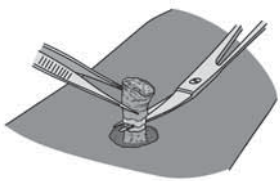
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- cylindrical punch biopsy knife
- formalin
- suture material, needle driver, forceps.

Procedure

1. Cleanse the area of the biopsy with skin antiseptic.
2. Anaesthetize the area with 1–2% lidocaine.
3. Stretch the skin perpendicular to the Langer's lines (natural creases in the skin).
4. Hold the cylindrical knife (trephine) perpendicular to the skin and gently push downward while rotating it clockwise and counter clockwise to cut through the skin. The trephine should be withdrawn after penetrating into the subcutaneous tissue.



5. Use a forceps or needle (the one used to anaesthetize the skin may be re-used here) to lift the specimen, and cut it free from the underlying tissue. Be sure to make the cut below the dermis. Avoid squeezing the specimen with a haemostat or forceps to avoid crush artefact.



6. If the wound is less than 2 or 3 mm, it can be dressed and allowed to heal by secondary intention. Wounds larger than 4 mm should be sutured with one or two simple sutures.

Investigations

- Send the biopsied tissue in formalin.

7.2.3 Skin snip for the diagnosis of microfilariasis

Indications

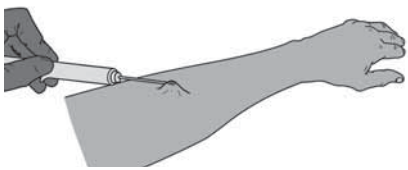
- Diagnosis of onchocerciasis or other skin filariasis.

Equipment

- antiseptic
- 23- to 25-gauge needles
- razor blade or scalpel
- water or saline
- microscope slides and cover slips
- inverted microscope.

Procedure

1. Select the sites with the highest numbers of microfilariae for examination.
   - In Latin America – over the scapula or iliac crest.
   - In Africa – the iliac crest or calf.
   - In Yemen – a skin snip not indicated because the most frequent clinical manifestation is a lichenified dermatitis (sowda) in which microfilaria are rarely found.
2. 1–2 snips should be taken from the sites as described above.
3. Clean the skin with antiseptic and allow it to dry.
4. Insert a fine sterile needle almost horizontally into the skin and raise the point of the needle, lifting with it a small piece of skin measuring about 2 mm in diameter and height.



5. Cut off the piece of skin with a sterile razor blade or scalpel.

6. Be sure to disinfect all instruments used during the procedure.
7. Place the tissue sample on a microscope slide with a few drops of saline or water. Cover with cover slip. Send the specimen to the laboratory immediately, as the movement of the microfilaria decreases and eventually ceases with time.

Comments

- Usually, the species and number of microfilariae emerging from the skin snip are reported. The number will be reported as 1–4, 5–14, 15–49, 50–100 or >100 per snip. If more than one snip is taken from one subject, then a mean skin microfilariae density is calculated.
- Besides the microfilariae of *Onchocerca volvulus*, those of *Mansonella streptocerca* in Africa and *Mansonella ozzardi* in Latin America may also inhabit the human skin.
- Microfilariae in the eye may be examined by using a slit lamp. See Section 10.12.

7.2.4 Skin biopsy – excision

Indications

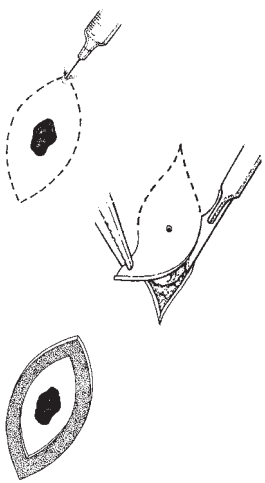
- basal cell and squamous cell carcinomas (squamous cell carcinoma is life-threatening and should be treated with wide local surgical excision.)
- melanoma.

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel blade and handle
- formalin
- suture material, needle driver, forceps

Procedure

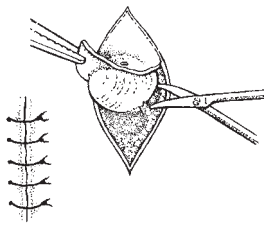
1. Cleanse the area of the biopsy with skin antiseptic.
2. Anaesthetize the area with 1–2% lidocaine.
3. Incise the skin with a scalpel parallel to the direction of the skin lines (Langer's lines). These can be found by placing two fingers on opposite sides of the incision and gently squeezing them and the skin together.
4. Use elliptical incisions, making the long axis large enough to close the skin without deformity. A rule of thumb is to make the long axis twice as long as the short axis.



5. Lift the sample with forceps and separate it from the underlying tissue.

6. Excise subcutaneous lesions after gaining access through the skin incision. Do not remove skin unless the subcutaneous mass is adherent.

7. Close the wound with simple interrupted sutures as needed.



Investigations
- Send biopsied tissue in formalin.

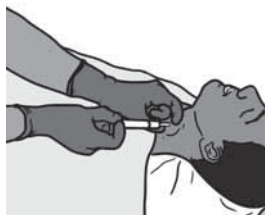
7.2.5 Fine needle aspiration (FNA)

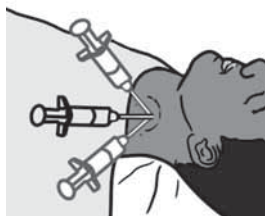
Indications
- FNA is a quick and minimally invasive procedure to evaluate a mass or lymphadenopathy (see Section 10.5).

Contraindications
- Pulsatile or air-filled mass.

Equipment
- antiseptic
- 10 ml syringe, 22-gauge needle (large bore needles exacerbate bleeding and tumour seeding)
- microscope slides
- mask for the health worker if TB is suspected.

Procedure
1. Clean the skin with antiseptic.
2. Fix the lymph node or mass so that it will not move. A right-handed clinician grasps the mass with the left hand and the syringe in the right hand.
3. Enter the lymph node parallel to the fingers of the left hand, ensuring that the left hand fingers are not in any danger.
4. Apply gentle suction syringe by pulling back the plunger 2–3 ml.
5. The mass is entered and multiple, sequential passes are made without exiting the skin surface. If the skin is exited, air will be pulled into the syringe and the specimen will be sucked from the bore of the needle into the syringe. This will make it difficult to get the specimen onto the slide.
6. Release the syringe completely and exit the skin.





7. Place a small drop of aspirated fluid on a glass slide. It may be necessary to carefully remove the needle (with the specimen cored in the centre) and withdraw the plunger of the syringe, then re-attach the needle and gently depress the plunger, pushing the specimen out.

8. A smear is made by laying another glass slide on top of the drop of fluid and pulling the slides apart to spread the fluid or, using a needle, to scrape it across the slide.

Investigations

- If suspected TB lymphadenopathy, send AFB smear. See Section 15.
- If there is a fair volume of specimen, consider sending fluid for mycobacterial or bacterial culture.
- If suspected malignancy, spray with fixative and send for cytology.
- Wet smears can be placed in 95% ethyl alcohol and treated with the Papanicoulau technique and stains.
- Specimens should be air dried and prepared for a Wright-Giemsa stain when the differential diagnosis includes salivary, lymphoproliferative or fatty tumours.
- If suspected plague, aspirate and look for small gram-negative or bipolar-staining ("safety-pin") ovoid coccobacilli on a smear. Also send for culture (slow growing).

Complications

- Pneumothorax – see Quick Check page 46 and Section 4.2 for immediate management. (If significant, the patient will require a chest tube.)
- Haemorrhage or haematoma

Comments

- If suspected TB, send sputum samples for AFB smear; consider chest X-ray (see Section15).
- Failure to establish an accurate diagnosis should lead to an excisional biopsy of the lymph node (see Section 7.2.6)
- If a cyst is encountered in the neck, it should be completely evacuated, and fluid and a portion of the capsule sent for cytology.

7.2.6 Lymph node biopsy (excisional)

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel blade and handle
- suture material, needle driver, forceps
- formalin
- culture media.

Procedure

1. Lymph nodes are located beneath the fascia and, therefore, require deeper dissection than skin or subcutaneous lesion biopsies. A general anaesthetic may be required.

2. Make an incision along the skin lines and dissect through the subcutaneous tissue, while controlling any bleeding that may arise.

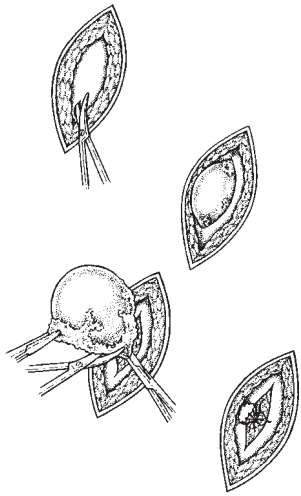
3. Identify the lymph node with a fingertip and incise the overlying superficial fascia.

4. Dissect the node from surrounding tissue without directly grasping it.

5. Instead, grasp the attached adventitial tissue with a small artery forceps, or place a figure-of-8 suture into the node for traction.

6. Separate all the tissue attached to the node.

7. Control the hilar vessels with forceps and ligate them with absorbable suture after the node has been removed.



Investigations

- Send biopsied tissue for histology in formalin.
- If suspected bacterial infection, send a portion of the node for culture.

7.2.7 Bone marrow aspiration and biopsy

Indications

- unexplained blood disorders (e.g. anaemia, elevated blood count, high or low platelets, etc.) see Sections 10.18 and 10.19
- suspected haematologic malignancy
- diagnosis of suspected leishmaniasis, schistosomiasis, or other mycobacterial, fungal, or parasitic infection
- diagnosis of iron metabolism disorders
- evaluation of fever of unknown origin
- evaluation of splenomegaly.

Contraindications

- absolute
  - haemophilia
  - severe disseminated intravascular coagulopathy (DIC)
  - other severe bleeding disorder.
- relative
  - low platelets (<20 x 109/litre) may require a platelet transfusion
  - skin infection or osteomyelitis near the chosen site.

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- and 21-gauge needles)
- scalpel blade and handle
- bone marrow aspiration needle with removable stylet and 1–2 ml syringe
- bone marrow biopsy (Jamshidi) needle with a device for removal of the

biopsied tissue
- dressing material
- microscope slides, culture media, and other collection materials as needed.

Procedure

1. Bone marrow aspiration and bone marrow biopsy are specialized procedures, and should be done by a clinician experienced in doing the procedure.
2. Discuss with the pathology laboratory prior to the procedure to determine which tests are available and how sampled tissue should be sent.
3. Patients may benefit from being pre-medicated with paracetamol. Diazepam or midazolam may be given in case of severe anxiety.
4. It is advisable to have an assistant to help with specimen preparation at the end of the procedures; aspirate samples can clot quickly and must be rapidly prepared to avoid this.
5. The posterior and anterior iliac crests, sternum, and various other sites may be used for bone marrow biopsy and aspiration. Biopsy (but not aspiration) is contraindicated at the sternum due to the risk of penetration into the thoracic cavity and resulting haemorrhage. The posterior iliac crest is preferred over the anterior iliac crest.
6. Position the patient lying face down or lying on the side opposite to that where the procedure will be done.
7. Identify the landmarks to be used for the procedures: posterior iliac crest, posterior superior iliac spine, or anterior superior iliac spine.
8. Identify the site, usually three finger widths from the midline and two finger widths below the posterior iliac crest, and cleanse with antiseptic.
9. Anaesthetize the skin and subcutaneous tissue at the site using the 23-gauge needle. Switch to the 21-gauge needle, penetrate to the periosteum, and anaesthetize a single 2 cm area, anticipating that two separate (but close) sites will be required for the biopsy and aspiration.
10. While waiting for the anaesthetic to take effect, make sure to have all the materials required to collect the biopsied tissue or aspirated fluid.
11. Make a small 3 mm incision at the site.

Bone marrow aspiration

1. Insert the bone marrow aspiration needle (with stylet) into the site, holding it perpendicular to the skin. When the periosteum is encountered, turn the needle in the direction of the anterior superior iliac spine.
2. Gently twist the needle back and forth (not more than 180°) to penetrate into the marrow cavity. Warn the patient that they may experience pain when this occurs.
3. At this point the stylet should be removed, the small syringe attached, and the marrow aspirated. No more than 0.5 ml should be aspirated at a time; larger quantities are prone to clotting. Once the required number of aspirates have been obtained, the needle should be withdrawn with stylet in place.

Bone marrow biopsy

1. Using the same incision, insert the (larger) bone marrow biopsy needle. It should be aimed in the same direction, but at a slightly different spot on the periosteum.
2. Twist until it is lodged firmly in the bone, then remove the stylet and advance further, about 15–20 mm.
3. In order to separate the biopsied sample from the underlying tissue, change the direction of the needle and twist once again. Advance again for a few millimetres and remove the needle. This is done to ensure that the sample remains in the needle when it is removed.
4. Remove the needle and cover the site with a dressing, holding pressure for a few minutes.
5. The specimen can be removed by threading the stylet through the cutting end of the needle.
6. Remember to examine the biopsied material before finishing: if it appears to be white or glistening tissue, it may be bone or cartilage and not bone marrow, and the biopsy should be repeated.

Aftercare

- Instruct the patient to lie still until bleeding stops, at least 10–15 minutes. If bleeding continues, apply pressure and have the patient wait for at least 1 hour before getting up.
- Paracetamol may be continued for 1 day for pain control.

Investigations

- To be discussed with the pathology laboratory in advance. Standard tests may include aspirate and buffy coat smears, biopsy section, iron stain, clot section, AFB smear, and mycobacterial cultures.

Complications

- bleeding
- needle breakage
- tumour seeding
- infection.

7.2.8 Pelvic examination

After taking a history, perform a pelvic examination.

There are 3 components of the female genital examination:

1. an external genital examination
2. a speculum examination
3. a bimanual examination.

Issues to consider before the examination

- A female chaperone or assistant should be present during the examination.
- Have all necessary equipment and supplies ready. Ensure the speculum used is at a comfortable temperature.

- Ask the woman to empty her bladder (urinate) and remove her underwear. Be particularly sensitive to her sense of modesty about uncovering normally clothed areas, or if the examination is perceived to be invasive.
- Position the woman on the examination table.

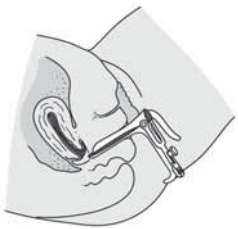
External genital exam

- Using a gloved hand, look for redness, lumps, swelling, unusual discharge, sores, tears, and scars around the genitals and in between the skin folds of the vulva. These can be signs of a sexually transmitted infection.

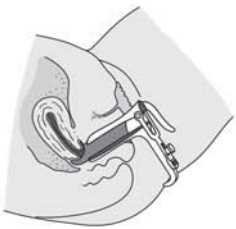
Speculum exam

1. Hold the speculum blades together sideways and insert them into the vagina. Be careful not to press on the urethra or clitoris because these areas are very sensitive.

2. When the speculum is halfway in, turn it so the handle is down.



3. Gently open the blades and look for the cervix. Move the speculum slowly and gently until the entire cervix is visualized.



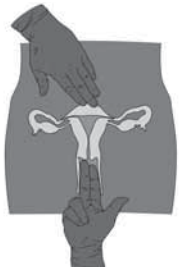
4. Tighten the screw (or otherwise lock the speculum in the open position) so it will stay in place.

5. Check the cervix, which should look pink, round, and smooth; although this may vary with parity.
   - There may be small, yellowish cysts, areas of redness around the opening (cervical os) or a clear mucoid discharge; these are normal findings.
6. Look for any abnormalities, which may include the following:
   - Vaginal discharge and redness of the vaginal walls, which are common signs of vaginitis. If the discharge is white and curd-like, there is probably a yeast infection. See Section 10.15.4.
   - Ulcers, sores, or blisters. Genital ulcers may be caused by syphilis, chancroid, herpes virus or, in some cases, cancer. Sores and blisters usually are caused by the herpes virus. See Section 11.15.
   - Easy bleeding when the cervix is touched with a swab, or a mucopurulent discharge, which are signs of a cervical infection. See Section 10.15.4.
   - An abnormal growth or tumour, which might be cervical cancer. See Section 10.15.8.
7. Gently pull the speculum until the blades are clear of the cervix. Then allow the blades to close being careful not to pinch the vaginal wall, and remove the speculum.

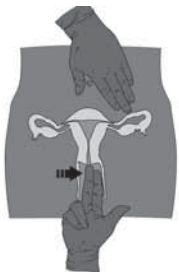
Bimanual exam

1. The bimanual examination allows the examiner to palpate the reproductive organs inside the abdomen.
2. Test for cervical motion tenderness.
   - Put the pointing and the middle finger of a gloved hand in the woman's vagina.
   - Turn the hand palm up.
   - Palpate the cervix to see if it is firm and round.
   - Then put one finger on either side of the cervix and move the cervix gently while watching the woman's facial expression.
   - If this causes pain (the woman may grimace), there is cervical motion tenderness, and she may have an infection of the womb, tubes or ovaries (pelvic inflammatory disease (PID) see Section 10.15.5), or an ectopic pregnancy. If her cervix feels soft, she may be pregnant.

3. Use the fingers that are in the vagina to move the pelvic organs toward the abdomen, allowing the hand that is on the abdomen to palpate them. The womb may be tipped forwards or backwards. It should feel firm, smooth, and smaller than a lemon.
   - If the womb feels soft and large, the woman is probably pregnant.
   - If it feels lumpy and hard, she may have a fibroid or other growth.
   - If it hurts her when palpated, she may have an infection.
   - If it does not move freely, she may have scars from an old infection.



4. Palpate the tubes and ovaries. If these are normal, they will be hard to feel:
   - If there are lumps that are bigger than an almond or that cause severe pain, she may have an infection or other condition needing urgent treatment.
   - If she has a painful lump, and her period is late, she may have an ectopic pregnancy. **This is an emergency** – see Section 10.15 and perform Quick Check.



5. Palpate the inside of the vagina. Make sure there are no unusual lumps, tears, or sores.
6. Ask the woman to cough or push down as if she were passing stool
   - Look to see if something bulges out of the vagina. If it does, she may have a fallen (prolapsed) womb or fallen bladder.

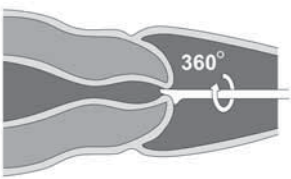
7.2.9 Cervical cancer screening: Pap smear

Equipment

- speculum
- wooden spatula or brush
- microscope slides
- fixative

Procedure

1. Begin by performing a speculum exam (see Section 7.2.8 above).
2. Insert the long tip of the wooden spatula or brush into the os, and rotate it through a full circle (360°).



3. Smear both sides of the spatula or brush onto a glass slide with one or two careful swipes.
4. Sample any abnormalities outside the cervical os, and smear on another slide.
5. Immediately fix each slide. Either use spray fixative, at a right angle to and a distance of 20 cm from the slide, or immerse the slide in a container of 95% ethanol for at least 5 minutes.
6. Gently close and remove the speculum.
7. Place all used instruments in decontamination solution.

Investigations and comments

After taking the smear, label each slide carefully and send for pathology.

- The pathology report will include the specimen adequacy, as well as the presence or absence of malignancy.
  - Comments regarding specimen adequacy can include:
    - satisfactory for evaluation (note presence or absence of endocervical transformation zone component);
    - unsatisfactory for evaluation (with the reason specified).
  - Comments regarding malignancy can include (general categorization):
    - negative for intraepithelial lesion or malignancy;
    - epithelial cell abnormality with the following descriptors
      - atypical squamous cells (ASC);
      - atypical squamous cells of undetermined significance (ASC-US);
      - atypical squamous cells, cannot exclude HSIL (ASC-H);
      - low-grade squamous intraepithelial lesion, including HPV changes and mild dysplasia, CIN1 (cervical intraepithelial neoplasia (CIN));
      - high-grade squamous intraepithelial lesion, including moderate and severe dysplasia, CIN2, CIN3;
      - squamous cell carcinoma;
      - atypical glandular cell.
  - Other comments, such as:
    - endometrial cells in a woman ≥40 years of age.

7.2.10 Cervical cancer screening: visual screening

In visual screening, the provider applies 3–5% acetic acid (in VIA) or Lugol's iodine solution (in VILI) to the cervix, and then looks to see if there is any staining. A VIA test is positive if there are raised and thickened white plaques or acetowhite epithelium; a VILI test is positive if there are mustard or saffron-yellow coloured areas, usually near the squamocolumnar junction (SCJ). Either test is suspicious for cancer if a cauliflower-like fungating mass or ulcer is noted on the cervix. Visual screening results are negative if the cervical lining is smooth, uniform and featureless; it should be pink with acetic acid and dark brown or black with Lugol's iodine.

- Visual methods are not recommended for use in postmenopausal women, because their transition zone is most often inside the endocervical canal and not visible on speculum exam.

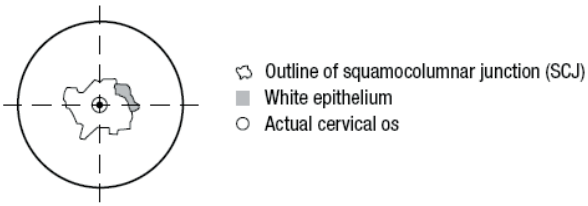
Equipment

- speculum
- cotton swab
- 3–5% acetic acid or Lugol's iodine solution.

Procedure

1. Begin by performing a speculum exam (see Section 7.2.8 above).
2. Adjust the light source in order to get the best view of the cervix.
3. Use a cotton swab to remove any discharge, blood, or mucus from the cervix.
4. Identify the SCJ, and the area around it.
5. Apply acetic acid or Lugol's iodine to the cervix; wait a minute or two to allow colour changes to develop. Observe any changes in the appearance of the cervix. Give special attention to abnormalities close to the transformation zone.
6. Inspect the SCJ carefully, and be sure to visualize all of it. Report if the cervix bleeds easily. If acetic acid was used, look for any raised and thickened white plaques or acetowhite epithelium. If Lugol's iodine was used, look for saffron-yellow coloured areas. Remove any blood or debris appearing during the inspection.
7. Use a fresh swab to remove any remaining acetic acid or iodine solution from the cervix and vagina.
8. Gently remove the speculum.
9. Record observations and test result. Draw a map of any abnormal findings on the record form.
10. Discuss the results of the screening test with the patient. See Section 10.15.8.

7.2.11 Colposcopy, cervical biopsy, and endocervical curettage



Indications

Indications for **colposcopy and biopsy** include the following:

- an abnormal screening test
- suspicious cervical lesions seen on speculum examination
- to map abnormalities before cryotherapy or LEEP.

Indications for **endocervical curettage** include the following.

- The patient has abnormal findings on Pap smear, but no abnormality is seen with colposcopy.
- The Pap smear revealed a glandular lesion. These usually arise from the columnar epithelium inside the canal. In this case, endocervical curettage must be performed regardless of the colposcopy findings.
- Colposcopy was unsatisfactory because the entire transformation zone was not seen.

Equipment

- speculum
- cotton swab
- colposcope

- saline
- 3–5% acetic acid
- forceps
- punch biopsy
- endocervical curette
- Monsel's paste
- formalin.

Procedure

1. Pain from cervical biopsies can be reduced by having the patient take paracetamol or ibuprofen 1–2 hours prior to the procedure.
2. Inspect the cervix at low-power magnification (5X to 10X), looking for any obvious areas of abnormality (e.g. leukoplakia, condylomata). Identify the transformation zone and the original and new squamocolumnar junctions (SCJ). If the entire SCJ is not visible, inspect the cervical canal using an endocervical speculum. If the entire SCJ is still not visible, the colposcopic procedure is termed inadequate or unsatisfactory and endocervical curettage should be done (see Step 8 below).
3. Apply saline to the cervix. Inspect the cervix with a green filter and 15X magnification, noting any abnormal vascular patterns.
4. After telling the patient that she might feel a mild stinging sensation, apply acetic acid. Wait 1 or 2 minutes to allow colour changes to develop. Observe any changes in the appearance of the cervix. Give special attention to abnormalities close to the SCJ.
5. Integrate the findings of the saline test and the acetic acid test to make a colposcopic assessment.
6. Tell the woman that a biopsy of her cervix will be taken, and this may cause cramping.
7. Take cervical biopsies of the most abnormal areas.
8. If necessary, perform endocervical curettage. Hold the curette like a pen and scrape the endocervical canal in short, firm strokes until it is completely sampled. Keep the curette inside the canal during the entire procedure.
9. If active bleeding is noted, apply Monsel's paste to the bleeding areas.
10. Withdraw the colposcope and gently remove the speculum.

After the procedure

- Advise the woman how to take care of herself when she goes home.
  - She should abstain from sexual intercourse until she has no more discharge or bleeding. If this is not possible, she should use condoms.
  - She should not insert anything into the vagina for 3 or 4 days.
  - Tell her the signs and symptoms of complications: active bleeding, serious cramping or lower abdominal pain, pus-like discharge, or fever. If she experiences any of these, she needs to return to the hospital.
- Provide condoms and teach her how to use them.

Investigations

- Send the biopsied and curetted tissue in formalin.

7.2.12 Clinical breast examination

The clinical breast examination consists of 2 components, inspection and palpation. The examination should include the neck, chest, and axillae in addition to the breasts.

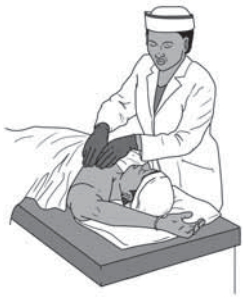
A female chaperone or assistant should be present throughout.

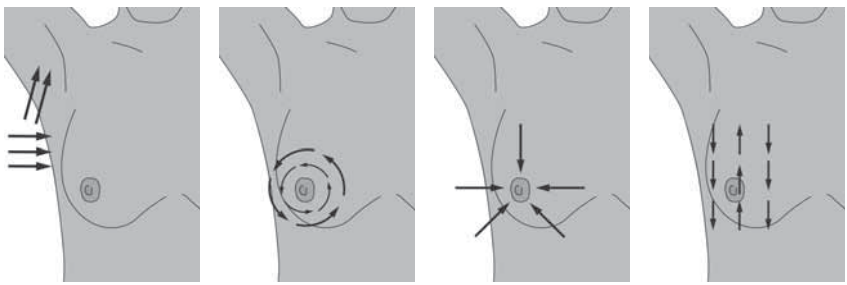
Inspection

- The patient should be respectfully asked to remove any clothing from the waist up.
- During each of the following steps, look for any asymmetry, bulging, or skin changes (including dimpling or swelling) in the breasts. The nipples should be carefully observed for retraction or discharge.
- Begin with the patient in the seated position (unclothed from the waist up).
- Ask the patient to raise her arms over her head.
- Ask the patient to lower her arms and place them on her hips, pressing in order to contract the pectoralis muscles.

Palpation

- While the patient is seated, the examiner should palpate the regional lymph nodes, paying special attention to the axillary nodes.
- The patient should then be positioned supine. While examining a given breast, the arm on that side should be raised above her head.
- Breast palpation requires a systematic approach covering the entire chest wall, with each side bounded by the clavicle, sternum, inferior-most rib, and mid-axillary line. The examiner should examine this entire area using a radial approach, concentric circles, or vertical strips. The pads of the fingers and not the fingertips should be used for palpation.





7.2.13 Endometrial biopsy

Indications

- infertility (to determine the response of the endometrium to ovarian stimulation)
- postmenopausal bleeding (in order to rule out uterine cancer)
- suspected pelvic tuberculosis
- suspected chronic endometritis.

Contraindications

- pregnancy.

Equipment

- speculum
- cotton swab
- iodine
- forceps
- tenaculum or vulsellum
- uterine sound
- long needle and syringe
- lidocaine, long needle, syringe
- cervical dilators
- biopsy curette and syringe
- formalin
- microscope slides
- culture media.

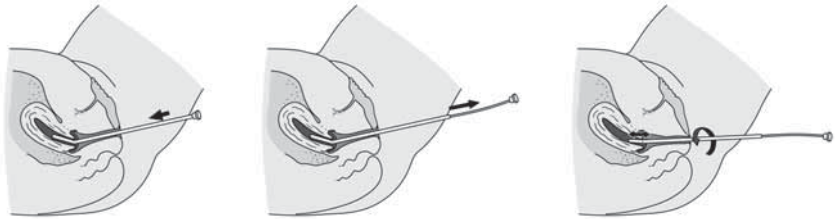
Procedure

A female chaperone or assistant should be present throughout.

1. Pain from endometrial biopsies can be reduced by having the patient take paracetamol or ibuprofen 1–2 hours prior to the procedure.
2. Carry out the procedure during the patient's premenstrual phase.
3. After positioning the patient, perform a bimanual exam to determine the size of the uterus and direction of the cervix.
4. Perform a speculum examination (see Section 7.2.8 above).
5. Cleanse the cervical os with iodine.
6. Grasp the cervix with a toothed tenaculum and pass a uterine sound to determine the size of the uterus. If the sound cannot be passed, or the patient experiences significant pain, perform a cervical block for anaesthesia using lidocaine.

7. Ensure that the patient has been adequately anaesthetized. If the sound still cannot be passed, attempt to dilate the cervix using narrow metal dilators, and then proceed with sounding the uterus.

8. Insert an endometrial biopsy curette and obtain at least 4 pieces of the endometrium for histopathological examination.
9. Examine for the secretory changes that identify the cycle as ovulatory.



Investigations
- Send the tissue biopsies in formalin and ask for Gram stain or AFB smear, or both, and culture depending on clinical suspicion.

Complications
- Uterine perforation – suspect in patients with signs of intraperitoneal haemorrhage (abdominal distension, hypotension) or significant vaginal bleeding not due to cervical laceration. Perform quick check, manage, and refer for emergency surgery.
- Abdominal cramping.
- Vasovagal reflex (dizziness, fainting).
- Bleeding.
- Post-procedure infection.

7.2.14 Gram stain

Equipment
- microscope slide
- Bunsen burner or flame
- rystal violet
- iodine
- decolouriser: acetone or ethanol
- safranin.

Procedure
1. Swab sample onto a slide.
2. Heat fix, this may be done by passing the slide through a flame.
3. Stain with crystal violet (60 seconds) and rinse.
4. Stain with iodine (60 seconds) and rinse.
5. Decolourise with acetone or ethanol for a few seconds (until the liquid runs clear).
6. Stain with safranin (60 seconds) and rinse.
7. Gently blot dry and examine under oil immersion (1000X). Gram-positive organisms will appear purple, Gram-negative organisms will appear red.

7.2.15 Wet mount

Equipment

- cotton swab
- microscope slide and cover slip
- 10% potassium hydroxide (KOH).

Procedure

1. Collect specimen: Take a sample of discharge with a swab from the side walls or deep in the vagina where discharge accumulates.
2. Prepare slide: Smear swab across slide and mix with 1 or 2 drops of saline on a glass slide and cover with a cover slip.
3. What to look for: Examine at 100X magnification and look for typical jerky movement of motile trichomonads. Examine at 400X magnification to look for yeast cells and trichomonads.
4. To make identification of yeast cells easier in wet mount slides, mix the vaginal swab in another drop of saline and add a drop of 10% KOH to dissolve other cells.

See Section 10.15.4 for interpretation.

7.2.16 Urinalysis

Equipment

- sterile container
- urinalysis dipstick
- test tubes
- microscope slide.

Procedure

1. For men, a midstream sample of urine collected in a sterile container will suffice. Women should be asked to clean the external genitalia prior to collection. Voided urine should be examined within 1 hour from the time of collection.
2. If a centrifuge is not available, unspun urine may be tested with a urinalysis dipstick. Dipstick testing allows for the determination of urine pH and specific gravity, with the presence or absence of protein, glucose, WBC, RBC, leukocyte esterase, and nitrite.
3. Centrifuging allows for the examination of urine sediment, enabling better quantification of RBCs, WBCs, and bacteria, and the detection of epithelial cells, crystals, and casts. Centrifuge a urine sample at 3000 rpm for at least 3 minutes. After pouring off the supernatant (clear portion on top of the pellet), the sediment should be resuspended with a gentle shake. Place a small amount of this fluid on a microscope slide for examination.

7.2.17 Taking stool samples, including Cary-Blair for cholera

Equipment

- cotton swab
- sterile plastic bag
- Cary-Blair media
- filter paper
- saline.

Procedure

Take stool samples before giving antibiotics to the patient. There are several ways to take samples.

- A fresh stool can be taken (cotton-tipped rectal swab soaked in liquid stool, placed in a sterile plastic bag) and transported quickly (within 30 minutes since amoebic trophozoites die and become unrecognizable after that) to the laboratory.
- A transport medium such as Cary-Blair or peptone water allows better conservation of samples. See below.
- Use strips of blotting paper or filter paper soaked with liquid stool. Place in a sealed tube or plastic bag, with 2 or 3 drops of normal saline (NaCl 9%) so that the specimen does not dry out. Refrigeration during transport is not necessary.

Tubes of Cary-Blair transport medium can be stored at ambient temperature for 1 to 2 years. The medium can be used as long as it does not appear dried out, contaminated, or discoloured.

Instructions for the use of Cary-Blair medium

- Moisten the swab in sterile Cary-Blair transport medium.
- Insert the swab 2 to 3 cm into the rectum and rotate.
- Withdraw the swab and examine it to make sure that it carries some visible faecal material.
- Immediately place the swab in the transport medium, pushing it right to the bottom of the tube.
- Break off and discard the top of the stick touching the fingers.
- Dispatch the sample to reach the laboratory within 7 days (it is not necessary to refrigerate the sample).

Stool direct smear[3]

- With a wax pencil or other marker, write the patient's name or identification number and the date at the left-hand side of the slide.
- Place a drop of saline in the centre of the left half of the slide and place a drop of iodine in the centre of the right half of the slide. N.B.: Iodine wet mount preparations are most useful for protozoan organisms, less so for helminths.
- With an applicator stick or match, pick up a small portion of faeces (approximately 2 mg which is about the size of a match head) and add it to the drop of saline. Repeat and add it to the drop of iodine. Mix the faeces with the drops to form suspensions.
- Cover each drop with a coverslip by holding the coverslip at an angle, touching the edge of the drop, and gently lowering the coverslip onto the slide so that air bubbles are not produced. Note: Ideal preparations containing

3 *Bench aids for the diagnosis of intestinal parasites.* WHO, 2004. Available at http://www.who.int/wormcontrol/documents/benchaids/training_manual/en/

2 mg of faeces are uniform – not so thick that faecal debris can obscure organisms, nor so thin that blank spaces are present.

- Examine the preparations with the 10X objective or, if needed for identification, higher power objectives of the microscope in a systematic manner (either up and down or laterally) so that the entire coverslip area is observed. When organisms or suspicious objects are seen, one may switch to higher magnification to see the more detailed morphology of the object in question.

Chemical test for occult blood in stools[4]

This test is used for screening for parasitic infection, e.g. intestinal schistosomiasis, or for detection of bleeding in the intestine caused by polyps, tumours, or inflammation.

Note: For 1 day before the examination, the patient should not:

- eat any meat
- take any drugs containing iron compounds
- brush teeth vigorously.

Materials and reagents

- centrifuge
- conical centrifuge tube
- applicators
- measuring cylinder, 20 ml
- test-tubes
- test-tube rack
- positive control tube (containing a 1% solution of blood in water)
- negative control tube (containing distilled water)
- acetic acid, 10% solution (reagent No. 2)
- hydrogen peroxide (fresh 10% solution)
- 95% ethanol
- aminopyrine, crystalline.

Note: The glassware used for the test must be clean, with no traces of blood.

Method

1. Immediately before carrying out the test, prepare a solution of aminopyrine:
   - put about 0.25 g of aminopyrine in the bottom of a test-tube
   - add 5 ml of 95% ethanol.
2. Put a portion of stool (approximately 4 ml) in a centrifuge tube. Add 7 ml of distilled water and mix thoroughly.
3. Centrifuge at low speed (1000 g) for about 5 minutes, or until the solids are precipitated (a hand-operated centrifuge can be used).
4. Decant the supernatant fluid into another test-tube and keep it.

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4 *Manual of basic techniques for a health laboratory, 2nd edition.* WHO, 2003. Available at http://whqlibdoc.who.int/publications/2003/9241545305.pdf

5. Add to the test-tube containing the supernatant fluid, without mixing:
   - 10 drops of 10% acetic acid solution
   - 5 ml of the aminopyrine solution.
     To prevent mixing, hold the tip of the pipette containing the aminopyrine solution against the inside wall of the test-tube and allow the liquid to run down the wall.
6. Add 10 drops of the 10% hydrogen peroxide solution. Do not mix. Let it stand for 1 minute. The results must be read within 5 minutes of adding the hydrogen peroxide solution.

Results
If the reaction is positive, a red colour appears between the two layers of liquid.

Report the results as follows:
- pale red = positive reaction (+)
- red = strong positive reaction (++)
- dark red = very strong positive reaction (+++)
- no change in colour = negative reaction (-)

7.2.18 Crude clotting time

Indications
- diagnose haemophilia
- monitor anticoagulant therapy
- detect coagulation disorders (as in certain types of snake-bite and see Section 10.19).

Equipment
- cotton swab
- needle and syringe
- test tube without anticoagulant
- watch or clock.

Procedure
1. Collect 4 ml of blood in a clean glass tube without any anticoagulant.
2. The blood tube is tilted every 15 seconds while keeping time.
3. The first appearance of a clot is noted and timed.
4. The normal coagulation time in glass tubes is 5–15 minutes.

7.2.19 Thin and thick blood films for malaria[5]

Indications

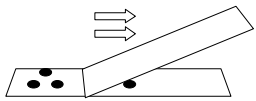
- diagnosis of malaria (see Section 11.25).

Equipment

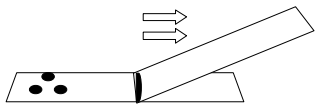
- 2 microscope slides
- methanol
- Giemsa solution.

Procedure

1. Place a small amount of blood near the middle of the slide for the thin film. Place two or three smaller drops off to the side for the thick film. Place the slide on a flat surface.
2. Hold another slide over the first at a 45 degree angle so that it just touches it. Slowly drag the upper (spreader) slide towards the drop of blood.



3. On contact with the spreader slide, the blood should spread along the width of the slide.



4. The spreader should then be drawn smoothly and rapidly in the opposite direction, producing a feathered edge.
5. Join the drops of blood intended for the thick film using a corner of the spreader slide. This should not require excessive stirring, only 3 to 6 circular or rectangular movements.

6. Allow the slide to air dry and label with a soft lead pencil.
7. Fix the thin film by adding a few drops of methanol and allow to dry. Try to avoid exposing the thick film to methanol.
8. Flood the slide with Giemsa solution and allow 30–45 minutes out of sunlight.
9. Rinse with water, drain, and air dry.

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5 *Bench aids for the diagnosis of malaria infection.* WHO, 2002.Available at http://whqlibdoc.who.int/publications/2000/9241545240.pdf

10. On the thick film, leukocyte nuclei should appear a deep, rich purple. Malaria parasites should have deep red chromatin and pale purplish blue cytoplasm. Non-lysed erythrocytes may appear at the periphery; in *P. vivax and P. ovale* infections Schuffner's stippling may be present.

7.2.20 AFB (Ziehl Neelsen)[6]

Indications

- diagnosis of TB.

Equipment

- microscope slide
- Bunsen burner or spirit lamp
- 3 mm wire loop
- forceps
- Ziehl Neelsen carbol fuchsin
- decolouriser: 3% HCL-ethanol or 20–25% H2SO4
- methylene blue 0.1%.

Procedure

1. Label slide carefully.
2. Using loop, take sputum sample from most dense portion of specimen (sample blood-specked, opaque, greyish, or yellowish cheesy mucus when present).
3. Smear the sample onto a slide over an area 2.0 X 1.0 cm; the broken end of a wooden stick may be used.
4. Air dry for 15 minutes.
5. Heat fix the sample by passing the slide smear side up through a Bunsen burner 3 times. The proper thickness of a heat fixed smear has been achieved when newsprint is just readable through it.
6. Flood the slide with carbol fuchsin.
7. Heat the slide until steam rises from the slide and wait 10 minutes.
8. Rinse with water and drain.
9. Flood the slide with decolouriser and wait 3 minutes.
10. Rinse with water and drain.
11. Flood the slide with methylene blue and wait 1 minute.
12. Rinse with water and drain.
13. Air dry.
14. Heat fix smear.
15. Acid-fast bacilli will appear as red, slender, rod-shaped bacilli against a blue background.

6 *AFB smear staining. WHO/Union,* 2004. Available at http://www.theunion.org/index.php/en/resources/scientific-publications/item/185-afb-smear-staining.

7.2.21 Ultrasound

This Section provides a brief introduction to clinician-performed, bedside trauma and obstetrical ultrasound for the trained district clinician. It is a simplified, step-by-step description of how and when to perform these ultrasound examinations. For more details, please consult an ultrasound-dedicated text.[7,8] Additional figures (1a to 8) referred to below may be found at the end of this Section.

Equipment

- ultrasound machine (with curved or phased array probe, and transvaginal probe)
- ultrasound gel (do not use alcohol; shampoo or water are acceptable gel substitutes)
- non-alcohol-based cleaning solution or wipes for probes
- condom or probe cover for transvaginal probe.

Trauma ultrasound

Trauma ultrasound can be performed quickly at the patient's bedside, and provides time-sensitive information to determine the presence of intra-abdominal or intra-thoracic haemorrhage. While ultrasound provides useful information regarding the presence or absence of bleeding, it cannot usually diagnose specific organ injury or the source of bleeding. The ultrasound exam should be performed soon after the patient arrives.

Indications

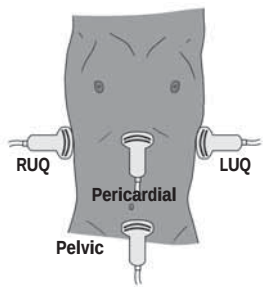
- torso trauma with suspected haemoperitoneum, haemothorax, or haemopericardium
- torso trauma with hypotension, tachycardia, or shock.

Procedure

1. Place the patient in the supine position, using cervical spine stabilization if necessary.
2. Place the ultrasound probe on the patient's body in 4 regions to assess for free fluid, which will appear black on the ultrasound screen. The fluid will accumulate between the solid organs, which appear grey on the ultrasound screen.

This figure shows the 4 regions for trauma ultrasound.

a. Pericardial (subxiphoid). Place the probe in the subxiphoid region of the abdomen, with the probe marker facing the patient's right side. Aim the probe into the left chest, and assess for free fluid between the muscular myocardium (grey in colour on the ultrasound screen) and the pericardium (bright white in colour on the screen) (see figures 1a–1b).



7 *Manual of diagnostic ultrasound. Volume 1, Second Edition*. WHO, 2011. Available at http://whqlibdoc.who.int/publications/2011/9789241547451_eng.pdf

8 Manual of ultrasound for low-resource settings. Partners in Health, 2011. Available at http://parthealth.3cdn.net/6e013074d8f4c4c7d8_mlblfxb8q.pdf

b. Right upper quadrant (RUQ). Place the probe in the right mid axillary line, along ribs 10–12, with the probe marker facing the head. Assess for free fluid between the liver and kidney (haemoperitoneum) or superior to the diaphragm, which appears as a thin bright white line on the screen (haemothorax) (see figures 2a–2b).

c. Left upper quadrant (LUQ). Place the probe in the left posterior axillary line, along ribs 9–11, with the probe marker facing the head. The liver is larger than the spleen, so the splenorenal interface is usually more superior than the RUQ view. Assess for free fluid between the spleen and diaphragm, spleen and kidney, and superior to the diaphragm (see figures 3a–3b).

d. Pelvic. Place the probe in the suprapubic region, with the probe marker facing towards the patient's right side. This view needs to be performed with a full bladder, or free fluid can be easily missed. Assess for fluid between the urinary bladder (also filled with black fluid) and the uterus (in a female) or the rectum (in a male) (see figures 4a–4b).

Potential pitfalls

- Failure to find fluid using ultrasound in the case of haemoperitoneum, haemothorax, or haemopericardium. Repeat the ultrasound exam if needed. If the patient's hypotension worsens, consider aspiration.
- Since both simple fluid and blood appear black on the ultrasound screen, pre-existing ascites and uroperitoneum from a ruptured bladder can cause free fluid in the abdomen, which will appear similar to haemoperitoneum. If unsure of the cause of the free fluid, an aspiration can help distinguish the cause.

Basic 1st trimester obstetric ultrasound

Obstetric ultrasound has many uses including assessment for ectopic pregnancy, estimation of gestational age, assessment of placental abnormalities (including previa, fetal demise confirmation, oligo and polyhydramnios), and confirmation of fetal lie. This section focuses on assessment for intra-uterine pregnancy in cases of suspected ectopic pregnancy.

Indications

- Vaginal bleeding or abdominal pain with a positive pregnancy test or suspected pregnancy.
- First trimester pregnancy with hypotension, tachycardia, syncope or shock.
- Suspected ectopic pregnancy with or without risk factors (prior ectopic, prior pelvic infection, prior tubal ligation, pregnancy despite IUD).

Procedure

1. Place the patient in the supine position, with the bladder full for transabdominal ultrasound or empty for transvaginal ultrasound.
2. Begin with transabdominal ultrasound with the probe position in the suprapubic area, and with the probe marker towards the patient's right side.
3. View the urinary bladder and, deep to the bladder, the uterus. Scan through the uterus from superior to inferior, and then turn the probe marker toward the head and scan in a sagittal plane, moving the probe to the right and left. This ensures that you will see the entire uterus.

4. If no pregnancy is seen inside the uterus, assess for free fluid outside the uterus, which could be a sign of ectopic pregnancy. The process is similar to the trauma ultrasound pelvic view.

5. If a pregnancy is seen inside the uterus, it is important to see not only a gestational sac (a sac of fluid that appears black on the screen), but also a yolk sac (a bright white ring that is within the gestational sac) or fetal pole (a small embryo that appears grey on the ultrasound screen). The yolk sac or fetal pole will be seen as early as 1 week after a missed period. If a gestational sac is seen without a yolk sac or fetal pole, an ectopic pregnancy could still exist (see Figure 5). If an intrauterine pregnancy is observed, this essentially rules out ectopic pregnancy. It is rare to have both intrauterine and ectopic pregnancies.

6. If unable to view a pregnancy using transabdominal views, ask the patient to empty her bladder and prepare the transvaginal probe with a cover or condom. Use gel both inside and outside the probe cover and avoid air pockets within the cover. The probe must be disinfected between each use. Note that transvaginal ultrasound allows for earlier and more reliable detection of intrauterine or ectopic pregnancy (except in the case of abdominal pregnancy).

7. Insert the probe 4–5 centimetres into the patient's vagina and view the uterus in both sagittal (probe marker towards the sky) and coronal (probe marker towards the patient's right side) views. Scan the entire uterus and assess for intrauterine pregnancy and presence of free fluid as described above.

8. If the uterus is empty or contains only a gestational sac, attempt to view free fluid elsewhere in the abdomen (as described in the Trauma ultrasound section above). An empty uterus or uterus with only fluid inside (no embryo or yolk sac) with haemoperitoneum on ultrasound should raise suspicion for a ruptured ectopic pregnancy (Figure 8).

Potential pitfalls

- Both simple fluid and blood appear black on the ultrasound screen. If there is concern whether fluid in the abdomen or pericardium may be blood or ascites, and the patient is haemodynamically unstable, a diagnostic peritoneal aspiration or culdocentesis should be performed. See Section 7.4.3.
- Failure to suspect ectopic pregnancy in patients with vaginal bleeding, abdominal pain, or hypotension during pregnancy.
- Misdiagnosis of fluid inside the uterus as a true intra-uterine pregnancy and missed diagnosis of ectopic pregnancy.
- Failure to diagnose free fluid in the abdomen and pelvis as a potential sign of a ruptured ectopic pregnancy in the patient with no visible intrauterine pregnancy.

Comments

- Ultrasound is considered safe in pregnancy, and there is no risk of ionizing radiation.

7.3 Therapeutic procedures

7.3.1 Chest tube (intercostal chest drain)

Indications

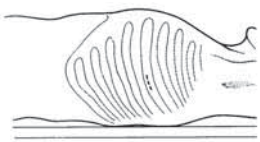
- Pneumothorax:
  - Tension pneumothoraces require immediate needle decompression followed by chest tube. See Quick Check page 22 for details.
  - Small pneumothoraces (rim of air less than 3 cm between lung and chest wall) may resolve spontaneously or require only simple aspiration.
  - Any intubated patient with a pneumothorax will require a chest tube.
- Haemothorax
- Haemopneumothorax
- Acute empyaema.

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine with epinephrine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel
- curved forceps and clamp
- chest tube and underwater seal drainage system (or one-way valve device and drainage bag)
- suture material (0 or 1–0 sutures required to anchor tube)
  - needle driver, large curved artery forceps
- dressing material.

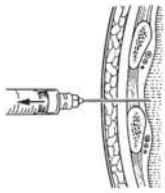
Procedure

1. Patients may require sedation and large amounts of analgesia for this procedure, as it can be quite painful. Consider ketamine.
2. Position the patient lying face up with arm of the involved side raised over the head. If the patient is unable to lie down due to respiratory distress, he or she may sit up in a bed or chair. Supplemental oxygen may be helpful.

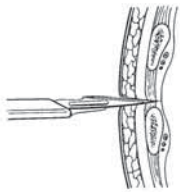


3. Choose the site, usually the 5th or 6th intercostal space at the midaxillary line. In order to avoid damage to vital organs, stay within the "triangle of safety" defined inferiorly by the nipple line in men or the base of the breast in women, anteriorly by the border of the pectoralis major muscle, and posteriorly by the latissumus dorsi muscle. The apex of the triangle should be just below the axilla.
4. Caution should be exercised throughout the procedure as broken ribs can easily pierce gloves. Double-gloving can help prevent this.
5. Prepare the skin with antiseptic.

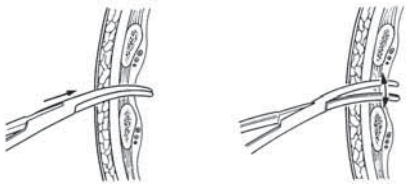
6. Using lidocaine, infiltrate the skin and muscle. Note the length of needle needed to enter the pleural cavity (this may be useful later when inserting the drain).



7. Aspirate fluid from the chest cavity to confirm position of the needle.
8. Make a 3–4 cm horizontal incision just above the rib to avoid damaging the vessels under the lower part of the rib.

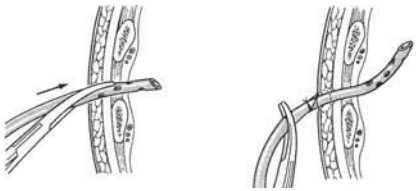


9. Use more lidocaine to anaesthetize the intercostal tissues and pleura at the site of insertion.
10. Use blunt dissection to penetrate the intercostal tissue to the pleura. Insert the closed clamp over the top of the rib and, once past the rib, open and spread to dissect, slowly enlarging the opening while proceeding inward. This will create a tunnel through which the tube may be inserted.

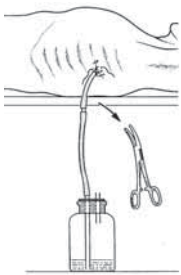


11. Insert a finger into the tunnel to confirm that it has penetrated through to the pleural space. A finger should be swept around to ensure the liver or spleen is not nearby.

12. Use the same forceps to grasp the tube at its tip and introduce it into the chest. Never use a sharp instrument to introduce the tube. For pneumothorax, angle the tube up; for pleural effusion, angle down and towards the back. Be sure to insert the tub far enough that all drainage holes are inside the pleural space.



13. Close the incision with interrupted skin sutures. Use 1 stitch to anchor the tube by leaving the ends of that suture very long and wrapping and tying the ends firmly around the tube several times. Leave an additional suture untied adjacent to the tube for closing the wound after the tube is removed. Apply a gauze dressing. Further secure the tube with adhesive tape.
14. Connect the tube to the underwater seal drainage system and mark the initial level of fluid in the drainage bottle. Alternatively, a one-way valve device and drainage bag may be used.



Aftercare and tube removal

- Routine administration of antibiotics to prevent infection is not necessary; however, there may be some benefit if there are penetrating chest injuries.
- Place a pair of large artery forceps by the bedside for clamping the tube when changing the bottle. The drainage system is patent if the fluid level swings freely with changes in the intrapleural pressure. Persistent bubbling over several days suggests a bronchopleural fistula and is an indication for referral.
- Change the connecting tube and the bottle at least once every 48 hours, replacing them with sterile equivalents.
- If there is no drainage for 12 hours, despite milking the tube, clamp the tube for a further 6 hours and X-ray the chest. If the lung is satisfactorily expanded, the clamped tube may be removed.
- To remove the tube, first carefully remove the dressing. Paracetamol given beforehand will reduce discomfort during the procedure. Clean the skin with antiseptic. Hold the edges of the wound together with fingers and thumb over the gauze while cutting the skin stitch that is anchoring the tube. Ask the patient to inhale and valsalva, and withdraw the tube rapidly as an assistant ties the previously loose stitch.

Complications

- Re-expansion pulmonary oedema – while the evidence is not clear, it may be prevented by removing less than 1.5 litres of fluid at a time.
- Chest tube malposition may be subcutaneous, intraparenchymal, or elsewhere. If the patient is stable, reposition chest tube. If the patient becomes unstable, see Section 2 Quick Check for management.
- Recurrent pneumothorax may be due to chest tube malposition; consider repositioning or replacing. If tension pneumothorax develops, see Section 2 Quick Check for management.
- Empyaema – if the patient appears severely ill, see Section 2 Quick Check and Section 3.2 for management.

7.3.2 Urinary catheter insertion – female

Indications

- acute urinary retention
- monitoring urinary output.

Contraindications

- possible fracture of the pubic symphisis (demonstrated by blood at the urethral opening after trauma).

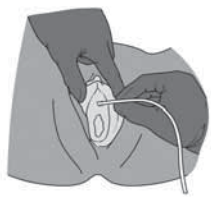
Equipment

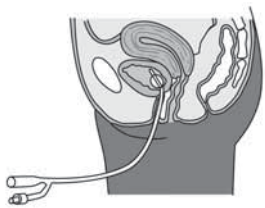
- sterile gloves and sterile towels or drapes
- antiseptic
- 2% lidocaine jelly or mineral oil
- urinary catheter
- 10 ml syringe filled with water or saline
- tape and suture material
- container for drainage.

Procedure

A female chaperone or assistant should be present throughout.

1. Position the patient lying face up with knees bent and apart.
2. Put on sterile gloves and, with sterile swabs, apply antiseptic to the labia and urethra. Isolate the area with a perforated sterile towel.
3. Check the integrity of the urinary catheter balloon, and then lubricate the catheter with a generous amount of sterile liquid paraffin (mineral oil) or lidocaine jelly.
4. Gently insert the urinary catheter into the urethra, which usually is located just at the top of the vaginal opening, and 2.5 cm below the clitoris. In some women, it can be difficult to see, and must be found by palpation.
5. Insert at least 20 cm of the catheter to ensure that it is in the bladder.





6. Fixing the catheter.
   - If a Foley catheter is being used, inflate the balloon with 10–15 ml of sterile water or clean urine. Partially withdraw the catheter until its balloon abuts the bladder neck.
   - If the catheter has no balloon, knot a ligature around the catheter just beyond the urethral opening and carry the ends to one side, securing them with tape to the lower abdomen or thigh.
7. Secure the catheter to the patient's thigh using tape.
8. Connect the catheter through a closed system to a sterile container.
9. Take care to decompress a chronically distended bladder slowly as rapid release of more than one litre of urine can cause fainting.

Aftercare

- If the catheterization was traumatic, administer an antibiotic with a Gram-negative spectrum for 3 days.
- Change the catheter if it becomes blocked or infected, or as otherwise indicated.
- Ensure a generous fluid intake to prevent calculus formation in recumbent patients, who frequently have urinary infections, especially in tropical countries.

Complications

- Urinary tract infection or sepsis – if the patient appears to be in shock, with fast heart rate and low blood pressure, see pages 19–20 Quick Check for immediate management.
- Bladder rupture is a rare complication of chronic indwelling urinary catheters – if the patient is in severe pain or shock or the rupture is determined to be intraperitoneal, see pages 23–24 Quick Check for immediate management and arrange for emergency surgery.
- Vaginal placement.
- Urethral trauma.

7.3.3 Marsupialization for Bartholin's cyst or abscess

Indications

- Asymptomatic Bartholin's cysts in women under 40 can be left alone. Pain or interference with sexual activity are indications for drainage.
- Asymptomatic Bartholin's cysts in women over 40 should be drained and biopsied due to the risk of carcinoma.
- Any Bartholin's abscess (cyst with clear evidence of infection) should be treated with incision, drainage, and marsupialization to prevent recurrence.

Equipment

- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- small forceps
- scalpel blade and handle
- suture material, needle driver, forceps
- 5 ml syringe

- microscope slides
- culture media
- formalin
- dressing material.

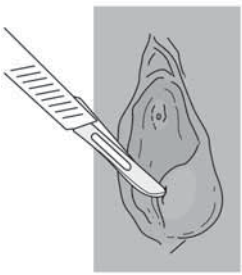
Procedure

A female chaperone or assistant should be present throughout.

1. Perform an external genital exam. Clean the area around the cyst or abscess with antiseptic.
2. Anaesthetize the area with lidocaine.
3. Hold the cyst with forceps and make a 1–3 cm vertical incision in the most prominent part, usually immediately outside the hymenal ring.
4. Once the pus or contents of the cyst cavity have been drained, evert the wound edges and suture them to the adjacent mucosal tissue, using absorbable suture. This opening will shrink over time and form a new orifice for the gland, allowing it to drain freely.
5. Dress the area so that any drainage will collect.

Investigations

- If abscess, send for Gram stain and culture.
- In women older than 40 with cyst or abscess, send a tissue sample in formalin to rule out carcinoma.



7.3.4 Intrauterine device (IUD) placement (copper-bearing IUD)

Indications

- IUDs are safe and suitable for nearly all women, including women who:
  - have or have not had children
  - are not married
  - are of any age, including adolescents and women over 40
  - have just had an abortion or miscarriage (provided there is no evidence of infection)
  - are breastfeeding
  - do hard physical work
  - have had an ectopic pregnancy
  - have had PID
  - have certain vaginal infections
  - have anaemia
  - are infected with HIV, or on antiretroviral therapy and doing well.

Contraindications

- recent, untreated puerperal sepsis or septic abortion
- unusual vaginal bleeding (should be evaluated prior to insertion)
- current cervical or endometrial cancer; gestational trophoblast disease
- untreated pelvic tuberculosis
- symptomatic cervicitis
- current pregnancy
- clinical judgement should be used in special cases:
  - between 48 hours and 4 weeks since giving birth;
  - noncancerous (benign) gestational trophoblast disease;
  - current ovarian cancer;
  - is at very high individual risk for gonorrhoea or *Chlamydia;*
  - has AIDS and is not clinically well on antiretroviral therapy (HIV alone is not a contraindication).

Equipment

- sterile gloves
- speculum
- cotton swab
- antiseptic
- tenaculum
- uterine sound
- IUD
- scissors.

Procedure

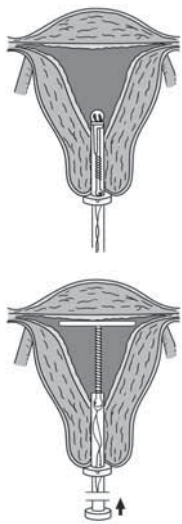
A female chaperone or assistant should be present throughout.

1. Explain the insertion procedure to the patient; show her the instruments to be used and the IUD. Tell her that she will experience some discomfort or cramping during the procedure, and that this is to be expected.

2. Ibuprofen (200–400 mg), paracetamol (325–1000 mg), or other pain relief may be given 30 minutes before insertion to help reduce cramping and pain. Do not give aspirin, which slows blood clotting.

3. Perform a pelvic examination to assess eligibility, first by doing a bimanual examination and then a speculum examination to inspect the cervix. Consider the following questions.
   - Is there any type of ulcer or discoloration on the vulva, vagina, or cervix (suggesting a STI)?
   - Does the client feel pain in her lower abdomen when the cervix is moved (suggesting PID)?
   - Is there tenderness in the uterus, ovaries, or fallopian tubes (adnexal tenderness) (suggesting PID)?
   - Is there a purulent cervical discharge (suggesting a STI or PID)?
   - Does the cervix bleed easily when touched (suggesting a STI or cervical cancer)?
   - Is there an anatomical abnormality of the uterine cavity that will prevent correct IUD insertion (distorts uterine anatomy and prevents proper placement)?
   - Was the size or position of the uterus not determined (essential to ensuring proper placement)?

   If the answer to any of the above questions is "yes", refer the patient for diagnosis and treatment as appropriate, and counsel regarding other methods of contraception.
4. If the patient is eligible, clean the cervix and vagina with appropriate antiseptic.
5. Slowly insert the tenaculum through the speculum and close the tenaculum just enough to gently hold the cervix and uterus steady.
6. Pass the uterine sound through the cervix to measure the depth and position of the uterus. Do not use force when inserting the sound; this increases the risk of uterine perforation. Do not allow the sound to touch any non-sterile surfaces, including the speculum and vaginal walls.
7. Load the IUD into the inserter while both are still in the unopened sterile package. Loading requires the horizontal arms of the IUD to be placed into the tube. The plastic rod should be inserted into the other end of the tube. This will be used to push the IUD free of the inserter once inside the uterus.
8. Insert the IUD and then remove the inserter. Do not allow the IUD or inserter to touch any non-sterile surfaces, including the speculum and vaginal walls.
9. Cut the strings on the IUD, leaving about 3 centimetres hanging out of the cervix.



10. After insertion, allow the patient to rest. She should remain on the examination table until she feels ready to get dressed.
11. Remind the patient about common side-effects, including changes in her bleeding patterns (especially in the first few months after insertion).
12. Tell her she should return immediately if:
    - she is unable to feel the strings

- the IUD has partially come out
- she feels the symptoms of PID
- she thinks she might be pregnant.

Complications

- Uterine perforation – in patients with signs of intraperitoneal haemorrhage (abdominal distension, hypotension) or significant vaginal bleeding not due to cervical laceration, see Quick Check page 20 for management and refer for emergency surgery
- Ectopic pregnancy – should be suspected in women who present with unusual abdominal pain or tenderness, abnormal vaginal bleeding, or giddiness or fainting. If the patient is in shock, see Quick Check pages 19–20 for immediate management, and refer for diagnosis and care as appropriate.
- Intrauterine pregnancy – when coexistent with an IUD, increases the risk of preterm delivery and miscarriage (and septic miscarriage). If the woman does not wish to continue the pregnancy, provide appropriate counselling. If she decides to continue, the IUD should be carefully removed. If she wishes to keep the IUD, her pregnancy should be followed closely.
- PID can occur if the woman has Chlamydia or gonorrhoea when an IUD is placed. See Section 10.15 for management.
- Changes in bleeding patterns (may result in or contribute to anaemia).

7.3.5 Reduction of paraphimosis

Paraphimosis occurs most commonly in children. Diagnose it by recognizing a retracted, swollen and painful foreskin. The glans penis is visible, and is surrounded by an oedematous ring with a proximal constricting ring. Differential diagnoses:

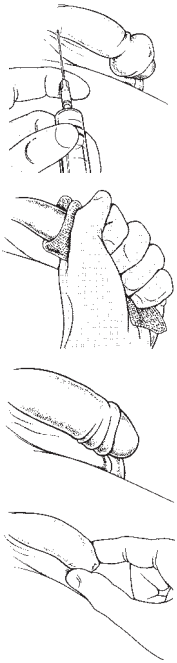
- inflammation of the foreskin (balanitis) due, for example, to infection
- swelling caused by an insect bite
- In these cases, the glans is not visible.

Equipment

- sterile gloves and sterile towels
- antiseptic
- lidocaine without epinephrine, 5–10 ml syringe, 23- to 25-gauge needle
- scalpel
- two artery forceps
- straight scissors
- suture material, needle driver, forceps.

Procedure

- Treat paraphimosis by reduction of the foreskin or, if this fails, by dorsal slit. Circumcision, performed as a non-emergent procedure is the definitive treatment.



Manual reduction of the foreskin

1. Sedate the patient if necessary – consider ketamine.
2. Cleanse the skin of the genitalia with antiseptic.
3. Isolate the penis with a perforated towel and inject lidocaine in a ring around its base.
4. Once local anaesthesia is achieved, take hold of the oedematous part of the penis in the fist of one hand and squeeze firmly; a gauze swab may be necessary for a firm grip. Exert continuous pressure, changing hands if necessary, until the oedema fluid passes proximally under the constricting band to the shaft of the penis.
5. Usually then, the foreskin can be pulled over the glans.

Phimotic ring incision

6. If manual reduction fails, a phimotic ring incision may be performed.
7. Once the penis has been cleaned with antiseptic and draped as above, infiltrate proximally to distally through the constricting phimotic ring at the 12 o'clock position. Try to follow a line that is perpendicular to the phimotic ring.
8. Incise slowly along that same line, taking care to not penetrate too deeply in order to avoid lacerating the penile shaft. The result should be a diamond shaped defect created when the edges of the incised ring spring apart.
9. Most lacerations resulting from the procedure require only simple suturing.

Dorsal slit

10. Following the placement of a phimotic ring incision, the foreskin is easily reducible. When incised to the distal tip of the foreskin, the phimotic ring incision becomes a dorsal slit.
11. Ensure that adequate anaesthesia has been achieved by touching the forceps to the inside of the foreskin.
12. Clamp the foreskin with 2 artery forceps on either side of the most distal tip of the existing incision and incise between them using a pair of straight scissors.
13. Some patients may have continued bleeding or oozing, or there may be separation of the incised layers of foreskin after unclamping the forceps. In this case, running absorbable sutures can be placed on each side of the incision. These should begin proximally at the apex and continue distally. The result will be a defect that appears to be an upside down "v" when the foreskin is reduced.

Aftercare

- It is important to reduce the foreskin post-procedure to prevent phimosis.
- Circumcision, if desired, may be performed as a non-emergent procedure once swelling and inflammation have diminished.

7.3.6 Urinary catheter insertion – male

Indications

- acute urinary retention
- monitoring urinary output.

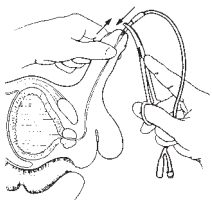
Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- 2% lidocaine jelly or mineral oil
- urinary catheter
- 10 ml syringe filled with water or saline
- tape and suture material
- a container for drainage.

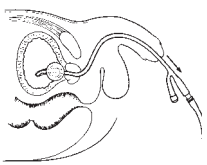
Procedure

1. Position the patient lying face up.
2. Wash the area with soap and water, retracting the foreskin to clean the furrow between it and the glans. Put on sterile gloves and, with sterile swabs, apply antiseptic to the urethra and glans. Isolate the penis with a perforated sterile towel.
3. Check the integrity of the urinary catheter balloon and then lubricate the catheter with a generous amount of sterile liquid paraffin (mineral oil) or lidocaine jelly.

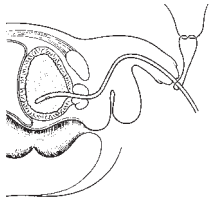
   If right-handed, stand to the patient's right, hold the penis vertically and slightly stretched with the left hand, and introduce the urinary catheter gently with the other hand.



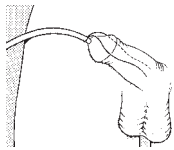
   At 12–15 cm, the catheter may stick at the junction of the penile and bulbous urethra, in which case angle it down to allow it to enter the posterior urethra. A few centimetres further, there may be resistance caused by the external bladder sphincter. This may be overcome by asking the patient to relax the perineal and rectal region while gently advancing the catheter.



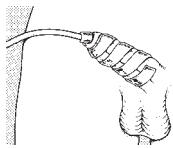
4. Urine escaping through the catheter confirms entry into the bladder. Advance the catheter 5–10 cm before inflating the balloon. This prevents the balloon inflating in the prostatic urethra.



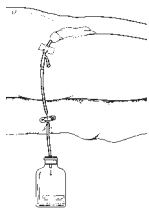
5. Remember to pull the foreskin back over the glans once the catheter has been placed. If left retracted (glans exposed), the foreskin can contract, causing a paraphimosis.



6. Fixation of the catheter:
   - If a Foley catheter is being used, inflate the balloon with 10–15 ml of sterile water or clean urine. Partially withdraw the catheter until its balloon abuts on the bladder neck.
   - If the catheter has no balloon, knot a ligature around the catheter just beyond the urethral opening and carry the ends along the body of the penis, securing them with a spiral of strapping brought forward over the glans and the knot.



7. Strap the penis and catheter laterally to the abdominal wall; this will avoid a bend in the catheter at the penoscrotal angle and help to prevent compression ulceration.



8. Connect the catheter through a closed system to a sterile container.
9. Take care to decompress a chronically distended bladder slowly; rapid release of more than 1 litre of urine can cause fainting.

Aftercare

- If catheterization was traumatic, administer an antibiotic with a Gram-negative spectrum for 3 days.
- Change the catheter if it becomes blocked or infected, or as otherwise indicated. Ensure a generous fluid intake to prevent calculus formation in recumbent patients, who frequently have urinary infections, especially in tropical countries.

Complications

- Urinary tract infection, sepsis. If the patient appears to be in shock, with fast heart rate and low blood pressure, see Quick Check page 20 for immediate management.
- Bladder rupture is a rare complication of chronic indwelling urinary catheters. If the patient is in severe pain or shock, or the rupture is determined to be intraperitoneal, see Quick Check pages 19–20 for immediate management and arrange for emergency surgery.
- Urethral or prostate trauma.

7.3.7 Suprapubic catheter

Indications

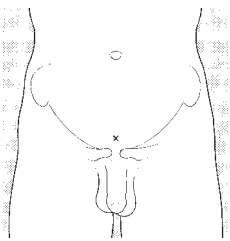
- Bladder puncture may become necessary if urethral catheterization fails.

Contraindications

- Caution should be taken in patients with previous abdominal surgeries; they may have developed adhesions that put them at greater risk for bowel injury during placement.

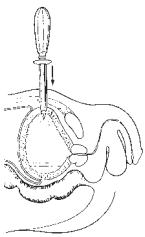
Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- 16-gauge needle, 50 ml syringe
- trochar and cannula
- 10 ml syringe filled with water or saline
- tape and suture material
- a container for drainage
- dressing material.

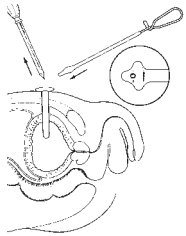


Procedure

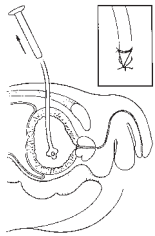
1. Assess the extent of bladder distension by inspection and palpation. If available, ultrasound will help to confirm the insertion site.
2. If proceeding to suprapubic puncture immediately after catheterization has failed, remove the perforated sheet that was used to isolate the penis and centre the opening of a new sheet over the midline above the pubis. Do not use the same gloves as for the failed urinary catheterization.



3. Clean the area with antiseptic.



4. Raise a weal of local anaesthetic in the midline, 2 cm above the symphysis pubis, and then continue with deeper infiltration. Make a simple puncture 2 cm above the symphysis pubis in the midline with a 16-gauge needle attached to a 50 ml syringe. This should be done by slowly advancing the needle while aspirating. Urine should be easily aspirated when the needle reaches the bladder. If there is difficulty placing the catheter as described below, urine may be aspirated using this syringe to relieve discomfort.

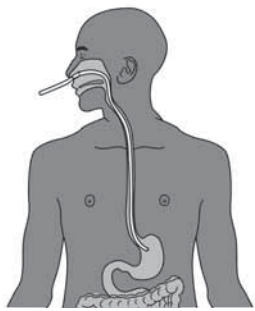


5. Introduce the trochar and cannula and advance them vertically with care. After meeting some resistance, they will pass easily into the cavity of the bladder, as confirmed by the flow of urine when the trochar is withdrawn from the cannula.
6. Introduce the catheter well into the bladder. Once urine flows freely from the catheter, withdraw the cannula. Inflate the catheter balloon.
7. Fix the catheter to the skin with the stitch used to close the wound and connect it to a bag or bottle. Take care that the catheter does not become blocked, especially if the bladder is grossly distended. If necessary, clear the catheter by syringing with saline.

Complications

- Bowel perforation. If the patient develops severe abdominal pain and tenderness, the bowel wall may have been perforated. See Quick Check page 23 for immediate management and arrange for emergency surgery.
- Leakage of urine into the abdomen.

7.3.8 Inserting a nasogastric (NG) tube



Indications

- upper GI bleed
- small bowel obstruction
- evaluation of gastrointestinal injury
- preoperative gastric decompression.

Contraindications

- facial fractures (use orogastric tube instead)
- severe coagulopathy
- oesophageal stricture
- recent alkali ingestion (may cause oesophageal perforation).

Equipment

- NG tube
- lubricant
- a cup of water
- a 50–100 ml syringe.

Procedure

1. Elevate the head of the bed, or ask the patient to assume an upright, sitting position.
2. In order to determine the appropriate length of tubing to be inserted, measure from the xyphoid (bottom of the sternum or breastbone) to the ear and then to the nose. Add 15 cm to this distance to obtain the insertion distance. The NG tube itself may be used to measure, marking the approximate point on the tube with tape.
3. Lubricate the tube with a liberal quantity of water-based lubricant prior to insertion.
4. The tube should then be inserted gently in the posterior (not superior) direction. Proceed gently to avoid trauma to the tissue behind the nose. If there is resistance, attempt to use the other nostril.
5. If the patient is having difficulty, instruct them to sip some water while simultaneously trying to pass the tube.
6. The patient can help direct the tube into the oesophagus by putting their chin to their chest. Tracheal insertion should be suspected if there is excessive coughing or condensation inside the tube.
7. Make sure to confirm placement of the tube before using it, especially in patients with an altered level of consciousness. Successful placement in the stomach can be confirmed by rapidly pushing air into the tube with a large syringe; there should be gurgling sounds which can be heard through a stethoscope placed on the stomach. A chest X-ray may be done to confirm placement.
8. The tube should be secured carefully to the nose and the patient's gown (to avoid displacing the tube if there is a sudden tug). A butterfly type bandage or tape may be used to secure the tube to the nose. Avoid the tube pressing on the medial or lateral aspects of the inner nostril, as this may result in necrosis or bleeding.

Complications

- Vomiting and aspiration during placement. If the patient begins to have difficulty breathing, see Quick Check page 17 for immediate management.
- Pulmonary placement. If the patient develops chest pain and shortness of breath, or has a suggestive chest X-ray, they may have a pneumothorax. See Quick Check page 46 and Section 4.2 for immediate treatment. The patient will likely require a chest tube.
- Intracranial placement. If the nasogastric tube is suspected to be in the cranium, call for surgical help.
- Gastric erosions and bleeding if the tube is in place long term.

7.3.9 Gastric lavage

Indications

- Gastric lavage is VERY RARELY indicated in the management of overdose. It is for patients who have ingested a potentially fatal amount of poison, AND the procedure can be performed within 1 hour of ingestion. See Section 3.8 Poisoning.

Absolute contraindications

- unconsciousness or depressed sensorium with unprotected airway (possibility of aspiration)
- ingestion of corrosive substances because of the danger of perforation
- ingestion of hydrocarbons, unless a more toxic substance is combined with the hydrocarbon, such as pesticide (possibility of aspiration)
- presence of frank convulsions (possibility of aspiration)
- patient at risk of haemorrhage or gastrointestinal perforation
- an uncooperative patient (the tube can injure the gastrointestinal tract).

Equipment

- suction apparatus
- orogastric or NG tube
- 100 ml syringe
- water or saline.

Procedure

1. Patients who are comatose or unable to protect the airway must be intubated prior to lavage. If intubation is not possible, lavage should not be attempted.
2. Place the patient on their left side with the head down by 15–30°. This is important to reduce the risk of aspiration.
3. Measure and mark the length of tube needed before insertion.
4. If the patient has ingested a solid poison (e.g. tablets), insert an appropriately sized (French 36–40) and properly lubricated orogastric tube. If the patient vomits, carefully and quickly apply suction to remove the vomitus. Do not use force to pass the tube.
5. If the patient has ingested a liquid poison (e.g. pesticide), insert a properly lubricated nasogastric tube. If the patient vomits, carefully and quickly apply suction to remove the vomitus. Do not use force to pass the tube.
6. Check the proper positioning of the tube in the stomach by air insufflation or aspiration with pH testing of aspirate.
7. Instil and lavage with no more than 100–300 ml lukewarm or tepid water or normal saline. Remove the fluid before giving more. Repeat until 1–2 litres have been given and removed. Large volume lavages are unlikely to offer significant benefit since the first few 100 ml will remove the majority of the poison that remains.

Complications

- aspiration pneumonia (see Section 3.2 for management)
- laryngospasm

- cardiac arrhythmias
- hypoxia and hypercapnia
- mechanical injury to the throat, oesophagus and stomach
- fluid and electrolyte imbalance.

7.3.10 Venous cutdown

Indications

- Used as a means of obtaining venous access in emergencies when no other options are available:
  - shock
  - pulseless cardiac arrest
  - IV drug users with sclerosed veins
  - distorted surface anatomy.

Contraindications

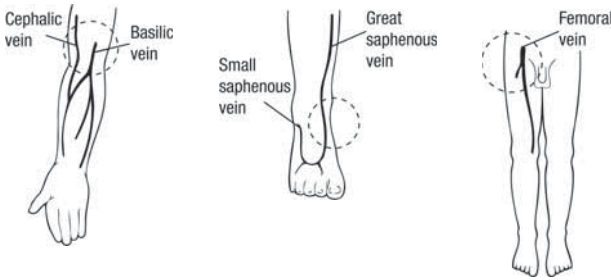
- Should not be performed if less invasive means of obtaining venous access are available.
- There is infection over cutdown site.
- Relative:
  - coagulation disorders
  - impaired immunity
  - impaired wound healing.

Equipment

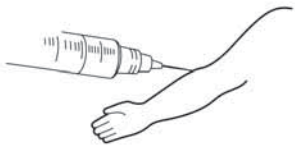
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- suture material
- scalpel
- curved haemostat
- scissors
- venous dilator
- large bore IV catheter
- IV tubing
- needle driver
- forceps
- antibiotic ointment
- tape
- dressing material.

Procedure

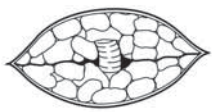
1. The most commonly used vessels for venous cutdown include the greater saphenous, basilic, and cephalic veins. The saphenous vein is easily accessible at its location just anterior to the medial malleolus, and the accompanying nerve is relatively unimportant, making it a good site for cutdown.



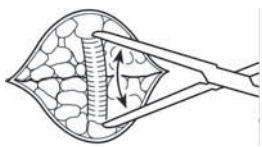
2. Clean the area with antiseptic and cover with sterile drapes; be sure to maintain strict aseptic technique.
3. The skin and subcutaneous tissue should be anaesthetized with lidocaine.



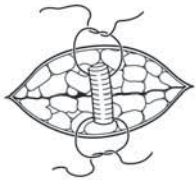
4. A tourniquet may be placed proximal to the cutdown site; this will help visualize the vein.
5. Using the scalpel, incise the skin perpendicular to the vein. A longitudinal incision will not allow the required degree of exposure.



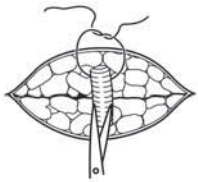
6. Carefully isolate and mobilize the vein using blunt dissection.



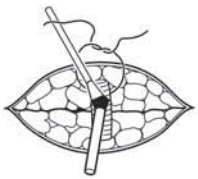
7. Using the haemostat, gently lift the vein free from the underlying connective tissue and pass two sutures under it proximal and distal to the site on the vein that will be cannulated.



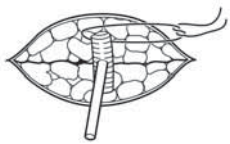
8. Tie the distal suture. The proximal suture may be left untied, as it will be used to control any bleeding.
9. Incise the vein at a 45° angle between the two sutures. Do not incise more than halfway through as this may cause the vein to tear and retract from the field.



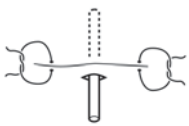
10. Use the venous dilator to lift the proximal corner of the incision and carefully cannulate the vein with the IV catheter. This may be the longest part of the procedure. The IV tubing may now be attached.



11. The proximal suture should be tied around the vein and the catheter to hold it in place.



12. The tourniquet may now be removed and the incision closed.



13. Once access has been established, the cutdown site should be dressed and the extremity splinted to prevent kinking or dislodgement of the cannula.

Complications
- haematoma
- infection
- phlebitis and thromboembolism
- injury to surrounding structures.

7.4 Diagnostic and therapeutic procedures

7.4.1 Thoracentesis (chest tap)

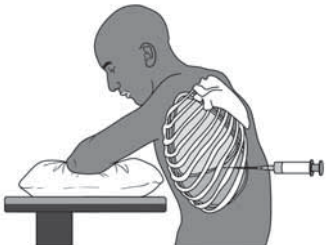
Indications
- Diagnostic: new pleural effusion that is not due to congestive heart failure.
- Therapeutic: dyspnoea that is caused by large pleural effusions.
- See Sections 10.6 and 15.

Contraindications
- thrombocytopaenia
- bleeding diathesis
- pre-existing infection at the site of needle insertion.

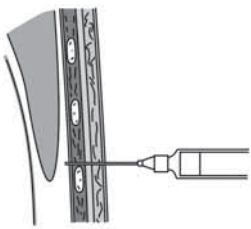
Equipment
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle, 20-gauge needle)
- 16-gauge needle; obese patients may require longer needle – consider using a spinal needle
- 30 ml syringe – may need larger (50–100 ml) for large effusions
- drip giving set
- haemostat
- microscope slides
- specimen tubes and culture media.

Procedure
1. The patient should be seated with arms and head supported (e.g. sitting backwards on a chair). A nurse or assistant may help with this.
2. Localize the pleural effusion by determining the level where dullness to percussion begins when percussing the posterior chest from top to bottom.
3. Choose a site on the posterior chest in the mid-scapular line (approximately 5–10 cm lateral to the spine). Use an interspace below the point where dullness to percussion begins, but above the 9th rib (to avoid subdiaphragmatic puncture).
4. Clean the area with antiseptic; be sure to maintain strict aseptic technique.
5. The skin and subcutaneous tissue should be anaesthetized with lidocaine using a 25-gauge needle.

6. Using a longer, 20-gauge needle, anaesthetize the pleura, and gently aspirate until pleural fluid is noted in the syringe. Then remove the needle and note the depth of insertion needed for the thoracentesis needle.
   - Make sure that the needle is positioned and advanced just above the rib. This assures that the intercostal nerve and blood vessels, which are located just below each rib, will not be injured.



7. In the previous puncture site, insert a 16-gauge needle attached to a large syringe or to a drip giving set with the end either placed into a bucket or attached to a urine bag. Be aware that some drip giving set chambers have one-way valves which need to be cut off to allow flow.
8. Advance the needle slowly, keeping it above the top of the rib. Aspirate gently while advancing the needle.
9. When pleural fluid is noted, place a haemostat on the needle to prevent it from accidentally advancing forward.
10. Remove the necessary amount of pleural fluid (usually 100 ml for diagnostic studies).
    - Do not remove more than 1500 ml of fluid at once as this can increase the risk of pulmonary oedema or hypotension. In addition, the risk of pneumothorax from needle laceration of the visceral pleura is higher if an effusion is completely drained.
    - Warn the patient that he or she is likely to want to cough as the lungs expand.



11. The patient may experience significant pain if a large volume of fluid is removed. Paracetamol may be used to control it, although a stronger analgesic occasionally may be required.
12. Gently remove the needle.
13. A post procedure chest X-ray is not routinely required but should be done if there is any suspicion of pneumothorax.

Investigations

- Lab studies distinguish an exudate from a transudate (see Sections 10.6 and 15 for interpretation).
- Collect 4 separate tubes of fluid:
  - tube 1 (plain, red top), protein, LDH, and glucose;
  - tube 2 (EDTA, purple top), cell count and differential, cytology;
  - tube 3 (sterile), Gram stain and culture (any sterile container may be used for the Gram stain and culture);
  - tube 4 (sterile), keep sample in case further studies required, e.g. AFB smear, mycobacterial culture.

Complications

- pneumothorax (see Quick Check page 46 and Section 4.2 for immediate management) – if significant, the patient will require a chest tube
- haemothorax (see Quick Check page 46 and Section 4.2 for immediate management) – the patient will likely require a chest tube
- spleen or liver puncture – if the needle is suspected to have punctured the spleen or liver, see Quick Check page 20 and Section 4.2 for immediate management and call for surgical help if the patient is unstable
- re-expansion pulmonary oedema – while the evidence is not clear, it may be prevented by removing less than 1.5 litres of fluid at a time
- air embolism if the patient becomes unstable, with fast breathing, fast heart rate, low blood pressure, or focal neurological deficits – see Quick Check page 19 for immediate management
- infection
- vasovagal episode.

7.4.2 Lumbar puncture

Indications

- suspected CNS infection (meningitis, encephalitis)
- suspected subarachnoid haemorrhage
- diagnosis of meningeal carcinomatosis and meningeal leukaemia
- diagnosis of tertiary syphilis
- follow-up of therapy for meningitis
- evaluation of dementia
- treatment of increased intracranial pressure caused by cryptococcal meningitis
- treatment of pseudo tumour cerebri
- introduction of drugs, anaesthetics or radiographic media in the CNS.

Contraindications

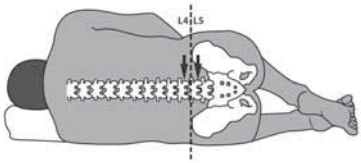
- Infection at the site.
- Increased intracranial pressure evidenced by focal neurological signs, papilloedema, altered mental status, or recent seizure. Lumbar puncture performed on a patient with increased intracranial pressure can lead to fatal cerebral herniation (brain shift) (see Section 10-10b).
- Bleeding disorder or low platelets.

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- 20- to 22-gauge spinal needle with stylet
- CSF pressure manometer or IV tubing and pole
- dressing material
- microscope slides
- specimen tubes and culture media.

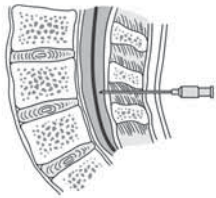
Procedure

1. Lumbar puncture can be a painful procedure, and some patients may require IV sedation, especially if they are delirious or uncooperative. It is advisable to pre-medicate all patients with paracetamol; however, this should not delay the procedure and the administration of antibiotics.
2. Carefully examine the patient for signs of increased intracranial pressure as described above. If increased intracranial pressure or a CNS space-occupying lesion is suspected, obtain a CT scan of the brain (if available) before performing the lumbar puncture (see Section 10-10b for further details).
3. This manual recommends performing a lumbar puncture prior to the administration of antibiotics if it can be done within 15 minutes. If this is not possible, or if the lumbar puncture is deferred, always give empirical antibiotics if meningitis is suspected.
4. Position the patient lying on one side with the spine flexed (draw shoulders forward and bring thighs towards the abdomen). Patients may also be positioned sitting upright with the spine flexed. However, this position will not allow for accurate measurement of the opening pressure. It may be helpful to have an assistant in front of the patient to help with positioning and reassurance.



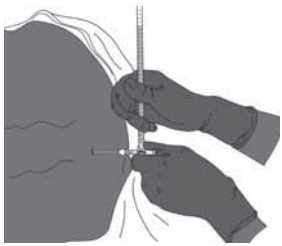
5. Lumbar punctures are typically performed at the level of the L4–L5 interspace, well below the end of the spinal cord. The interspace may be found by drawing an imaginary line between the iliac crests. Placing four fingers on the iliac crests with thumbs pointing inwards, towards the spine, may help.
6. Clean area with antiseptic.
7. Anaesthetize the skin and subcutaneous tissues with lidocaine.

8. Gently introduce the spinal needle with bevel turned upward and angled slightly towards the head. Slowly advance. If the needle hits bone, withdraw to just under the skin and change angles (usually aiming more steeply towards the head) before advancing the needle again.



9. When the subarachnoid space is entered, there may be a slight "give". At this point, the stylet should be carefully withdrawn to confirm the flow of cerebrospinal fluid (CSF). It should flow freely from the needle and should not ever be aspirated.

10. Measure opening pressure (usually between 10–20 cm H20).
    - Breath holding or straining can increase opening pressure. Reassure the patient and have them relax.
    - If elevated, remove only 5 ml of spinal fluid and remove the needle.
    - If a manometer is unavailable, IV tubing that has been marked using a tape measure and attached to an IV pole can be used to measure opening pressure.



11. Collect 2 ml CSF in each of 4 collection tubes. In patients with cryptococcal meningitis, up to 30 ml may be removed at once (see Section 11.5).

12. Replace stylet and remove the needle. Apply pressure with sterile dressing for a few minutes.

Investigations
(see Section 10.10b for interpretation)
- Collect 4 separate tubes of fluid:
  - tube 1, protein, glucose
  - tube 2, Gram stain
  - tube 3, save fluid for further study
  - tube 4, cell count (total and differential).
- Additional tests:
  - if known or suspected HIV-positive, India ink, cryptococcal latex agglutination (CrAg)
  - AFB smear

- VDRL or RPR
- bacterial culture
- mycobacterial culture
- fungal culture
- cytology.

Complications

- Cerebral herniation – if the patient becomes unstable, with slow breathing, slow heart rate, high blood pressure, altered consciousness, or focal neurological deficits, see Quick Check page 18 for immediate management and call for surgical help.
- If post-lumbar puncture headache (is worse when standing), treat with paracetamol.

Other complications may include:

- severe radicular pain
- paraparesis
- infection
- bleeding.

7.4.3 Paracentesis (abdominal tap)

Indications

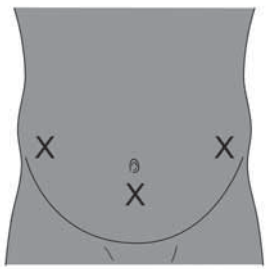
- Diagnostic
  - sample for investigation of ascites of undetermined etiology
  - evaluation for peritonitis
  - evaluation of intra-abdominal haemorrhage or bowel perforation in trauma.
- Therapeutic
  - relief of abdominal pain and discomfort caused by tense ascites
  - relief of dyspnoea caused by elevated diaphragm from ascites
  - initiation of peritoneal dialysis.

Contraindications

- a bleeding diathesis (other than DIC) as the risk of bleeding is very low
- bowel distention or obstruction
- infection or surgical scars at the site of needle entry.

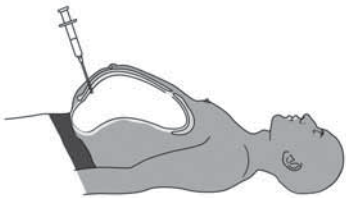
Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- needle and syringe
- drainage bag and tubing or IV drip giving set
- dressing material
- microscope slides
- specimen tubes and culture media.

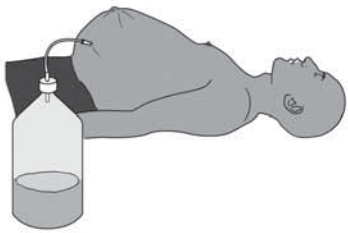


Procedure

1. The patient should be instructed to empty their bladder. Occasionally, insertion of a urinary catheter may be required.
2. Patients with significant ascites can be positioned lying face up; those with less ascites can be positioned lying down on the left side.
3. The left lower quadrant (2–3 cm lateral to the border of the rectus muscles) has been shown to be a good site for paracentesis. The right lower quadrant and a site 3–4 cm below the umbilicus have also been used.
4. Cleanse the area with antiseptic.
5. Anaesthetize the puncture site with lidocaine.
6. Carefully insert the needle at the site. A small amount of "give" may be felt as the needle enters the peritoneal cavity. Caution is required to avoid sudden penetration of the needle.



7. Remove only the necessary amount of fluid. A drainage bag attached to the needle with tubing may be used when large amounts of fluid must be removed. Note that removal of more than 1 litre of fluid may result in post-paracentesis hypotension.



Investigations

(see Section 10.9 for interpretation)

- Routine investigations include cell count and differential, albumin, total protein, Gram stain, and culture.
- If tuberculous peritonitis is suspected, send sample for AFB smear and mycobacterial culture.
- If malignancy is suspected, send sample for cytology.
- Glucose and amylase may be useful.

Complications

- Post-paracentesis hypotension. Give fluids acutely – usually self-resolving (see Quick Check page 19 for immediate management).
- Bowel perforation. If the patient develops severe abdominal pain and tenderness, the bowel wall may have been perforated (see Quick Check page 20 for immediate management and arrange for emergency surgery).
- Puncture site infection.
- Abdominal wall haematoma.
- Continued leakage of ascitic fluid.

7.4.4 Arthrocentesis (joint aspiration)

Indications

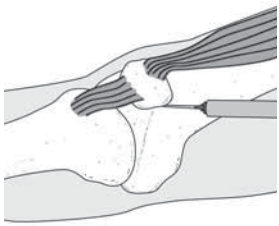
- suspected infectious or crystal-induced arthropathy
- unexplained joint effusion or monoarthritis
- symptomatic relief from a large effusion
- see Section 10.13 Painful joints.

Contraindications

- significant overlying cellulitis or soft tissue infection
- bleeding diathesis
- joint prosthesis.

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- 21-gauge needle and syringe
- dressing material
- microscope slides
- specimen tubes and culture media.



Procedure (knee joint aspiration)

1. Position the patient lying face up on the examination table. Examine the knee to determine the size of the joint effusion, and presence of any overlying skin infection.
2. Palpate the superolateral or superomedial aspect of the patella and mark a spot 1 cm superior and lateral to this point. Cleanse the area with skin antiseptic.
3. The area may be anaesthetized, but merely stretching the skin may also help reduce discomfort.
4. Steady the patella with one hand.

5. Insert a 21-gauge needle (with an appropriately sized syringe attached) at a 45° angle to the knee, aiming for below the patella.

6. Fluid should be easily aspirated once the needle has penetrated more than a few centimetres. Gently compressing the opposite side of the joint may increase flow.
7. Once sufficient fluid has been withdrawn to ease the patient's symptoms, the needle may be withdrawn and the fluid in the syringe sent for studies.

Investigations
(see Section 10.13 Painful joints for interpretation)
- cell count and differential, protein
- Gram stain and culture
- polarized microscopy (if in an area with high prevalence of crystal-induced arthritis).

Complications
- Latrogenic septic arthritis if the patient appears to be in shock, with fast heart rate and low blood pressure, see Quick Check page 19 for immediate management.
- Other complications may include:
- joint instability
- re-accumulation of joint effusion.

7.4.5 Pericardiocentesis

Indications
- diagnostic sample to determine etiology of effusion
- cardiac tamponade (semi-elective or emergent).

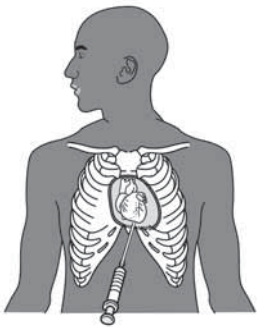
Contraindications
- small pericardial effusion
- traumatic haemopericardium, haemopericardium due to aortic dissection, and purulent pericarditis (surgical approach preferred)
- bleeding diathesis.

Equipment
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine, 5–10 ml syringe, 23- to 25-gauge needle

- long 18-gauge needle
- dressing material
- microscope slides and culture media.

Procedure

1. If possible, this procedure should be done by an experienced operator with guidance from fluoroscopy or echocardiography or ultrasound, and in a cardiac catheterization laboratory or operating room.
2. After the area has been sterilized and anaesthetized, the needle should be inserted 1 cm to the left of the xiphoid process, and directed towards the left shoulder. One should maintain a 30° angle to the skin to avoid the pleura and nearby arteries.



3. While the needle is being inserted, aspiration should be gently and intermittently attempted until fluid is withdrawn. A "pop" or sudden change in the density of the tissue being penetrated may occur, indicating that the pericardium has been accessed. Sanguineous pericardial fluid may be distinguished from blood by dropping a small amount onto a clean, dry sponge. If it is pericardial fluid, the resulting spot should appear much lighter than blood.
4. In the emergency or tamponade situation, the removal of even 50 ml may at least temporarily improve haemodynamics.
5. No more than 1 litre of fluid at a time should be aspirated in order to avoid acute right ventricular dilatation.

Investigations

- Gram stain, chemistry and culture
- cytology
- if tuberculous pericarditis is suspected, perform adenosine deaminase and send for mycobacterial culture.

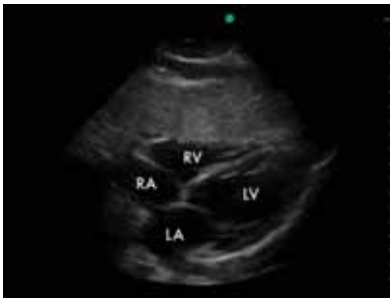
Complications

- Myocardial or coronary vessel laceration may present in a delayed fashion as hemopericardium or cardiac tamponade – (see Quick Check page 20 for immediate management and call for surgical help).
- Acute left or right ventricular failure with pulmonary oedema (see Quick Check page 20 and Section 3.2.5).
- Arrhythmia – obtain ECG and treat according to national guidelines. If the

patient appears to be in shock, with fast heart rate and low blood pressure, see Quick Check page 20 for immediate management.

- Pneumothorax (see Quick Check page 46 and Section 4.2 Trauma for immediate management). If significant, the patient will require a chest tube.
- Air embolism – if the patient becomes unstable, with fast breathing, fast heart rate, low blood pressure, or focal neurological deficits, see Quick Check page 20 for immediate management.
- Puncture of peritoneal cavity or abdominal organs. If the patient develops severe abdominal pain and tenderness, an abdominal organ may have been punctured. See Quick Check page 24 for immediate management and call for surgical help.

Fig 1a Normal Pericardium



1b Free fluid in Pericardium

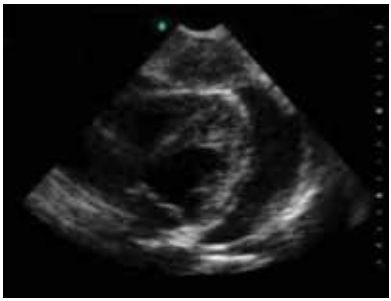
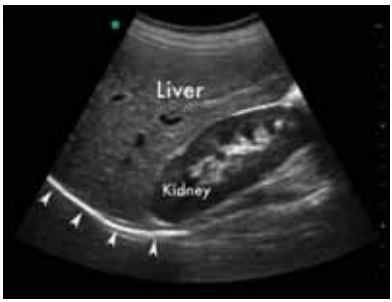


Fig 2a Normal RUQ



2b Free fluid in RUQ

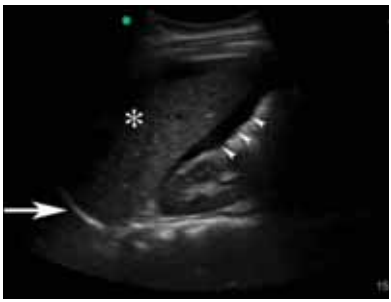
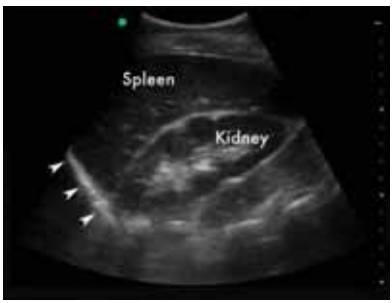


Fig 3a Normal LUQ



3b Free fluid in LUQ

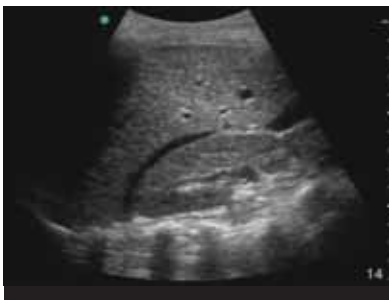
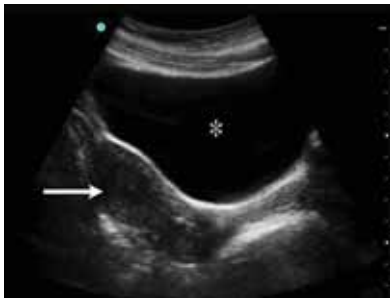


Fig 4a Normal Pelvis



4b Free fluid in Pelvis

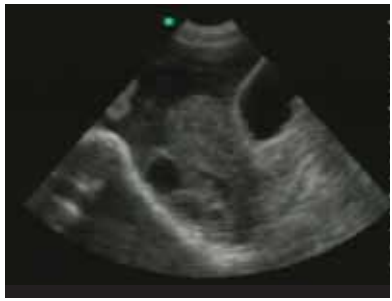


Fig 5 Gestational sac with yolk sac in early pregnancy

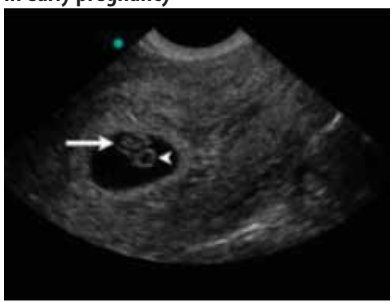


Fig 6 Early pregnancy with fetus

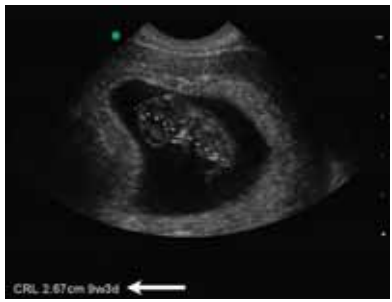


Fig 7 Fetal Heart Rate with M-mode

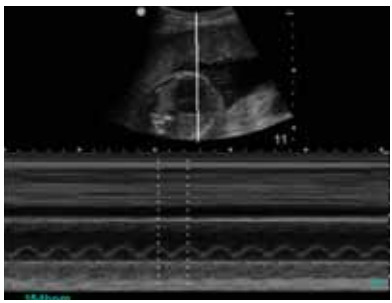
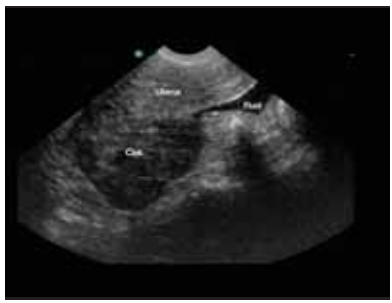


Fig 8 Ruptured ectopic with empty uterus and free fluid



8. Medicines/therapies

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8. Medicines/therapies

Section 8 covers only the treatment recommendations for conditions covered in this manual and does not serve as a comprehensive list of indications for each medicine. Also, it does not include routine contraception, vaccines, or immunoglobulin therapy.

Information on medicines in this section is drawn from the WHO Model Formulary,[1] Pharmacological treatments of mental disorders in primary health care[2], manufacturers' product literature, UpToDate[3], and evidence-based formularies such the British National Formulary[4] and Australian Medicines handbook.[5] Other sources include the Sanford Guide to Antimicrobial Therapy.[6]

These summaries do not cover all adverse reactions and interactions. The information given should be interpreted in the light of professional knowledge and by reference to the approved product information for the individual drugs and should be supplemented as necessary by specialist advice.

Where deemed important, the principles of prescribing and medicine administration are dealt with in the relevant Sections of the manual. For example, principles of prescribing in mental health disorders are in Section 10.11.

Where possible, adverse reactions are classified according to their probable incidence: common = incidence of 1% or more; infrequent or rare = incidence of less than 1%.

Section 8 is subdivided into:

8.1 Analgesics for pain relief

8.2 Information on equivalence for interchangeability- corticosteroids

8.3 Iron content of different salts

8.4 Information on individual medicines in adolescents and adults
Section 8 should be adapted in each country to match national guidelines and essential medicines lists. Please also refer to the updated WHO essential medicines list and the *2008 WHO Model Formulary.*[1]

The medicines list in 8.4 is not comprehensive. For a more complete list and for specific medicine interaction information, see the *2008 WHO Model Formulary*.[1]

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1 *WHO Model Formulary.* WHO, 2008. Available at www.who.int/selection_medicines/list/WMF2008.pdf

2 *Pharmacological treatment of mental disorders in primary health care.* WHO, 2009.

3 *UpToDate,* available at http://www.uptodate.com/store.

4 Joint Formulary Committee (2010). *British National Formulary.* 60th ed. London, British Medical Association and Royal Pharmaceutical Society of Great Britain. Available through HINARI (http://extranet.who.int/hinari/en/journals.php).

5 Rossi, S. ed, *Australian Medicines Handbook 2008.* Adelaide, Medicines Handbook Pty Ltd, 2008.

6 Gilbert DN, Ellopoulos GM, Moellering RC, Saag MS, Chambers HF, eds. *The Sanford Guide to Antimicrobial Therapy.* 40th ed. Sperryville, Antimicrobial Therapy, 2010.

For renal and hepatic impairment drug dosage adjustments, please refer to appendices 4 and 5 in *2008 WHO Model Formulary*[1] and Section 11.31 in this manual.

Some of the other common or important indications for the medicines that are not addressed in this manual are listed in the left column under "Other indications".

Special advice for prescribing medications for the elderly

- Drugs that commonly cause problems in the elderly include hypnotics, diuretics, nonsteroidal anti-inflammatory drugs, antihypertensives, psychotropics, and digoxin.
- For some medications, start low, go slow, expect unusual side-effects and drug interactions.
- See Section 18 Geriatric care.

8.1 A guide to the use of different analgesics (see Section 20 Palliative care)

	Analgesics	Starting dose in adolescents and adults	Range	Side-effects/ cautions
STEP 1	**Non-opioid**			
	Paracetamol (also lowers fever)	1 gram every 4–6 hours but no more than 4 grams in 24 hours	Only 1 tablet (500 mg) may be required in the elderly or the very ill or when combined with an opioid. Mild pain might be controlled with every 6 hour dosing.	Do not exceed 4 grams in 24 hours (more can cause serious liver toxicity).
	Aspirin (acetylsalicylic acid) (also anti-inflammatory and lowers fever)	600 mg (2 tablets of 300 mg) every 4 hours		Avoid use if gastric problems. Stop if epigastric pain, indigestion, black stools, petechiae, or bleeding. Avoid in presence of any bleeding. **Do not give to children under 16 years.**
	Ibuprofen (also anti-inflammatory and lowers fever)	1.0 200–400 mg 3–4 times daily. Maximum 2.4 g daily.	Maximum daily dose of 2.4 g	With or after food
STEP 2	**Opioid for mild to moderate pain** (give in addition to aspirin or paracetamol)			
	Codeine (if not available, consider alternating aspirin and paracetamol)	Codeine phosphate 30 mg every 4 hours	Codeine phosphate 30–60 mg every 4 hours. Maximum daily dose for pain 180–240 mg – switch to morphine if pain management inadequate.	Give laxative to avoid constipation unless diarrhoea.
STEP 3	**Opioid for moderate to severe pain**			
	Oral morphine: 5 mg/5 ml or 50 mg/5 ml or tablets Give by mouth but, if necessary, can be given rectally. **IV or IM or subcutaneously**	Initially, morphine sulfate 2.5–10 mg every 4 hours, increased by 30–50% if pain persists	According to pain **There is NO ceiling dose** See Section 20.	Give laxative to avoid constipation unless diarrhoea. Excessive dosage can reduce respiratory rate.

8.2 Information on equivalence for interchangeability – corticosteroids

Table: Corticosteroid equivalents		
Steroid	**Equivalent dose**	**Half-life**
Hydrocortisone	100 mg	8–12 hours
Prednisone/prednisolone	25 mg	12–36 hours
Methylprednisolone	20 mg	12–36 hours
Dexamethasone	4 mg	36–54 hours

Table: Classification of potencies of topical corticosteroids and interchangeability			
Mild		**Potent**	
hydrocortisone	0.5%, 1%	betamethasone	0.05%
hydrocortisone acetate	0.5%, 1%	dipropionate	0.1%
		betamethasone valerate	0.1%
		hydrocortisone butyrate	0.1%
		mometasone furoate	0.1%
		triamcinolone acetonide	
Moderate		**Very potent**	
betamethasone valerate	0.02%, 0.05%	clobetasol propionate	0.05%
clobetasone butyrate	0.05%		
triamcinolone acetonide	0.02%		

8.3 Iron content of different iron salts

Iron salt	Amount	Content of ferrous iron
Ferrous fumarate	200 mg	65 mg
Ferrous gluconate	300 mg	35 mg
Ferrous sulfate	300 mg	60 mg
Ferrous sulfate, dried	200 mg	65 mg

8.4 Summary of medicines/therapies in adolescents and adults

Note: These summaries do not include dosing or administration to children less than 10 years of age.

References to Sections in this manual are in parentheses.

Medicines not included in the WHO Model Formulary are in italics.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Acamprosate Maintenance of abstinence in alcohol dependence (16.5)	***Tablet: 333 mg enteric coated*** >55 kg: 2 tablets 3 times daily. <55 kg: 2 tablets twice daily	**Common:** Pruritus, maculo-papular rash; diarrhoea; changes in libido **Infrequent or rare:** Nausea, vomiting, abdominal pain; bullous skin reactions, angioedema, anaphylactic reactions	**Pregnancy/breastfeeding:** Not recommended during pregnancy or breastfeeding. **Use with caution:** Renal or hepatic impairment (give lower doses) Does not alter CNS effects of drinking alcohol or withdrawal symptoms
Acetazolamide Pre-operative treatment of acute angle-closure glaucoma (10.12.2) (**Other indications:** Adjunctive treatment of chronic open-angle glaucoma)	***Tablet: 250 mg*** Oral: Initially 250 mg then 500-750 mg per day in divided doses until patient reaches referral care.	**Common:** Paresthesia (of hands, face, feet, or mucocutaneous junctions), fatigue, drowsiness, depression, decreased libido, bitter or metallic taste; nausea, vomiting, abdominal cramps, diarrhoea, black faeces; polyuria, renal stones; metabolic acidosis, hypokalaemia, hyponatraemia **Infrequent or rare:** Transient myopia; Stevens-Johnson syndrome; aplastic anaemia (especially in the first 6 months), thrombocytopenia, agranulocytosis, neutropenia	**Pregnancy/breastfeeding:**Avoid in first trimester of pregnancy. **Contraindications:** Hypokalaemia, hyponatraemia, acidosis, severe renal impairment, severe hepatic impairment, chronic angle-closure glaucoma (may mask deterioration) **Use with caution:** In the elderly, diabetes mellitus, gout, history of renal stones, sulfonamide allergy **Counselling:** Take tablets with meals to reduce the risk of stomach upset.
Acetylcysteine Paracetamol overdosage (3.8.1)	***Injection: 200 mg/ml (intended for antidotal, not mucolytic, use) Oral: 100 mg/ml*** IV: Initially 150 mg/kg over 15 minutes; then 50 mg/kg over 4 hours; then 100 mg/kg over 16 hours Oral: Loading dose of 140 mg/kg; THEN 4 hours after loading dose, initiate maintenance dose of 70 mg/kg administered at 4-hour intervals for 17 doses. Continue until 72 hours post-ingestion (longer if LFTs abnormal).	**Common:** Flushing, urticaria, itch **Infrequent or rare:** Anaphylactoid or hypersensitivity-like" reactions including angioedema, bronchospasm/ respiratory distress, hypotension, and, rarely, tachycardia or hypertension. Usually occur 15–60 minutes after start of infusion. (Manage by reducing infusion rate or suspending infusion until reaction has settled; stop infusion if severe anaphylaxis occurs; rash – use an antihistamine; acute asthma – use short-acting beta2 agonist such as salbutamol.) Once an anaphylactoid reaction is under control, infusion can normally be restarted at the lowest infusion rate (100 mg/kg in 1 litre over 16 hours).	**Pregnancy/breast feeding:** Clinical experience indicates that use of acetylcysteine for treatment of paracetamol overdose is effective and benefits outweigh risks. **Use with caution:** In patients with asthma or history of bronchospasm, but do not delay acetylcysteine treatment **Administration:** IV: Dilute requisite dose in glucose intravenous infusion 5% as follows: initially 200 ml given over 15 minutes, then 500 ml over 4 hours, then 1 litre over 16 hours. Oral: Dilute to a 5% solution in soda pop, juice, or water prior to oral or nasogastric administration. **Storage:**A change in the colour of the solution to light purple has sometimes been noted; this colour change is not thought to indicate significant impairment of safety or efficacy. Store below 25°C.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Acetylsalicylic acid (aspirin) Acute coronary syndrome/ myocardial infarction (Quick Check page 20) Mild to moderate pain (20.2, 2.4); fever (10.1.2) (**Other indications:** acute ischaemic stroke; prophylaxis of cerebrovascular disease or myocardial infarction; acute migraine attack; inflammatory arthritis)	***Tablet: 100 mg, 300 mg*** Oral: 300 mg (preferably chewed or dispersed in water) given immediately as a single dose 300 mg–600 mg every 4 hours as needed; higher doses (900mg) may be useful for analgesia in some patients; maximum 4 grams in 24 hours	**Common:** Gastrointestinal irritation with slight blood loss, tinnitus; deafness (large doses), nausea, dyspepsia, vomiting, increased bleeding time, headache, dizziness **Infrequent or rare:** Steven Johnson syndrome, iron deficiency anaemia, renal impairment, oesophageal ulceration, major GI bleeding, blood dyscrasias, Reyes syndrome. Allergy, bronchospasm angioedema, urticaria or rhinitis in hypersensitive patients (particularly in people with asthma) * If overdose, see Section 3.8.	**Pregnancy/breastfeeding:** Precautions in the first and second trimesters – low doses probably not harmful. Consider alternative for analgesia. Use not recommended in third trimester due to impaired platelet function and risk of haemorrhage. Delayed onset and increased duration of labour with increased blood loss; avoid analgesic doses if possible in last few weeks (low doses probably not harmful); with high doses, closure of fetal ductus arteriosus *in utero* and possibly persistent pulmonary hypertension of newborn; kernicterus in jaundiced neonates. **Breastfeeding:** Short course safe in breastfeeding at usual dosage (monitor infant, regular use of high doses could produce hypoprothrombinaemia in infant if neonatal vitamin K stores low; possible risk of Reye syndrome; avoid breastfeeding 1–2 hours after dose to minimise infant exposure. **Contraindications:** In hypersensitivity (including asthma, angioedema, urticaria or rhinitis) to acetylsalicylic acid or any other NSAID, active peptic ulceration, bleeding disorders, and in children and adolescents under 16 years (Reye syndrome) Not for treatment of gout **Use with caution:** in asthma, heart failure, uncontrolled hypertension, allergic disease, previous peptic ulceration, renal impairment, hepatic impairment, G6PD deficiency, dehydration, and in the elderly **Administration:** Give with food, large quantities (~240 ml) of water (unless fluid restricted) or milk to minimize gastric irritation. **Counselling:** If you develop swollen ankles, difficulty in breathing, black stools or vomit that looks like coffee grounds stop taking the medicine.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Aciclovir	***Tablet: 200 mg, 400 mg, 800 mg*** ***Oral suspension: 200 mg/5 ml*** ***Infusion: 250 mg vial*** ***Eye ointment: 3% W/W***	**Common:** Nausea, vomiting, diarrhoea, hallucinations (with high dose), headaches, lethargy, confusion, seizures **Infrequent or rare:** Hypersensitivity reactions; agitation, vertigo, dizziness, weakness; oedema, renal impairment; arthralgia; sore throat; abdominal pain, constipation; hepatitis, jaundice; blood disorders (anaemia, thrombocytopenia, leukopenia), Stevens-Johnson syndrome, toxic epidermal necrolysis, anaphylaxis Severe local inflammation on intravenous infusion	P**regnancy:** Precautions in the first trimester **Breastfeeding:** Considered safe **Use with caution:** In renal impairment, with concurrent administration of other nephrotoxic drugs, use of IV form in patients with underlying neurological abnormalities, in elderly patients **Administration:** Maintain adequate hydration with IV use (balance with risk of cerebral oedema in patients with encephalitis). Infuse IV dose over 1 hour to prevent renal damage. Ensure adequate fluid intake (1.5–2 litres/day), which should also be maintained with oral administration to prevent crystallization in the renal tubules. Changes in renal function during treatment usually respond to rehydration and/or dosage reduction. **Counselling:** Drink plenty of fluids (at least 1.5–2 litres/daily). Tablet can be dissolved in water if desired. If taking 5 times daily, take every 4 hours during waking hours.
Herpes simplex virus (HSV); genital herpes, initial or recurrent episode (11.15)	Oral: 400 mg 3 times daily OR 200 mg 5 times daily for 7–10 days (longer if new lesions appear or incomplete healing)		
Prophylaxis for recurrent herpes simplex (chronic suppression)(11.15)	Oral: 200 mg 3–5 times daily OR 400 mg twice daily Interrupt every 6–12 months for reassessment.		
HSV encephalitis or hepatitis (11.15)	IV: 10 mg/kg 3 times daily for 14–21 days		
HSV oesophagitis (11.15, 10.7b.3):	Oral: 200 mg 5 times daily OR 400 mg 3 times daily for 7–10 days		
• If NOT immuno-compromised	Oral: 400 mg orally 5 times daily for 14–21 days		
• If immuno-compromised	Oral: 400 mg twice daily AND ART		
• HSV oesophagitis suppression	See dosing in 11.45.1		
Varicella (chickenpox) (11.45.1) Herpes zoster (shingles) (11.45.2)	Oral: 800 mg 5 times daily for 7 days (begin within 72 hours of appearance of rash to be effective) AND 3% eye ointment every 4 hours if ophthalmic involvement		
Herpes keratitis (10.12.2)	Apply 1 cm ointment 3% directly to eye 5 times daily; continue for at least 3 days after healing is complete. OR oral aciclovir 400 mg 5 times daily until healing is complete		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Albendazole	***Tablet: 400 mg (chewable)***	**Common:** During treatment of neurocysticercosis, neurological symptoms (fever, headache, worsening of disease, probably due to CNS reaction to dying parasites) **Infrequent or rare:** GI intolerance, increase in liver enzymes, reversible alopecia, rash, reversible leukopenia, bone marrow suppression (pancytopenia, aplastic anaemia, agranulocytosis), Stevens-Johnson syndrome	**Pregnancy/breastfeeding:** Recommended for use only during the second and third trimesters of pregnancy and only when there are no alternatives and benefit outweighs risk. **Administration:** Check liver function tests and blood counts before longer-term treatment and twice during each cycle (every 2 weeks). Cease therapy if enzymes greater than twice normal limit. **Counselling:** Chew and take on an empty stomach. **Contraindications:** Do not co-administer ivermectin if onchocerciasis or loaisis are co-endemic with filariasis.
Strongyloidiasis (if ivermectin not available) (11.36)	Oral: 400 mg twice daily for 3 days (consider longer course in immunocompro-mised patients). THEN maintenance at 400 mg monthly.		
Cysticercosis, as alternative to praziquantel in uncomplicated cases (11.7)	Oral: 15 mg/kg daily for 8 days		
Filariasis (11.12)	Oral: 400 mg as a single dose + diethyl-carbamazine OR albendazole 400 mg/twice daily for 2 weeks + ivermectin as a single dose		
Ascaris (10.7), hookworm (10.18) • Treatment • Prophylaxis	Oral: 400 mg as a single dose Oral: 400 mg as a single dose every 6 months		
Amiloride	**Tablet: 5 mg**	**Common:** Hyperkalaemia, hyponatraemia, hypochloraemia (especially when combined with thiazide diuretics), weakness, headache, nausea/vomiting, constipation, impotence, dizziness, muscle cramps **Infrequent or rare:** Diarrhoea, anorexia, dry mouth, abdominal pain, flatulence, polyuria, rash, pruritus, visual disturbances, mild psychiatric disturbances, palpitations	**Pregnancy/breastfeeding:** Not recommended in pregnancy or breastfeeding; consider alternatives. **Contraindications:** Hyperkalaemia, renal failure **Use with caution:** In the elderly, debilitated patients with cardiopulmonary disease or uncontrolled type 1 diabetes; in patients with cirrhosis, may precipitate renal failure, hyperchloraemic metabolic acidosis, hepatic encephalopathy; with medicines that can increase potassium concentration (ACE inhibitors) **Counselling:** Take in the morning. Dizziness with standing may occur.
Oedema (10.4.4) (**Other indications:** Liver cirrhosis)	Oral: 10 mg daily in 1–2 divided doses; give in combination with furosemide		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Amitriptyline Depression (10.11.6); neuropathic pain (10.10a); herpetic neuralgia (11.45)	***Tablet: 25 mg, 50 mg*** Oral: Start 50 mg at bedtime AND Increase gradually as necessary by 25–50 mg every 1–2 weeks to 100–150 mg daily. Maximum dose of 200 mg daily for depression; up to 300 mg for neuropathic pain (single dose, preferably at bedtime or in divided doses). Note: delay in onset of effect For elderly and medically ill: Start at 25 mg at night, can be increased gradually to maximum tolerated dose of 100 mg per day	**Common:** Orthostatic hypotension (fall risk), dizziness, sedation, dry mouth, constipation, nausea, difficulty urinating, blurred vision, headache, confusion, disorientation, increased liver enzymes, worsening depression, anxiety, insomnia, ejaculatory problems, impotence, appetite and weight changes **Serious side-effects:** Cardiac arrhythmias, heart attack, stroke, seizures, hyperthermia, heat stroke, mania/hypomania If overdose, see Section 3.8.	**Pregnancy:** Manufacturer advises against use unless essential, particularly during first and third trimesters. **Breastfeeding:** Use with caution if indicated and if the drug of choice; reversible withdrawal symptoms and adverse effects possible (monitor infant for drowsiness). Preferably, give as a single nightly dose after breastfeeding. **Contraindications:** Patient has taken an MAO-I within 2 weeks, recent myocardial infarction, arrhythmias (especially heart block), bipolar disorder, severe liver disease. Do not use in adolescents. **Use with caution:** In elderly, patients with cardiac history; epilepsy, hepatic impairment, thyroid disease, pheochromocytoma, history of mania, psychoses, angle-closure glaucoma, history of urinary retention, concurrent electroconvulsive therapy, anaesthesia. May increase the risk of suicidal thinking and behaviour. Prone to multiple significant drug interactions. **Counselling:** Blurred vision and dry mouth may be troublesome but may lessen or disappear after about 7 days. Try to take it at night to reduce daytime drowsiness. You may feel dizzy on standing when taking this medicine; get up gradually from sitting or lying to minimize this effect. Avoid driving and operating machinery until you know how you react to this medicine. Do not stop taking the medicine suddenly. If you suddenly stop taking amitriptyline, you may experience withdrawal symptoms such as nausea, headache, and lack of energy. Your clinician will probably decrease your dose gradually. May increase the effects of alcohol.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Amoxicillin	***Tablet/capsule: 250 mg, 500 mg Powder for oral liquid: 125 mg/5 ml***	**Common:** Nausea, vomiting, diarrhoea; hypersensitivity reaction (discontinue if severe rash, urticaria, wheezing); superinfection including candidiasis **Infrequent or rare:** Fever, erythema, exfoliative dermatitis, angioedema, *C. difficile* colitis, anaphylaxis, bronchospasm, interstitial nephritis, serum sickness-like syndrome, haemolytic anaemia, toxic epidermal necrolysis, erythematous rashes (common in glandular fever, lymphocytic leukaemia, cytomegalovirus infection, Epstein-Barr virus infection, possibly HIV)	**Pregnancy**: Not known to be harmful **Breastfeeding:** Considered safe **Contraindications:** Known hypersensitivity/ anaphylaxis to penicillins or other beta-lactams **Use with caution:** If history of allergy or renal impairment. Maintain adequate hydration with high doses (risk of crystalluria). Reduce dose if severe renal failure. **Counselling:** Swallow the capsule whole with a glass of water at the start of a meal or slightly before.
Non-severe pneumonia (10.6.3)	Oral: 500–1000 mg 3 times daily for 5–7 days		
Sinusitis (11.35)	Oral: 1 gram 3 times daily for 7 days		
Non-severe cutaneous anthrax (10.2.10)	Oral: 500 mg every 8 hours for 7–10 days		
Refractory gastritis/ PUD–eradication regimen for documented *H. pylori* infection (10.7a.2)	Oral: 1 g twice daily AND clarithromycin AND omeprazole for 1 week		
Dental abscess (10.17.5) and peritonsillar abscess (10.17.9)	Oral: 500 mg to 1 g 3 times daily for 5–7 days AND metronidazole		
(**Other indications:** Bronchitis; otitis media; osteomyelitis; endocarditis prophylaxis; post-splenectomy prophylaxis)			

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Amoxicillin with clavulanic acid (co–amoxiclav) Doses are based on amoxicillin component. Septic abortion (10.15.6) Lower urinary tract infection (11.44) Dental abscess (10.17.5); peritonsillar abscess (10.17.9) Cholecystitis (10.7a) Sinusitis (11.35) (**Other indications**: Otitis media; cellulitis)	***Tablet/capsule: amoxicillin 500 mg + clavulanic acid 125 mg; amoxicillin 875 mg + 125 mg clavulanic acid*** Oral: 500 mg 3 times daily for 5 days (double in severe infections) Oral: 500 mg 3 times daily for 3–7 days Oral: 500 mg 3 times daily or 875 mg every 12 hours for 14 days. Oral: 1 g 3 times daily or, if severe, 4 times daily 875 mg twice daily for 7 days	**Common:** Transient increase in liver enzymes and bilirubin See amoxicillin. **Infrequent or rare:** Acute generalised exanthematous pustulosis; very rarely hepatic events have been reported, predominantly in males and elderly patients; these may be associated with prolonged treatment. In some cases may not become apparent until several weeks after treatment has ceased. These are usually reversible.	**Pregnancy/breastfeeding:** Not known to be harmful. **Breastfeeding:** Considered safe. **Contraindications**: Known severe hypersensitivity to penicillins or other beta-lactams **Use with caution:** In history of mild hypersensitivity to beta-lactams, renal impairment, hepatic impairment **Administration:** Renal dose adjustment required (do not use high doses with CrCl ≤30 ml/hour). 875 mg orally every 12 hours can be substituted for 500 mg orally every 8 hours. **Counselling:** To minimize stomach upset, take at the start of a meal.
Amphotericin B (conventional) Cryptococcosis (11.5) Histoplasmosis (moderate–severe) (11.16); penicilliosis (moderate–severe) (11.29) Visceral and cutaneous leishmaniasis (11.20) (**Other indications:** disseminated deep fungal infections)	***Infusion, intravenous: 50 mg vial (dissolve 50 mg in 10 ml sterile water and make up to 500 ml with 5% glucose to give 100 mcg/ml)*** See Section 11.5 for dosing and administration. IV: 0.7 mg/kg until clinical improvement (usually 14 days) THEN itraconazole maintenance therapy See Section 11.20	**Common:** Acute infusion reactions (fever, chills, headache, hypotension) – these become less frequent over time; thrombophlebitis, anaemia, nephrotoxicity (major dose-limiting toxicity); hypokalaemia, hypomagnesaemia **Infrequent or rare:** Anaphylaxis occurs rarely with any IV amphotericin product. Headache, anorexia, weight loss, nausea, vomiting, diarrhoea; muscle and joint pain; cardiovascular toxicity (arrhythmias and cardiac arrest, due to rapid infusion and electrolyte disturbances); neurological disorders, abnormal liver function (discontinue treatment)	**Pregnancy/breastfeeding:** Use with caution in pregnancy or breastfeeding, if clinically indicated. Available safety data are limited. **Use with caution:** In renal impairment use liposomal amphotericin if possible (see Section 11.5). **Administration:** Follow instructions in Section 11.5. Give via D5W IV infusion (incompatible with NS, 1/2 NS, other saline-containing solutions, or preservatives) over 2 to 6 hours. Infusion time may be reduced to approximately 1 hour in patients who tolerate treatment well. If the patient experiences discomfort during infusion, the duration of infusion may be increased. Existing IV line should be flushed with D5W prior to infusion (if not feasible, administer through a separate line).

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Amphotericin B (liposomal) Visceral and cutaneous leishmaniasis (11.20) Cryptococcal meningitis in patients with renal impairment (11.5)	***Injection, powder for reconstitution: 50 mg (contains soy, sucrose 900 mg)*** See Section 11.20 for dosing. See Section 11.5 for dosing.	See conventional amphotericin B. Incidence of decreased renal function and infusion-related events are lower than with conventional amphotericin B. For a patient who experiences chills, fever, hypotension, nausea, or other nonanaphylactic infusion-related reactions, premedicate with the following drugs 30–60 minutes prior to drug administration: paracetamol OR hydrocortisone 50–100 mg.	If available, liposomal amphotericin B should be used instead of conventional amphotericin B in patients with renal failure; or switch from amphotericin B if renal impairment develops. Available at decreased cost through WHO-Gilead partnership for leishmaniasis (see http://www.gilead.com/visceral_leishmaniasis). **Pregnancy/breastfeeding:** Use with caution in pregnancy or breastfeeding, if clinically indicated. Available safety data are limited. **Use with caution:** In renal impairment; continue to monitor electrolytes and renal function tests despite lower incidence of adverse renal effects than with conventional amphotericin. **Administration:** See conventional amphotericin B.
Ampicillin Severe infections (septic abortion (10.15.6); septic shock (3.1.5); upper urinary tract infection (pyelonephritis) (11.44) Empirical therapy for meningitis, if ceftriaxone not available (10.10b.3) Initial empirical antibiotics for emergency management (QC p. 19) Cholangitis (10.7a.2), peritonitis (10.7a.2) Listerial meningitis (10.10b.3) Leptospirosis (11.22) (**Other indications:** Mastoiditis; osteomyelitis)	***Injection: 500 mg vial, 1 g vial*** IM/IV: 250 mg/kg daily, divided every 4 hours (range 6–12 g/day) AND gentamicin for 10–14 days AND, for septic abortion, clindamycin IM/IV: 250 mg/kg daily divided every 4 hours (range 6–12 g/day) AND gentamicin + cotrimoxazole for 10–14 days IM/IV: 2 g in a single dose AND gentamicin 240 mg IV: 2 g every 4 hours AND gentamicin + metronidazole for 10–14 days IV: 2 g IV every 4 hours for at least 21 days PLUS gentamicin IV: 500 mg to 1 g every 6 hours for 7 days	**Common:** Nausea, vomiting, diarrhoea **Infrequent or rare:** Haemolytic anaemia, interstitial nephritis, blood disorders, *C. difficile* colitis Hypersensitivity reaction (discontinue if severe), anaphylaxis	**Pregnancy:** Not known to be harmful. **Breastfeeding:** Considered safe **Contraindications:** Severe hypersensitivity to penicillins and other beta-lactams **Use with caution:** In mild hypersensitivity to beta-lactams with renal impairment. Erythematous rashes common in glandular fever, lymphocytic leukaemia, Epstein-Barr virus, cytomegalovirus infection. **Administration:** Injection contains 2.7 mmol (62 mg) sodium/gram. Reduce dose in severe renal failure.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
ANTIRETROVIRALS for HIV infection Note: antiretroviral therapy must include at least 3 ARVs. See Sections 13 and 14.			
Abacavir (ABC) Antiretroviral (13, 14)	***Tablet: 300 mg*** ***Oral liquid: 100 mg/ml*** Oral: 300 mg twice daily or 600 mg once daily If hepatic impairment (mild), 200 mg twice daily (maximum)	**Common:** Nausea, vomiting, diarrhoea **Infrequent or rare:** Life-threatening hypersensitivity reactions, blood disorders, lipodystrophy, lactic acidosis	**Pregnancy/breastfeeding:** Limited safety data available, but continuation of antiretroviral therapy throughout pregnancy is recommended. Potential alternate if AZT and TDF are not tolerated during pregnancy. **Use with caution:** In hepatic disease. Can lead to potential life-threatening lactic acidosis. Safe to use after lactic acidosis. Do not use after ABC hypersensitivity reactions.
Atazanavir + ritonavir (ATV/r) Antiretroviral (13, 14)	***Capsule 300 mg atazanavir; capsule ritonavir 100 mg*** Oral: 300 mg ATV and 100 mg ritonavir once daily	**Common:** Diarrhoea; indirect hyperbilirubinaemia, clinical jaundice, hyperglycaemia, fat maldistribution; nephrolithiasis; prolonged PR interval – first-degree symptomatic AV block in some patients	**Pregnancy/breastfeeding:** Generally safe **Use with caution:** In haemophilia: possible increased bleeding episodes **Administration:** Take both at same time with food
Didanosine (ddI) Antiretroviral (13, 14)	***Capsule: 400 mg*** Oral: 250 mg once daily if <60 kg; 400 mg once daily if >60 kg Ensure sufficient antacid from buffered tablets at least 1 hour before food or on empty stomach	**Common:** Nausea, vomiting, diarrhoea, **Infrequent or rare:** Acute pancreatitis, lactic acidosis, peripheral neuropathy, lipodistrophy, hyperuricaemia	**Pregnancy/breastfeeding:** Lactic acidosis with hepatic steatosis may be more frequent in pregnant women. Should be used during pregnancy only if there is NO alternative. **Contraindications:** Do not use with stavudine (d4T). **Use with caution:** In renal or hepatic impairment; see dose adjustment in Section 11.31.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Efavirenz (EFV) Antiretroviral (13, 14)	***Capsule: 100 mg, 200 mg*** ***Tablet: 600 mg*** ***Oral solution: 150 mg/5 ml*** Oral: 600 mg once daily See Section 14 for use of EFV as ARV prophylaxis against MTCT of HIV.	**Common:** Hypersensitivity reaction; Rash – generally mild, often resolves within 3–5 days without need to change ART (but discontinue if severe) Often self-limiting CNS toxicities: Insomnia, abnormal dreams; less commonly, persistent and severe CNS toxicity (depression, confusion) Hepatic toxicity: Elevated liver enzymes (if seropositive for hepatitis B or C) Hyperlipidaemia; male gynaecomastia; potential teratogenicity (first trimester of pregnancy) Infrequent or rare: Stevens-Johnsons syndrome	**Pregnancy/breastfeeding:** Potential risk of teratogenicity in first trimester. Safe after first trimester. Provide effective contraceptives after delivery. Discuss risk and benefit of using EFV with women who are planning to become pregnant or who may become pregnant. If a woman is diagnosed as pregnant before 28 days of gestation or plans to become pregnant, EFV should be stopped and NVP or a PI substituted. There is no indication for termination of pregnancy in women exposed to EFV in the first trimester. Provide effective contraceptive for women of reproductive age who are taking EFV and choose to avoid conception. **Use with caution:** In hepatic impairment (avoid if severe), severe renal impairment, elderly, history of mental illness or substance abuse. Rash usually resolves within 3-5 days, but discontinue ART and monitor AST or ALT if rash severe or if accompanied by blisters, desquamation, involvement of mucous membranes, or fever; seek urgent medical care. See Section 13. Seek urgent medical care also in severe CNS toxicities or if depression, confusion occurs. **Contraindications:** History of severe psychiatric illness **Administration:** Take at bedtime on an empty stomach. Suggested substitution **if not tolerated:** NVP, or bPI if neither NNRTI is tolerated; or triple NRTI if no other options
Emtricitabine (FTC) Antiretroviral (13)	***Capsule: 200 mg*** ***Oral liquid: 10 mg/ml*** Oral: 200 mg once daily	**Common:** Nausea/vomiting, abdominal pain, diarrhoea, headache, peripheral neuropathy	**Pregnancy/breastfeeding:** There is limited experience with use during pregnancy. **Use with caution:** In renal impairment, hepatic disease **Active against HBV** (see **Section 11.14**)

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Lamivudine (3TC) Antiretroviral (13, 14)	***Tablet: 150 mg*** ***Oral solution: 50 mg/5 ml*** Oral: 150 mg twice daily OR 300 mg once daily See Section 14 for use as ARV prophylaxis against MTCT of HIV.	**Common:** Well tolerated; occasional nausea and diarrhoea, pancreatitis	**Pregnancy/breastfeeding:** Favourable safety profile **Active against HBV** (see Section 11.14)
Nevirapine (NVP) Antiretroviral (13, 14)	***Tablet: 200 mg*** Oral: 200 mg once daily for first 14 days; THEN (if no rash present) 200 mg twice daily See Section 14 for use as ARV prophylaxis against MTCT of HIV.	**Common:** Nausea and vomiting, rash (including Stevens-Johnson syndrome) **Infrequent or rare:** Toxic epidermal necrolysis, hepatotoxicity jaundice, abdominal pain, diarrhoea, hypersensitivity reactions	**Pregnancy/breastfeeding:** Avoid using in pregnant women with CD4 count >350. In women with CD4 count of 250–350 increased risks of maternal hepatotoxicity; use, with close monitoring, as benefit exceeds risk in those who require ART. **Contraindications:** Severe hepatic failure, pregnancy with CD4 >350 **Use with caution:** In hepatic impairment or history of chronic hepatitis; monitor liver function. **Counselling:** Advise patients about the signs or symptoms of hypersensitivity reactions. Seek immediate medical attention if such symptoms develop.
Lopinavir + ritonavir (LPV/r) Antiretroviral (13, 14)	***Tablet: Fixed dose combination of (LPV 200 mg + RTV 50 mg) and (LPV 100 mg + RTV 25 mg)*** Oral: LPV 200 mg + RTV 50 mg (2 tablets) twice daily In patients taking rifampicin, use ritonavir super-boosting (LPV 400 mg + RTV 400 mg OR LPV 800 mg + RTV 200 mg) twice daily.	**Common:** GI intolerance, nausea, vomiting, diarrhoea, headache **Infrequent or rare:** Hyperlipidaemia (especially hypertriglyceridaemia), elevated transaminases, hyperglycaemia, fat maldistribution, PR interval prolongation, QT interval prolongation, torsade de pointes, lipodystrophy	**Pregnancy/breastfeeding:** Continuation of antiretroviral therapy throughout pregnancy is recommended; close monitoring of blood glucose recommended, as risk of pregnancy-related hyperglycaemia may be increased. **Use with caution:** Close clinical and hepatic enzyme monitoring needed in patients taking ritonavir super-boosting. **Administration:** Possible increased bleeding episodes in patients with haemophilia **Suggested substitute:** ATV/r

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Saquinavir (SQV) Antiretroviral (13, 14)	***Capsule: 200 mg*** Oral: 1 g twice daily (with 100 mg ritonavir booster)	**Common:** Diarrhoea, headache, increased transaminases, dyslipidaemia, hyperglycaemia, buccal and mucosal ulceration, unconjugated hyperbilirubinaemia	**Pregnancy/breastfeeding:** Continuation of antiretroviral therapy throughout pregnancy is recommended; close monitoring of blood glucose recommended, as risk of pregnancy-related hyperglycaemia may be increased. **Use with caution:** In severe hepatic impairment **Administration:** Take with a fatty meal or up to 2 hours after meal. Avoid garlic capsules, which reduce plasma saquinavir concentration)
Tenofovir (TDF) Antiretroviral (13, 14)	***Tablet: 300 mg*** Oral: 300 mg tablet once daily	**Common:** Nausea, vomiting, diarrhoea, abdominal pain, headache, dizziness **Infrequent or rare:** Renal insufficiency, Fanconi syndrome, hypertriglyceridaemia, osteomalacia. Severe acute exacerbation of hepatitis may occur in HBV co-infected patients who discontinue TDF.	**Pregnancy/breastfeeding:** Concern of HBV flare if HBV–HIV co-infected mother stops the medication postpartum. Limited data available on potential maternal and infant bone toxicity. **Contraindication:** Renal impairment **Use with caution:** In underlying renal disease, age >40 years, BMI <18.5 (or body weight <50 kg), diabetes mellitus, hypertension, concomitant use of a bPI or nephrotoxic drug **Administration:** Do not use with ddI (levels increased). **Active against HBV** (see Section 11.14)
Zidovudine (ZDV, AZT) Antiretroviral (13, 14)	***Capsule: 250 mg*** Oral: 250–300 mg twice daily See Section 14 for use as ARV prophylaxis against MTCT of HIV.	**Common:** Nausea, vomiting, diarrhoea, headache, fatigue, myalgia **Infrequent or rare:** Bone marrow suppression (macrocytic anaemia, neutropenia); pancreatitis, lactic acidosis with hepatic steatosis, CNS problems, insomnia, pigmentation of nails, skin, oral mucosa	**Pregnancy/breastfeeding:** Well tolerated, risk of anaemia **Contraindications:** Abnormally low neutrophil counts or severe anaemia (Hb <7.0 g/dl and/or ANC <750 cells/mm^3); high risk for anaemia and neutropaenia if CD4 count <200, BMI <18.5 (or body weight <50 kg), anaemia at baseline. **Use with caution:** In vitamin B12 deficiency, renal or hepatic impairment, elderly patients

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Artemether Severe malaria (note: IV artesunate is preferred) (QC, p.20 and 11.25)	***Injection: 80 mg/ml in 1 ml ampoule*** Loading dose: IM (in anterior thigh): 3.2 mg/kg then 1.6 mg/kg daily until patient can take oral. Start appropriate oral treatment as soon as tolerated and give full course (see Section 11.25).	**Common:** Refer to artesunate. Neurotoxicity has been reported in animal studies, particularly with very high doses of intramuscular artemether, but has not been substantiated in humans.	**Pregnancy:** Both artesunate and quinine may be considered as options for the treatment of severe malaria during pregnancy. See note under artesunate **Use with caution:** In all patients, artemether IM should only be used if parenteral formulations of artesunate or quinine are not available, as its absorption may be erratic.
Artemether + lumefantrine Uncomplicated *P. falciparum* malaria, first-line (11.25)	***Co-formulated tablets of 20 mg artemether + 120 mg lumefantrine*** Oral: 80 mg artemether and 480 mg lumefantrine twice daily for 3 days	**Common:** Abdominal pain, anorexia, diarrhoea, nausea/vomiting, palpitation, cough, headache, dizziness, sleep disturbances, asthenia, arthralgia, myalgia, pruritus, rash, QT prolongation **Infrequent or rare:** Paraesthesia, ataxia, hypoaesthesia, increased liver transaminases	**Pregnancy/breastfeeding:** Not recommended in first-trimester pregnancy unless no other treatment immediately available. **Contraindications:** History of arrhythmias, clinically relevant bradycardia, or CHF with reduced LV ejection fraction; family history of sudden death or prolonged QT interval. **Administration:** Lumefantrine absorption is enhanced by co-administration with fat. **Counselling:** Take this ACT immediately after a meal or drink containing at least 1.2 g fat. Dizziness may impair ability to perform skilled tasks such as operating machinery and driving.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Artesunate Severe malaria (QC p. 20, 11.25.5)	***Injection: 60 mg ampoule with separate ampoule of 5% sodium bicarbonate*** IM/IV: 2.4 mg/kg on admission AND repeat at 12 hours, 24 hours; then once daily. Start appropriate oral treatment as soon as tolerated, and give full course. See Section 11.25.5.	Generally well tolerated **Infrequent or rare:** Mild gastrointestinal disturbances, dizziness, tinnitus, reticulocytopenia, neutropenia, elevated liver enzyme values, ECG abnormalities (bradycardia, prolongation of the QT interval), Type 1 hypersensitivity reactions in approximately 1 in every 3000 patients. Post-treatment hemolysis has been observed with high cumulative doses. (Patients should be monitored for signs of hemolysis after parasitologic cure.)	**Pregnancy/breastfeeding:** Both artesunate and quinine may be considered as options for the treatment of severe malaria during pregnancy. Treatment must not be delayed; so, if only one of the drugs artesunate, artemether, or quinine is available, then that should be started immediately. Give quinine if possible during first trimester; for second and third trimesters, artesunate is preferred, as it is for all adolescents and adults. **Use with caution:** In patients who must perform skilled tasks, such as operating machinery or driving, that would be impaired by dizziness. **Administration:** The solution should be used immediately after the powder is dissolved. It should not be used for intravenous infusion if the solution appears cloudy or if sediment is present.
Artesunate + amodiaquine Uncomplicated *P. falciparum* malaria, first-line (11.25)	***Co-formulated tablets of artesunate + amodiaquine, 25/67.5 mg, 50/135 mg, or 100/270 mg. Blister packs of separate scored tablets also exist.*** Oral: 200 mg artesunate and 540 mg amodiaquine fixed-dose combination once daily for 3 days	**Common:** Anorexia, abdominal pain, nausea; somnolence, insomnia; cough. **Infrequent or rare:** Weakness, anaemia, vertigo. Amodiaquine (at higher doses and/or during prolonged treatment) may lead to leukopenia and neutropaenia, agranulocytosis; nervous system disorders. **Rare:** Neuromyopathy, transient accommodation disorders, corneal opacification (regresses once treatment stops) but, very rarely, irreversible retinopathy; hepato-biliary disorders: severe, sometimes fatal hepatitis; slate-gray pigmentation of the skin, notably affecting the fingers and mucous membranes.	**Pregnancy:** Not recommended in first-trimester pregnancy unless no other treatment immediately available **Breastfeeding:** No data available on the excretion of artesunate/amodiaquine fixed-dose combination in breast milk. Continuation can be considered while taking into account safety profile of artesunate/amodiaquine fixed-dose combination tablets. **Contraindications:** Previous hypersensitivity to amodiaquine or artesunate, history of liver toxicity or neutropenia during treatment with amodiaquine, retinopathy (in cases of frequent treatment) **Use with caution:** Avoid if possible in PLHIV on zidovudine or efavirenz. **Counselling:** Somnolence, dizziness, or weakness may occur. May impair ability to perform skilled tasks such as operating machinery and driving.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Artesunate + sulfadoxine–pyrimethamine Uncomplicated *P. falciparum* malaria, first-line (11.25)	***Co-blistered, scored tablets of 50 mg artesunate and tablets of 500 mg sulfadoxine + 25 mg pyrimethamine*** Oral: 200 mg artesunate once daily for 3 days AND 1500 mg/75 mg sulfadoxine- pyrimethamine as a single dose on day 1	**Common:** Nausea/vomiting, anorexia, diarrhoea **Infrequent or rare:** See cotrimoxazole.	**Pregnancy:** Not recommended in the first trimester unless no other treatment immediately available. **Breastfeeding:** Safe to use U**se with caution:** Do not choose this option if patient is taking cotrimoxazole prophylaxis. See cotrimoxazole.
Artesunate + mefloquine Uncomplicated *P. falciparum* malaria, first-line (11.25)	***Co-blistered, scored tablets of 50 mg artesunate and 250 mg base of mefloquine*** Oral: 200 mg artesunate once daily for 3 days AND 1500 mg mefloquine, usually split on days 2 and 3 (e.g. 4 tablets on day 2 and 2 on day 3)	**Common:** Nausea/ vomiting, diarrhoea, abdominal pain, anorexia, headache, dizziness, loss of balance, sleep disorders (abnormal dreams) **Infrequent or rare:** Neurological and psychiatric disturbances (convulsions, depression, hallucinations, panic attacks, emotional instability, aggression, suicidal ideation), cardiac conduction problems, muscle weakness/rash, disturbances in liver function tests	**Pregnancy:** Not recommended during the first trimester unless no other treatment immediately available. **Breastfeeding:** Safe to use **Contraindications:** Do not give mefloquine within 60 days of prior administration. History of neuropsychiatric disorders, epilepsy, hypersensitivity to quinine **Use with caution:** Avoid in severe hepatic impairment, cardiac conduction disorders. **Counselling:** May impair ability to perform skilled tasks such as operating machinery and driving. These effects may continue up to 3 weeks after the last dose.
Artesunate + clindamycin Uncomplicated *P. falciparum* malaria, first-line (11.25)	***See clindamycin and artesunate*** Oral: Artesunate 2 mg/kg once daily AND clindamycin 10 mg/kg twice daily for 7 days	See artesunate and clindamycin.	**Pregnancy:** Not recommended during the first trimester unless no other treatment available. **Breastfeeding:** See clindamycin.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Atropine Organophosphate poisoning (3.8.1) Beta-blocker overdose with hypotension (3.8.1) Beta-blocker overdose: prophylaxis before inserting NG tube (3.8.1) Block muscarinic effects of neostigmine (3.9.2) (**Other indications:** Bradycardia; heart block with hypotension)	***Injection: 1 mg (sulfate) in 1 ml ampoule*** IM/IV: Give bolus 1–3 mg (aim for clear lungs, stable blood pressure and dry mucous membranes) THEN double initial dose if no improvement at 5 minutes. See Section 3.8.1 for further treatment and monitoring. IV: 0.5–1 mg. Repeat every 3–5 minutes to a total dose of 0.04 mg/kg IV: 0.6 mg IV: 25–30 mcg/kg given 30–60 seconds before neostigmine administration	**Common:** Dry mouth, tachycardia, blurred vision, photophobia, constipation, urinary retention, flushing, delirium, fever **Infrequent or rare:** Vomiting, headache, paralytic ileus, rash, acute angle-closure glaucoma, seizures	**Pregnancy:** May be used at recommended doses. Can affect fetal heart rate. **Breastfeeding:** Use with caution in breastfeeding; monitor infant (e.g. drying of secretions, temperature rise). May suppress milk production. **Contraindications**: Angle-closure glaucoma. **Use with caution:** In Down syndrome, myasthenia gravis, pyloric stenosis, ileus, prostatic enlargement, cardiac disorders, hypoxia, and in the elderly. Patients with pyrexia and in warm environments: Monitor temperature and keep patients cool. Use may precipitate acute attack of angle-closure glaucoma, particularly in the elderly or long-sighted.
Atropine eye drops Iritis, uveitis; prereferral treatment for bacterial corneal infection (10.12.2) (**Other indications:** Cycloplegic refraction procedures)	***Solution (eye drops): 0.5%, 1% (sulfate)*** 1 drop (0.5% or 1% solution) up to 4 times daily	**Common:** Transient stinging, raised intraocular pressure, local irritation, hyperaemia, oedema, contact dermatitis, systemic toxicity (in very young and elderly)	**Precautions:** May cause sensitivity to light and blurred vision. **Contraindications**: Angle-closure glaucoma **Counselling:**Avoid skilled tasks, such as operating machinery or driving, until your vision is clear.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Azithromycin Uncomplicated genital chlamydial infections (10.15.4) Trachoma (10.12.5) Early syphilis (11.37) Mycobacterium avium complex (MAC) (11.27) Yaws (10.2.5)	***Capsule: 250 mg, 500 mg, 600 mg*** Oral: 1 g as a single dose (>45 kg) OR 20 mg/kg as a single dose (<45 kg) Oral: 20 mg/kg up to 1 g once annually AND tetracycline ointment Oral: 2 g once (do not use in PLHIV) Oral: 600 mg daily AND ethambutol for 6 months Oral: 30 mg/kg (maximum 2000 mg) single dose	**Common:** Nausea/ vomiting, diarrhoea, abdominal pain and cramps, headache, dizziness, drowsiness, candida infections, taste disturbances **Infrequent or rare:** Constipation, hepatitis, hepatic failure, syncope, insomnia, agitation, anxiety, asthenia, paraesthesia, hyperactivity, thrombocytopenia, haemolytic anaemia, interstitial nephritis, acute renal failure, photosensitivity, tooth and tongue discoloration, C. *difficile* colitis; hypersensitivity reactions including anaphylaxis	**Pregnancy/breastfeeding:** Use, with caution, in pregnancy or breastfeeding, if clinically indicated. Available data on safety are lmited. **Contraindications:** Hypersensitivity to macrolides **Use with caution:** In renal impairment, hepatic impairment; in combination with other medications that can prolong QT interval; myasthenia gravis **Administration:** Capsule should be taken on an empty stomach. Oral suspension can be taken with food. **Counselling:** Swallow whole at least 1 hour before or 2 hours after food. Do not take with aluminium or indigestion remedies containing magnesium.
Beclometasone inhaler Chronic asthma, COPD (10.6.4, 10.6.5)	***Inhalation: aerosol 50 mg per dose (dipropionate); 250 mg (dipropionate) per dose*** See Section 10.6 for dosing.	**Common:** Oropharyngeal candidiasis; cough, dysphonia; bruising, facial skin irritation following nebulisation **Infrequent or rare:** Adrenal suppression, growth retardation in adolescents, impaired bone metabolism, cataract, glaucoma with high doses or when combined with oral steroids, paradoxical bronchospasm, urticaria, rash, angioedema, sleep disorders, anxiety, behavioural changes	**Pregnancy:** Benefit of treatment greater than risk. Not known to be harmful. **Breastfeeding:** Considered safe **Use with caution:** If active or quiescent TB possible.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Benzathine benzylpenicillin Streptococcal pharyngitis (10.17.9) Secondary prophylaxis of rheumatic fever (11.32) Early syphilis (11.37) Late syphilis (11.37) Yaws (10.2.5)	***Injection: benzathine benzylpenicillin 1.8 g (equal to 2.4 million IU) in 5 ml vial*** IM: 900 mg (1.2 million IU) as a single dose IM: 900 mg (1.2 million IU) every 3–4 weeks IM: 1.8 g (2.4 million IU), divided between 2 sites, as a single dose IM: 1.8 g (2.4 million IU), divided between 2 sites, once weekly for 3 consecutive weeks IM: 900 mg (1.2 million IU) as a single dose	**Common:** Pain/inflammation at injection site **Infrequent or rare:** Hypersensitivity reactions, including anaphylaxis, haemolytic anaemia, interstitial nephritis, blood disorders, CNS toxicity, Jarisch-Herxheimer reaction	**Pregnancy:** Not known to be harmful. **Breastfeeding:** Considered safe (monitor infant) **Contraindications:** Severe hypersensitivity to penicillins or other beta-lactams **Use with caution:** With history of allergy, renal failure, heart failure. **Administration:** Given by deep IM injection only. Give doses of more than 900 mg as two injections at separate sites. Do not give IV. Avoid intrathecal injection.
Benznidazole Chagas disease (11.42)	***Tablet: 100 mg*** Oral: 5 mg/kg daily, divided in 2 or 3 daily doses, over 60 consecutive days (maximum 300 mg/day)	**Common:** Dermatitis with cutaneous eruptions (rash and rash erythematous); generalized oedema; fever, myalgias, arthralgias; gastrointestinal disorders; depression of bone marrow; polyneuropathy, paresthaesia, peripheral neuropathy, among others	**Pregnancy/breastfeeding:** Not recommended in first trimester; use, with caution, in second and third trimester or breastfeeding if clinically indicated. Available data on safety are limited. **Contraindications:** Renal impairment; hepatic impairment **Administration:** Preferably after meals

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Benzyl benzoate Scabies (10.2.3); empirical treatment of itching papular lesions (10.2.3) Pediculosis (10.2.8)	***Lotion: 25%*** Topical: Follow instructions in 10.2.3. Apply to affected area THEN wash off 24 hours later (further applications may be needed after 7 and 14 days).	**Infrequent or rare:** Local irritation, burning sensation, itch dermatitis, CNS stimulation (e.g. seizures with excessive use)	**Pregnancy:** May be used in pregnancy at the recommended dose, but permethrin is the preferred treatment during pregnancy. **Breastfeeding:** May be used at the recommended dose if it is the treatment of choice; systemic absorption likely to be minimal with topical use, but excess lotion should be wiped from nipple areas, and infant skin contact, minimized. **Use with caution:** Do not use on inflamed or broken skin. Avoid contact with eyes and mucous membranes. **Administration:** See Section 10.2.3. Do not bathe before application. Application to the face and genitals can cause irritation; an alternative agent such as permethrin is preferable. **Counselling:** Remember to apply also between fingers and toes, under nails, in skin folds, navel, between the buttocks, and on groin area. If you wash your hands or any other parts of the body during the treatment period, you should reapply the lotion to the washed areas.
Benzoyl peroxide Acne (10.2.3)	***Cream or lotion: 2.5%, 5%*** Initially apply directly to clean skin on alternate days, increasing frequency to 1–2 times daily as tolerance to irritant effect develops. Continue until 2 weeks after lesions disappear.	**Common:** Initial irritation: skin dryness or peeling, feeling of warmth, mild stinging, erythema, but subsiding with continued use (in some cases may need to reduce frequency of application or temporarily suspend use) **Infrequent or rare:** Contact sensitivity (occasionally, even one application can cause severe irritation).	**Pregnancy/breastfeeding:** Safe to use **Use with caution:** Avoid contact with eyes, mouth, and mucous membranes; avoid use of occlusive dressings. **Counselling:** Before applying, wash affected area with mild soap or soap substitute and warm water. Gently pat dry. Then apply a thin layer to the affected area and rub in gently. May bleach fabrics, hair, and skin. Avoid excessive exposure to sunlight.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Benzylpenicillin (penicillin G) Streptococcal endocarditis (11.10) Neurosyphilis (11.37) Severe anthrax (10.2.10, 10.6.2) Leptospirosis (11.22) (**Other indications:** Otitis media; gas gangrene; actinomycosis; osteomyelitis; brain abscess)	***Intravenous: 600 mg (1 million IU); 3 g (5 million IU) (sodium or potassium salt) in vial*** IV: 7.2–10.8 g (12–18 million IU) daily in 4 or 6 equally divided doses for 4 weeks IV: 1.8–2.4 g (3–4 million IU) every 4 hours for 2 weeks IV: 2.4–3.6 g (4–6 million IU) every 6 hours for 7–10 days IV: 900 mg (1.5 million IU) every 6 hours for 7 days	See benzathine benzylpenicillin.	See benzathine benzylpenicillin.
Betametasone (topical) Severe inflammatory skin conditions including papular lesions; eosinophilic folliculitis; pityrosporum folliculitis; papular urticaria; eczema; contact, atopic dermatitis; numular eczema; seborrhoeic dermatitis; psoriasis; itchy papular lesions (10.2) (**Other indications:** Lichen planus)	***Cream, ointment: 0.1%*** Apply sparingly 1 or 2 times daily.	**Common:** Folliculitis, steroid rosacea, perioral dermatitis, atropy-thinning of the skin, striae, depigmenatation, dilated vessels, acne at site of application, exacerbation of local infection or worsening of the condition; local trophic changes (particularly on the face and in skin folds) **Infrequent or rare:** Contact dermatitis, hyperaesthesia, subcutaneous tissue atrophy, hypertrichosis	**Pregnancy/breastfeeding:** May be used in pregnancy and breastfeeding; systemic absorption likely to be minimal with topical use. **Contraindications:** Untreated skin infections, broken skin, rosacea, acne, perioral dermatitis **Use with caution:** In psoriasis (may precipitate severe pustular psoriasis on withdrawal; avoid in widespread plaque psoriasis). If used on a large area of the body or for a long time, risk for adrenal suppression (particularly with an occlusive dressing). Avoid use on the face for more than 7 days. Secondary infection requires treatment with an appropriate antimicrobial. **Counselling**: Apply a thin layer by smoothing gently into skin, preferably after bathing.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Biperiden Acute dystonic reaction (QC p. 29) Antipsychotics causing extrapyramidal side-effects such as parkinsonism or dystonia (10.11.4)	***Injection: 5 mg IM/IV*** ***Tablet: 2 mg*** IM: 5 mg (give IV if condition life-threatening); maximum 20 mg in 24 hours Oral/IV: Start with 1 mg twice daily. Increase to 2 mg 3 times daily to a target dose of 3–12 mg daily.	**Common:** Nausea, vomiting, dry mouth, constipation, dyspepsia; blurred vision, mydriasis, dry eyes; urinary retention, tachycardia; sedation, confusion, memory disturbance especially in elderly **Infrequent or rare:** arrhythmia, dizziness, drowsiness, headache, hallucinations, fever, anaphylaxis, acute angle-closure glaucoma, myasthenia gravis, gastrointestinal obstruction	**Pregnancy/breastfeeding:** Appears to be safe
Buprenorphine Opioid withdrawal (3.6.2) Opioid substitution treatment (17.4)	***Tablet given sublingually:*** ***2 mg, 8 mg*** SL: 2–16 mg/day for 3–14 days SL: Start at 2–8 mg and increase by up to 8 mg daily as needed up to a maximum of 32 mg. Average dose is usually 12–16 mg daily.	***Opioid agonist effects*** **Common:** Euphoria; constipation, anorexia, nausea, vomiting, sweating, headache, dizziness, vasodilatation; dry mouth, fatigue, sedation, anxiety. postural hypotension, miosis, decreased libido **Infrequent or rare:** Hallucinations, confusion, spasm of urinary or biliary tract, hypotension, vertigo, bradycardia, tachycardia, palpitations, hypothermia, rash, facial flushing, urticaria ***Opioid antagonist effects*** (which can occur if used soon after a full opioid agonist such as methadone) mimic those of naltrexone in opioid dependence. **Common:** Vomiting, nausea, diarrhoea, anxiety, agitation, restlessness, insomnia, muscle aches, sweating, dilated pupils, tachycardia, hypertension. **Infrequent or rare:** Delirium, involuntary ejaculation	**Pregnancy**: Previously commenced therapy can be maintained. **Breastfeeding:** Caution in breastfeeding; poor oral bioavailability, but monitor infant for opiate side-effects. **Use with caution:** Must not be given while the person has any signs of opioid toxicity due to risk of precipitating withdrawal syndrome. Buprenorphine has both opioid agonist and antagonist properties and may precipitate withdrawal symptoms in people with high degree of tolerance to opioids, including those prescribed opioids for pain. When injected, buprenorphine has a similar abuse potential to injected heroin and may lead to dependence. Unlike most opioid analgesics, the effects of buprenorphine are only partially reversed by naloxone. **Counselling:** Place the tablet under the tongue and keep in place until dissolved. Do not chew or swallow the tablet.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Calamine lotion Mild pruritus; mild drug reactions (10.2)	***Lotion: calamine 15%, zinc oxide 5%, bentonite 3%, sodium citrate 0.5%, liquid phenol 0.5%, glycerine 5% + water to 100 ml***		
Calcium gluconate Hypotension with calcium channel blocker overdose (3.8.1) Antidote for magnesium sulfate toxicity (QC p. 28) Hyperkalemia with ECG changes or K >6.5 mmol/l (5.2.2) (**Other indication:** Hypocalcaemic tetany)	***IV: 100 mg/ml in 10 ml ampoule (10%)*** IV: 0.6 ml/kg (600 mg/kg) to a maximum of 30 ml over 5 minutes; can be repeated every 10–20 minutes, up to 4 doses IV: 1 g (10 ml of 10% solution) over 10 minutes IV: 10 ml of calcium gluconate 10% slowly, given over 2–5 minutes; may repeat after 5 minutes titrated and adjusted to ECG improvement	**Common:** Nausea, vomiting, constipation; injection site reactions; fall in blood pressure **Infrequent or rare:** Bradycardia/arrhythmia, peripheral vasodilation, renal calculi, severe tissue damage with extravasation	**Pregnancy:** Use only when indicated (no controlled trials or animal studies). **Breastfeeding:** Calcium in breastmilk is normal nutritional component. **Contraindications:** Conditions associated with hypercalcaemia and hypercalciuria (for example, some forms of malignant disease) **Use with caution:** In renal impairment, sarcoidosis, history of nephrolithiasis **Administration:** Monitor ECG (and plasma calcium if feasible) with IV administration. Do not give by subcutaneous or IM route, as it will cause tissue necrosis. For infusion, dilute 100 ml of calcium gluconate 10% in 1 litre of glucose 5% or sodium chloride 0.9%, and give at an initial rate of 50 ml/hour, adjusted according to response.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Carbamazepine	***Oral liquid: 100 mg/5 ml*** ***Tablet (chewable): 100 mg, 200 mg*** ***Tablet (scored): 100 mg, 200 mg***	**Common:** Drowsiness, dizziness, ataxia, headache, diplopia (may be associated with high plasma levels); dry mouth; mild transient generalized erythematous rash (withdraw if worsens or other symptoms); diarrhoea or constipation; leukopenia, thrombocytopenia; increased liver enzymes (usually not clinically significant) **Infrequent or rare:** Antibody deficiency, exfoliative dermatitis, Stevens-Johnson syndrome, systemic lupus erythematosus, agranulocytosis; aplastic anaemia, multiorgan hypersensitivity syndrome (including fever, severe skin disease, lymphadenopathy, haematologic abnormalities, hepatitis); psychiatric disorders, or facial dyskinesia, jaundice/hepatitis, acute renal failure, cardiovascular problems (arrhythmias, heart block heart failure), neuropsychiatric problems, impotence/male infertility, photosensitivity, pulmonary hypersensitivity, confusion/agitation (elderly), SIADH	**Pregnancy/breastfeeding:** Avoid in pregnancy. May be used in breastfeeding (monitor infant for drowsiness). **Contraindications:** Atrioventricular conduction abnormalities, history of bone marrow depression, porphyria; history of sensitivity to tricyclic antidepressants, oxcarbazepine, or other structurally related drugs; use of MAO-Is within past 2 weeks; on antiretrovirals for HIV (lowers levels) **Use with caution:** In hepatic impairment, renal impairment, cardiac disease, skin reactions, history of blood disorders, glaucoma, elderly. Monitor blood counts before and during treatment. Avoid sudden withdrawal. Prone to multiple drug interactions. Monitor for drug interactions when starting any new medication. **Counselling:** Take with food to help prevent stomach upset. This medicine may cause drowsiness, dizziness, or blurred vision, especially at the start of treatment or when the dose is increased. If affected, do not drive or operate machinery. May increase the effects of alcohol. Tell your health care provider that you are taking carbamazepine before starting any new medicine including herbal and OTC products.
Generalized tonic-clonic seizures, partial seizures (3.5, 10.10c)	Oral: initially 100–200 mg 1–2 times daily (tablets) OR 50–100 mg every 6 hours as oral suspension THEN Increase gradually by ~200 mg every week as needed (usual maintenance dose is 400–1400 mg daily in divided doses)		
Bipolar disorders (10.11.5)	Oral: initially 200 mg daily at bedtime THEN gradually increase to 400–600 mg daily (divided doses); in severe cases may need 1000 mg (In elderly or medically ill: see Section 10.11.5)		
Peripheral neuropathy (10.10a.6); neuropathic pain (20.3)	100 mg once or twice daily, THE increase to 200 mg 3 or 4 times daily (up to 1.6 g daily in some patients)		
Cefixime	***Capsule: 400 mg***	**Common:** Nausea, vomiting, diarrhoea, abdominal discomfort; headache **Infrequent or rare:** Allergic reactions (including anaphylaxis), erythema multiforme; transient hepatitis, jaundice; leukopenia, thrombocytopenia, agranulocytosis, aplastic anaemia, haemolytic anaemia; interstitial nephritis	**Pregnancy/breastfeeding:** Safe to use **Contraindications:** Cephalosporin hypersensitivity **Use with caution:** In sensitivities to beta-lactam antibacterials (avoid if history of immediate hypersensitivity reaction); renal impairment **Note:** Can cause false positive urinary glucose (if tested for reducing substances) and false positive Coombs' test.
Gonorrhoea, uncomplicated (10.15.4)	Oral: 400 mg as a single dose		
Gonococcal dermatitis-arthritis syndrome (10.13.2)	Oral: 400 mg twice daily to complete total 7–10 days, after ceftriaxone for 3 days.		
Gonococcal septic arthritis (10.13.2)	Oral: 400 mg twice daily to complete 14–21 days, after ceftriaxone for 3 days.		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Ceftriaxone	***Injection: 250 mg, 1 g (as sodium salt) in vial***	**Common:** Diarrhoea, nausea; rash, electrolyte disturbances, pain and inflammation at injection site **Infrequent or rare:** Antibiotic-associated colitis (particularly with higher doses), hypersensitivity reactions (including anaphylaxis), erythema multiforme, transient hepatitis/jaundice, blood disorders (leukopenia, thrombocytopenia, agranulocytosis, aplastic anaemia, haemolytic anaemia), interstitial nephritis, pancreatitis, cholecystitis, pseudolithiasis (dose-dependent, asymptomatic, and reversible biliary sludge formation due to calcium–ceftriaxone complex, which usually resolves after treatment stopped), nephrolithiasis (formation of calcium–ceftriaxone renal stones, sometimes requiring treatment, usually reversible) pain, tenderness at IM injection site (can reconstitute with 1% lidocaine for patient comfort)	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects) **Contraindications:** Cephalosporin hypersensitivity (anaphylaxis, hives), porphyria, hypoalbuminaemia or impaired bilirubin binding **Use with caution:** In history of allergy to beta-lactams (minor rash), pre-existing gallbladder disease **Administration:** Incompatible with calcium; do not give via calcium-containing solutions. Divide IM dose over 1 g between 2 sites.
First-line empirical antibiotic coverage for emergency management (QC p. 19); septic shock (3.1.5); severe pneumonia (3.2.3); acute pyelonephritis (11.44); septic abortion (10.15.6)	IV: 1 g daily for 7–14 days for severe infection		
Endocarditis - viridans streptococci (11.10)	IV: 2 g daily for 4 weeks		
Meningitis (10.10b.3)	IV: 2 g twice daily for 5–14 days		
Cholangitis (10.7a.2)	IV: 1 g daily AND metronidazole for 10–14 days		
Spontaneous bacterial peritonitis (10.9.2)	IV: 2 g daily for 5–10 days		
Gonorrhoea, uncomplicated (10.15.4, 11.13)	IM: 250 mg as a single dose		
Prophylaxis of contacts of meningococcal meningitis (10.10b.2)	IM: 250 mg as a single dose		
Gonorrhoea, arthritis (10.13.5)	IV: 1 g daily, continuing 1–2 days after improvement; THEN cefixime to complete 14–21 days treatment		
Gonorrhoea, conjunctivitis (10.12.2)	IM: 1 g as single dose pre-referral		

PID (10.15.5) Severe cellulitis (10.2.2) Leptospirosis- moderate to severe disease (11.22) Typhoid fever (11.43)	IM: 250 mg as a single dose AND doxycycline + metronidazole IV: 1 g daily for 7–10 days IV: 1 g daily for 7 days IV/IM: 1–2 g daily for 10–14 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Charcoal, activated Antidote for some poisons (3.8)	***Powder*** Oral (adults and adolescents >13 years of age): 50–100 g	**Common:** Nausea/vomiting, constipation, black stools, colicky abdominal pain **Infrequent or rare:** Diarrhoea, aspiration pneumonitis, dehydration and electrolyte imbalances, gastrointestinal obstruction/faecal impaction in dehydrated patients	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding **Contraindications:** Poisoning by hydrocarbons, with high potential for harm if aspirated; poisoning by corrosive substances – may prevent visualization of lesions caused by poison **Use with caution:** In drowsy or unconscious patients – risk of aspiration (intubate via nasogastric or gastric tube before administration) Not effective for poisoning with alkalis, acids, heavy metals, iron, lithium, toxic alcohols, glycols, or hydrocarbons such as kerosene **Administration:** Improve palatability by chilling. It may be easier for some patients to take it in a covered container with a large straw or with eyes shut.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Chloramphenicol Severe infections such as sensitive H. influenzae meningitis (10.10b.3); H. influenzae epiglottitis (3.2.2) Empirical treatment of bacterial meningitis if anaphylaxis to penicillin (10.10b.3) Epidemics of meningococcal meningitis (10.10b) Typhoid fever if known antibiotic sensitivity (11.43) Rickettsial diseases in pregnant women (11.33) Tetanus (11.39) (**Other indications:** Cerebral abscess; mastoiditis; relapsing fever; plague; psittacosis; tularemia; Whipple disease)	***Capsule: 250 mg*** ***Injection: 1 g (sodium succinate) vial*** ***Oily injection: 500 mg/ml, 2 ml ampoule (for IM use only)*** IV: 1 gram every 6 hours IV: 1 gram every 6 hours AND cotrimoxazole IM (oily): 100 mg/kg (maximum 3 g) as a single dose; repeat after 24–48 hours if necessary Oral: 2 to 3 g in 4 divided doses for 14 days Oral: 500 mg 4 times daily for 5–7 days IV: 1 gram every 6 hours	**Common:** Nausea/vomiting, headache, reversible bone marrow suppression **Infrequent or rare:** Diarrhoea, stomatitis/ glossitis, depression, hypersensitivity reactions (including anaphylaxis), aplastic anaemia, peripheral/optic neuritis, minor disulfiram-like reactions, grey baby syndrome (premature and newborn infants), C. *difficile* colitis	**Pregnancy:** Use with caution in pregnancy; risk of neonatal "grey syndrome" with high doses close to term. **Breastfeeding:** Not recommended with systemic use **Use with caution:** In porphyria reduce high doses as soon as clinically indicated; avoid repeated courses and prolonged use. Reduce dose in hepatic and severe renal impairment. Blood counts required before and during treatment. Plasma concentration monitoring required in the elderly and in hepatic or renal impairment; renal and hepatic dose adjustment required. **Counselling:** Tell your doctor if you get pale skin, sore throat, fever, tiredness or weakness, or unusual bleeding or bruising in the months after you stop taking the medicine.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Chloramphenicol – eye drops and ointment Superficial bacterial infections of the eye; prophylaxis against bacterial infection following minor ocular trauma (10.12.2) (**Other indications:** blepharitis)	**Drops: 0.5%** **Ointment: 1%** Eye drops: 1 or 2 drops, every 2 hours for the first 24 hours; THEN decrease to every 6 hours until 48 hours after resolution Ointment: May be used at bedtime (if eye drops used during day) or 3–4 times daily (if eye ointment used alone).	**Common:** Transient stinging **Infrequent or rare:** Unpleasant taste, hypersensitivity reactions (local allergy, angioedema, anaphylaxis), dermatitis. (Large, population-based studies have found no association between use of chloramphenicol eye drops and aplastic anaemia.)	**Pregnancy/breastfeeding:** Safe to use **Contraindications:** Chloramphenicol hypersensitivity **Maximum duration of use:** 7 days; prolonged use may lead to overgrowth of non-susceptible organisms
Chlorhexidine Multiple skin infections, itching (10.2.8) (**Other indications:** Disinfection of clean instruments; pre-operative skin disinfection and hand washing)	**Solution: concentrate for solution, 5%** 0.05% aqueous solution applied to affected areas	**Infrequent or rare:** Skin irritation/local contact dermatitis	**Pregnancy/breastfeeding:** May be used in pregnancy and breastfeeding. Systemic absorption likely to be minimal with topical use. **Use with caution:** Not for use in body cavities. Avoid contact with middle ear, eyes, brain and meninges.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Chloroquine Malaria caused by *P. malariae, P. vivax*, or *P. ovale* (11.25.3) (**Other indications:** Malaria prophylaxis; rheumatoid arthritis)	**Tablet: chloroquine base (as phosphate or sulfate) 100 mg, 150 mg** Oral: Initially 10 mg/kg (600 mg) as a single dose THEN 5 mg/kg (300 mg) 6–8 hours later THEN 5 mg/kg (300 mg) daily on next 2 days (24 and 48 hours after initial dose) THEN full anti-relapse treatment of 14 days of primaquine in P. vivax and P. ovale infections, except during pregnancy and breastfeeding	**Common:** Nausea, vomiting, diarrhoea, abdominal pain or cramps; headache; rash, pruritus Infrequent or rare (with prolonged treatment): Psychotic episodes, anxiety, personality changes, visual disturbances (dose-related retinopathy), hair loss, blue-black pigmentation of mucous membranes and skin, photosensitivity, tinnitus, hearing loss, bone marrow suppression, hypersensitivity reactions, atrioventricular block, porphyria, exacerbation of psoriasis, neuromyopathy	**Pregnancy:** Benefit exceeds risk when indicated for treatment of acute malaria. **Breastfeeding:** Use with caution. **Use with caution:** In hepatic and renal impairment, neurological disorders (avoid for prophylaxis if epilepsy history), severe gastrointestinal disorders, G6PD deficiency, pre-existing auditory damage, elderly. May exacerbate psoriasis or myasthenia gravis. If patient continues to deteriorate after chloroquine, administer quinine intravenously (suspect resistance). **Counselling:** Take with food to minimize nausea and vomiting. If part or all of a dose is vomited, the same amount should be taken again immediately.
Chlorphenamine (chlorpheniramine) Itching (10.2.8) Allergic reactions, anaphylaxis (adjunct) (3.1.3)	**Tablet: 4 mg** **Injection: 10 mg/ml, 1 ml ampoule; (if necessary, injection solution can be diluted with sodium chloride 0.9% injection)** Oral: 4 mg every 4–6 hours (maximum 24 mg daily) SC/IM/IV: 10–20 mg (maximum 40 mg in 24 hours); give IV over 1 minute	**Common:** Drowsiness, headache, psychomotor impairment, antimuscarinic effects such as urinary retention, dry mouth, blurred vision, and gastro-intestinal disturbances **Infrequent or rare:** Hypotension, palpitations, arrhythmias, extrapyramidal effects, dizziness, confusion, depression, sleep disturbances, tremor, convulsions, hypersensitivity reactions (including bronchospasm, angioedema, and anaphylaxis, rashes, and photosensitivity reactions), blood disorders, liver dysfunction, angle-closure glaucoma.	**Pregnancy/breastfeeding:** May be used at recommended doses in pregnancy and breastfeeding (monitor infant for drowsiness). **Use with caution:** In the elderly; may cause a paradoxical stimulation. Also, use with caution in prostate enlargement, urinary retention, ileus or pyloroduodenal obstruction, glaucoma, renal impairment, hepatic impairment, epilepsy. **Counselling:** Drowsiness may impair ability to perform skilled tasks such as operating machinery or driving. Drowsiness may diminish after a few days of treatment.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Chlorpromazine Psychosis (including schizophrenia) (10.11.4) Vomiting (10.7c.3, 14.1.11) Tetanus spasms (11.39)	***Tablet: 100 mg*** ***Oral liquid: 25 mg/5 ml*** ***Injection: 25 mg/ml, 2 ml ampoule*** Oral: Initially 75 mg at night Typical effective dose is 75–300 mg daily, but up to 1000 mg may be necessary in severe cases. Oral/IM/IV: 25–50 mg 4 times daily until vomiting stops IM: 50–150 mg every 4–8 hours	**Common:** *Extrapyramidal side-effects:* Acute dystonic reaction or severe muscle spasm, stiffness, tremor, motor restlessness, agitation, Parkinson's syndrome; with prolonged administration, potentially irreversible involuntary movements (tardive dyskinesia) *Autonomic side-effects:* Drowsiness; orthostatic hypotension, dizziness; tachycardia; dry mouth; blurred vision; constipation; urinary retention *Other:* Nausea, anorexia, dyspepsia; headache; apathy, confusion, depression, nightmares, insomnia; weight gain; photosensitivity; rash; galactorrhoea, gynaecomastia, sexual dysfunction, impotence, menstrual irregularities; jaundice, altered liver enzymes **Infrequent or rare, serious:**Neuroleptic malignant syndrome; hyperthermia, hyperpyrexia, heat stroke; blood disorders, including leukopenia, thrombocytopenia, aplastic anaemia; lupus erythematosus-like syndrome; exfoliative dermatitis; seizures; cholestatic jaundice; arrhythmias; respiratory depression at high doses **Other infrequent or rare:** ECG changes; hypothermia; corneal and lens opacities; purplish pigmentation of the skin, cornea and retina (with prolonged high doses)	**Pregnancy:** Use, with caution, in pregnancy, if benefit is greater than risk. **Breastfeeding:** Use caution (monitor infant for drowsiness). **Contraindications:** CNS depression/impaired consciousness; bone marrow depression; phaeochromocytoma, porphyria, basal ganglia disease, parkinsonism **Use with caution:** In cardiovascular and cerebrovascular disorders, dementia, respiratory disease, epilepsy, acute infections, renal and hepatic impairment (avoid if severe), history of jaundice, leukopenia (blood count required if unexplained fever or Infection), hypothyroidism, myasthenia gravis, prostatic hypertrophy, angle-closure glaucoma, organophosphate poisoning; subarachnoid haemorrhage, metabolic disturbances (hypokalaemia, hypocalcaemia, hypomagnesaemia), seizure disorders; in patients on other QT-prolonging medications **Elderly/debilitated (including HIV stage 3 or 4):** Haloperidol preferred; alternative is chlorpromazine at one-third to half adult dose. Avoid abrupt withdrawal. Check blood counts if unexplained fever or infection. **Administration:** Avoid skin contact with injection solution or oral liquid, as there is a risk of contact dermatitis. Oral hygiene is very important with regular use of oral liquid. **Counselling:** Warn patients that this medication may impair ability to perform skilled tasks such as operating machinery or driving. If taking liquid form, daily oral hygiene is very important.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Ciprofloxacin	**Tablet: 250 mg** **Solution for IV infusion: 2 mg/ml**	**Common:** Nausea, vomiting, diarrhoea, dyspepsia, abdominal pain **Infrequent or rare:** Hepatitis, jaundice, pancreatitis; dizziness, sleep disorders; convulsions, paraesthesia, movement disorders (discontinue use); hypersensitivity reactions (if severe rash, discontinue), petechiae, haemorrhagic bullae, erythema nodosum; photosensitivity reaction; psychiatric symptoms (depression, confusion, hallucinations – discontinue if occurs); haemolytic anaemia; C. difficile colitis. Tendon damage (including rupture) has been reported rarely in patients receiving quinolones. Tendon rupture may occur within 48 hours of starting treatment; cases have also been reported several months after stopping a quinolone. If tendinitis is suspected, the quinolone should be discontinued immediately.	**Pregnancy/breastfeeding:** Contraindicated in pregnancy and breastfeeding due to theoretical risk of injury to developing cartilage; consider alternatives where possible; use only if no available alternatives and benefit is greater than risk. **Contraindications:** History of quinolone-associated tendon disorder **Use with caution:** In elderly patients and those on corticosteroids (higher risk of tendonitis/rupture); in history of epilepsy or seizure, renal impairment, G6PD deficiency, myasthenia gravis (risk of exacerbation). Prone to multiple drug interactions. If TB infection is suspected, limit use if there are alternate antibiotics available. **Administration:** Give IV infusion over at least 60 minutes. **Counselling:** Oral: Take 1 hour before or 2 hours after meals. Drink plenty of fluids while taking it. Dairy products; antacids; and iron, zinc, or calcium supplements may reduce absorption; do not take within 2 hours of a ciprofloxacin dose. This medication may impair ability to perform skilled tasks such as operating machinery or driving. Avoid extended exposure to sunlight (discontinue if photosensitivity occurs; report to clinician).
Severe infections: acute pyelonephritis (11.44); typhoid fever (11.43)	Oral: 500 mg twice daily OR IV: 400 mg twice daily for 10–14 days		
Cholecystitis (10.7a.2)	Oral: 500 mg twice daily for 5–7 days AND metronidazole		
Cholangitis (10.7a.2)	IV: 400 mg twice daily AND metronidazole for 10-14 days		
Isosporiasis with intolerance to cotrimoxazole or resistance to ampicillin and cotrimoxazole) (11.18)	Oral: 500 mg twice daily for 7 days Prophylaxis: Oral: 500 mg 3 times a week		
PID (10.15.5)	See table in Section 10.15.5.		
Uncomplicated gonorrhoea if susceptible (10.15.4); gonococcal conjunctivitis (10.12.2)	Oral: 500 mg as a single dose		
Anthrax, cutaneous (10.2.10)	Oral: 500 mg twice daily for 7-10 days		
Anthrax, severe (10.2.10)	IV: 400 mg twice daily for 7-10 days		
Prophylaxis, meningococcal meningitis in non-epidemic situations (10.10b.3)	Oral: 500 mg as a single dose		
Cholera (10.7d.2)	Oral: 1 g as a single dose		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Clarithromycin	***Tablet: 250 mg, 500 mg*** ***Oral suspension: 125 mg/5 ml, 250 mg/5 ml***	**Common:** Dyspepsia. **Infrequent or rare:** Tooth and tongue discoloration; smell and taste disturbances, stomatitis, glossitis; headache, arthralgia, myalgia, hepatitis, pancreatitis; tinnitus, dizziness, insomnia, nightmares, anxiety, confusion, psychosis, paraesthesia; convulsions; hypoglycaemia; interstitial nephritis, renal failure; leukopenia, thrombocytopenia; pulmonary infiltration with eosinophilia; prolonged QT interval, torsade de pointes; on IV infusion, local tenderness, phlebitis. See also erythromycin adverse effects.	**Pregnancy:** Use alternative macrolides in pregnancy where possible. **Breastfeeding:** Caution in breastfeeding (monitor infant for side-effects) **Contraindications:** Sensitivity to macrolide antibiotics. Known interactions with many drugs. **Use with caution:** In renal impairment **Counselling:** Before starting or stopping any other medicines, tell your doctor that you are taking this medication.
MAC treatment in PLHIV (11.27)	Oral: 500 mg twice daily AND ethambutol 15 mg/kg daily for 6 months		
Helicobacter pylori infection eradication (10.7a.2)	Oral: 500 mg twice daily AND amoxicillin + omeprazole for 7 days		
Buruli ulcer (10.2.10)	Oral: 7.5 mg/kg twice daily (not to exceed 500 mg twice daily) AND rifampicin for 8 weeks		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Clindamycin Cellulitis (10.2.2) Complicated soft tissue infection including necrotizing fasciitis (10.2.2) Septic abortion (10.15.6) PID (10.15.5) Uncomplicated *P. falciparum* malaria in first trimester pregnant woman (11.25) (**Other indications:** Staphylococcal bone and joint infections; endocarditis prophylaxis)	***Capsule: 150 mg*** ***Injection: 150 mg/ml, 2 ml ampoule*** Oral: 300-450 mg every 8 hours (maximum 450 mg every 6 hours) IM/IV: 900 mg every 8 hours AND ampicillin or cloxacillin IV: 900 mg every 8 hours AND ampicillin/penicillin + gentamicin for 14 days See table in Sectoin 10.15.5. Oral: 600 mg twice daily AND quinine (600 mg every 8 hours) for 7 days	**Common:** Nausea, vomiting, diarrhoea, abdominal pain or cramps; rash, contact dermatitis **Infrequent or rare:** Unpleasant taste in the mouth; oesophagitis; altered liver enzymes, jaundice; blood disorders (leukopenia, granulocytosis, eosinophilia, thrombocytopenia); pain/induration/abscess after intramuscular injection, thrombophlebitis after intravenous injection, erythema multiforme, polyarthritis; *C. difficile* colitis (see Section 10.7d)	**Pregnancy:** Not known to be harmful **Breastfeeding:** Unknown safety; amount in milk probably too small to be harmful. Discontinue immediately if diarrhoea or colitis develops. **Contraindications:** Diarrhoeal states, porphyria **Use with caution:** In hepatic impairment. Monitor liver function during prolonged therapy. **Administration:** Dilute in glucose 5% or normal saline to concentration not more than 12 mg/ml and infuse slowly (not more than 30 mg/minute) to reduce risk of adverse cardiac effects. Single doses over 600 mg by intravenous infusion only and should not exceed 1.2 g over 1 hour. **Counselling:** Take with a full glass of water. Stop taking this medication and tell your doctor immediately if you develop diarrhoea.
Clindamycin, topical Moderate acne (10.2.3)	***Gel/lotion: clindamycin 1% (as phosphate)*** Gel: Apply to lesions once daily. Lotion: Apply to the lesions twice daily. Continue until 2 weeks after lesions disappear.	**Common:** Dry, scaly, or peeling skin **Infrequent or rare:** Contact dermatitis, irritation, burning sensation, itch	**Pregnancy/breastfeeding:** Safe to use **Counselling:** Noticeable improvement usually seen in 6 weeks; however, 8–12 weeks of treatment may be required before maximum benefit is seen. Before applying, wash affected area with a mild soap and warm water, rinse thoroughly, and pat dry. Avoid contact with eyes, lips, and inside of your nose or mouth.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Clofazimine Leprosy (multibacillary) (11.21) Type 2 lepra reaction if inadequate response to prednisolone or if steroids contraindicated (11.21)	***Capsule: 50 mg, 100 mg*** See Section 11.21 for dosing of clofazimine as part of multidrug treatment for multibacillary leprosy 200-300 mg daily in 2-3 divided doses for maximum 3 months	**Common:** Nausea/ vomiting (hospitalize if persistent), abdominal pain, headache, tiredness, brownish-black discoloration of lesions, pink to brownish-black discoloration of skin including areas exposed to light; reversible hair discoloration; dry skin; red discoloration of faeces, urine, and other body fluids; rash, pruritus. **Infrequent or rare:** Photosensitivity, acne-like eruptions, anorexia, eosinophilic enteropathy, bowel obstruction, dry eyes, dimmed vision, macular and subepithelial corneal pigmentation; elevation of blood sugar, weight loss, splenic infarction, lymphadenopathy, GI bleeding, constipation, taste disorder, dizziness, drowsiness	**Pregnancy:** No information **Breastfeeding:** May cause reversible skin discoloration in nursing infants **Use with caution:** In liver and renal impairment and pre existing GI symptoms **Counselling:** This medication is absorbed best if taken with food. Your skin may become pink to brownish-black while you are taking this medicine, but this is reversible. Avoid exposure to sunlight. Tears and urine may turn reddish-brown.
Clomipramine Obsessive-compulsive disorders; phobic states, panic attacks (10.11.7)	***Capsule: 10 mg, 25 mg*** Oral: see instructions in Section 10.11.7.	See amitriptyline.	**Pregnancy:** Use, with caution, in pregnancy if clinically indicated and drug of choice. **Breastfeeding:** Caution in breastfeeding (monitor infant for drowsiness) **Contraindications:** See amitriptyline.
Cloxacillin Cellulitis (10.2.2) S. aureus endocarditis (11.10) Septic arthritis due to S. aureus (10.13.2)	***Capsule: 500 mg, 1 g*** ***Powder for injection: 500 mg in vial*** Oral: 500 mg every 6 hours IV: 1-2 g every 6 hours IV: 2 g every 4 hours or 3 g every 6 hours for 6 weeks IV: 2 g every 6 hours for 2-4 weeks	See benzylpenicillin. **Common:** Nausea/vomiting, transient increases in liver enzymes and bilirubin **Infrequent or rare:** Cholestatic hepatitis	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects) **Contraindications:** Known severe hypersensitivity to penicillins or other beta-lactams **Use with caution:** In patients with history of mild hypersensitivity to beta-lactams, renal/hepatic impairment **Counselling:** This medicine is absorbed best if taken on an empty stomach at least half an hour before food or 2 hours after food.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Coal tar Chronic psoriasis, either alone or in combination with exposure to ultraviolet light (10.2.7)	***Solution: 5%.*** Topical: apply directly to the affected area 1–3 times daily, preferably starting with lower strength preparation or add 100 ml to bath of tepid water and soak affected area for 10–20 minutes, once daily to once every 3 days for at least 10 baths.	**Common:** irritation, photosensitivity reactions; skin, hair, and fabrics discoloured. **Infrequent or rare:** hypersensitivity	**Contraindications:** inflamed, broken or infected skin. **May be used with salicylic acid in psoriasis** **Administration:** Skin protection possibly required to reduce photosensitivity reactions. Bathing can be alternated with exposure to ultraviolet (UVB) rays, allowing at least 24 hours between exposure and treatment with coal tar.
Codeine Acute or chronic pain (20.2, 20.4)	***Tablet: 30 mg (phosphate)*** Oral: 30 mg every 4 hours; maximum dose for pain 240 mg; consider switch to morphine when a dose of 180 mg is reached.	**Common:** Nausea, vomiting, constipation; dizziness, headache, miosis, difficulty with micturition, urinary retention, dry mouth, dyspepsia **Infrequent or rare:** Dependence, biliary spasm, palpitations, bradycardia, tachycardia, hypothermia, hallucinations/mood changes, rash; in large doses, convulsions, respiratory depression, hypotension	**Pregnancy/breastfeeding:** Considered safe at recommended doses in both pregnancy and breastfeeding **Contraindications:** Conditions where inhibition of peristalsis should be avoided; abdominal distension; acute diarrhoeal conditions such as ulcerative colitis or antibiotic-associated colitis; acute respiratory depression **Use with caution:** With prolonged use, tolerance or dependence may occur in elderly and debilitated patients and patients with hepatic or renal impairment. 6–10% of Caucasians and 1-2% of Asians lack the enzyme CYP2D6 (necessary to metabolise codeine to morphine) and are, therefore, unlikely to obtain analgesia with codeine.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Cotrimoxazole- trimethoprim with sulfamethoxazole (TMP-SMX) (doses based on the trimethoprim component)	***Tablet: sulfamethoxa-zole 100 mg + trimethoprim 20 mg; sulfamethox-azole 400 mg + trimethoprim 80 mg (single-strength=SS); sulfamethoxa-zole 800 mg + trimethoprim 160 mg (double-strength=DS); Injection: sulfamethoxa-zole 80 mg + trimethoprim 16 mg/ml, 5 ml and 10 ml ampoules***	**Common:** Nausea, vomiting, diarrhoea; headache; hyperkalaemia; rash; anorexia, sore mouth, fever **Infrequent or rare:** Stevens-Johnson syndrome, toxic epidermal necrolysis, photosensitivity – discontinue immediately; drowsiness; liver damage (including jaundice and hepatic necrosis), pancreatitis, *C. difficile* colitis, myocarditis, cough and shortness of breath, pulmonary infiltrates, aseptic meningitis, depression, convulsions, peripheral neuropathy, ataxia, tinnitus, vertigo, hallucinations, hypoglycaemia, blood disorders (including leukopenia, thrombocytopenia, megaloblastic anaemia, eosinophilia), hyponatraemia, renal disorders (including interstitial nephritis), arthralgia, myalgia, vasculitis, systemic lupus erythematosus; rhabdomyolysis reported in HIV-infected patients; crystalluria	**Pregnancy:** Avoid in first trimester. However, if a pregnant woman with HIV requires cotrimoxazole prophylaxis, it should be started regardless of the stage of pregnancy. Pregnant women in malarial areas who are taking cotrimoxazole should not be given sulfadoxine-pyrimethamine-based intermittent preventive therapy for malaria. See Sections 13 and 14 for PMTCT and management of cotrimoxazole side-effects. Breastfeeding women living with HIV should continue to receive cotrimoxazole prophylaxis. **Contraindications:** Severe renal or hepatic impairment; previous severe reactions to sulfa-containing drugs. **Use with caution:** In predisposition to folate deficiency, patients with a sulfa allergy, elderly, and G6PD deficiency. See Section 13.3 for response to rash. Discontinue immediately if anaemia or new jaundice appears. Renal dose adjustment required. Avoid in blood disorders except with specialist supervision. **Administration: IV:** Dilute each 5 ml in 100–125 ml fluid, preferably glucose 5%, and infuse over 60–90 minutes. Maintain adequate fluid intake. **Counselling:** Take this medicine with food to reduce stomach upset. Tell your doctor if you get a sore throat, fever, troublesome rash, cough, difficulty breathing, joint pain, dark urine, or pale stools. If taking prolonged high dose treatment: Drink a lot of fluid – at least 2–3 litres daily.
P. jirovecii (P. carinii) pneumonia (PCP) (10.6.3)	IV: 5 mg/kg (based on the trimethoprim component) 4 times daily for 21 days		
Primary prophylaxis for PLHIV (see 13.3 for indications for primary prophylaxis); secondary prophylaxis after PCP pneumonia (10.6.3), isosporiasis (11.18), toxoplasmosis (11.40)	1 DS tablet or 2 SS tablets once daily. Total daily dose is 960 mg (800 mg SMX + 160 mg TMP)		
Acute bacterial meningitis-empirical treatment in absence of ceftriaxone (10.10b.3)	IV: 10–20 mg/kg (based on the trimethoprim component) daily divided into 2–4 doses AND ampicillin		
Acute bacterial meningitis with anaphylaxis to penicillin (empirical or for confirmed *N. meningitidis, H. influenzae, S. pneumoniae*) (10.10b.3)	IV: 10–20 mg/kg (based on the trimethoprim component) daily divided into 2–4 doses AND chloramphenicol		

Listeria meningitis with anaphylaxis to penicillin (10.10b.3)	IV: 10–20 mg/kg (based on the trimethoprim component) daily divided into 2–4 doses		
Severe pneumonia, suspect community- associated MRSA where cotrimoxazole has activity (3.2.3)	Add IV cotrimoxazole to regimen		
Septic arthritis where MRSA suspected	IV: 15–20 mg/kg (based on the trimethoprim component) daily divided into 2–4 doses for 2–4 weeks		
Epididymitis with suspected coliforms (10.16.4); donovoniasis (granuloma inguinale) (10.14.3)	Oral: 2 SS or 1 DS twice daily for 14 days.		
Empirical treatment for prostatitis (10.16.5)	Oral: 2 SS or 1 DS twice daily for 21 days		
Persistent diarrhoea in immunocompromised patients (10.17d.2), isosporiasis (11.18)	Oral: 2 DS tablets twice daily for 14 days THEN 1 DS tablet twice daily for 3 weeks		
Toxoplasmosis (11.40)	Oral: 2 DS tables 3 times daily for 6 weeks		
Uncomplicated cellulitis, furuncle, carbuncle, abscess (10.2.2), sinusitis (11.35)	Oral: 1 to 2 DS tablets twice daily for 7–10 days Oral: 1 DS tablet twice daily for 7 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Dapsone Leprosy, paucibacillary (11.21) Leprosy, multibacillary (11.21) Alternative to cotrimoxazole prophylaxis for PLHIV allergic to sulfa-based medicines (13.3)	***Tablet: 25 mg, 50 mg, 100 mg*** Oral: 100 mg daily for 6 months AND rifampicin on day 1 of each month Oral: 100 mg daily for 12 months AND rifampicin + clofazimine (see Section 11.21) Oral: 100 mg daily	**Common:** Nausea/vomiting, diarrhoea, abdominal pain or cramps, hepatitis, rash, fever, jaundice, headache, nervousness, blurred vision **Infrequent or rare** (dose-related and uncommon at doses used for leprosy): haemolysis, methaemoglobinaemia, allergic dermatitis including Stevens-Johnson syndrome	**Pregnancy:** Third trimester use can result in neonatal haemolysis and methaemoglobinaemia; folic acid 5 mg daily should be given to mother. **Breastfeeding:** Continue breastfeeding, monitor infant for jaundice. **Use with caution:** In anaemia, susceptibility to haemolysis **Administration:** Obtain full blood count before starting treatment; then again each week for the first month, and then each month during treatment. **Counselling:** Take dapsone with food to reduce stomach upsets. Stop medication and inform your doctor if troublesome rash occurs.
Deferoxamine (desferrioxamine mesilate) Acute iron poisoning (3.8.1) (Other indications: Chronic iron overload including hemoglobinopathies; aluminium overload in end-stage renal disease; diagnosis of iron or aluminium overload)	***Powder for injection: 500 mg (mesilate) in vial*** IV (slow): Initially 15 mg/kg per hour THEN reduce after 4–6 hours so that total dose does not exceed 80 mg/kg in 24 hours.	**Common:** Nausea, vomiting, diarrhoea, abdominal cramps or pain; injection-site reactions (including redness, pain, swelling rashes and itch); hypotension (especially when given too rapidly by intravenous injection); asthma; fever, headache, arthralgia and myalgia; growth retardation; bone deformities **Infrequent or rare:** Disturbances of hearing and vision (including lens opacity and retinopathy); acute respiratory distress syndrome, neurological disturbances (including dizziness, neuropathy and paraesthesia), Yersinia and mucormycosis infections, rash, renal impairment, blood dyscrasias, anaphylaxis	**Pregnancy:** Use only if benefit greater than risk (risk of teratogenicity). **Breastfeeding:** Caution in breastfeeding; not recommended, but low oral bioavailability so unlikely to cause adverse effects **Use with caution:** In renal impairment, aluminium encephalopathy (may exacerbate neurological dysfunction) **Administration:** Perform eye and ear examinations before treatment and at 3-month intervals during treatment.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Dexamethasone Also, see steroid equivalents table in Section 8.2. Addison's disease (adrenal insufficiency) (3.4.3) Cerebral oedema associated with malignancy (20.3) Bacterial meningitis (consider before antibiotics but do not delay antibiotics) (10.10b.3) (**Other indications:** Some malignant neoplasms, to help prevent chemotherapy-induced emesis)	***Tablet: 500 mg, 4 mg*** ***Injection: 4 mg/ml, 1 ml ampoule*** IV: 8 mg; then repeat every 8 hours IV/IM: Initially 24 mg daily; THEN reduce by 2 mg/day to lowest effective maintenance dose. IV: 10 mg every 6 hours for 4 days	See prednisolone. In addition: Burning and tingling in perineal area (high dose IV treatment) Dexamethasone has a long duration of action and very high glucocorticoid activity in conjunction with insignificant mineralocorticoid activity. This makes it particularly suitable for high-dose therapy in conditions where fluid retention would be a disadvantage.	**Pregnancy/breastfeeding:** Use in pregnancy only if drug of choice and benefit greater than risk (risk of intrauterine growth retardation); unlikely to be harmful at low doses (<40 mg daily prednisolone equivalent) **Breastfeeding:** Caution in breastfeeding; prednisolone preferred Contraindications: Systemic infection (unless life-threatening or specific antimicrobial therapy given); avoid live virus vaccines in those receiving immunosuppressive doses. **Use with caution:** In patients with infections (symptoms may be masked until advanced stage; clinical presentation may be atypical); can activate or exacerbate TB, amoebiasis, strongyloidiasis; in the elderly and adolescents, hypertension, recent myocardial infarction, congestive heart failure, liver failure, renal impairment, diabetes mellitus (including family history), osteoporosis, glaucoma (including family history), severe affective disorder (particularly if history of steroid-induced psychosis), epilepsy, psoriasis, peptic ulcer, hypothyroidism, history of steroid myopathy. Adrenal suppression can occur during prolonged treatment and persist for years after stopping treatment. **Administration:** Monitor weight, blood pressure, fluid and electrolyte balance, and blood glucose throughout prolonged treatment.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Diazepam	***Tablet: 2 mg, 5 mg*** ***Injection: 5 mg/ml*** ***rectal solution: 10 mg/2 ml***	**Common:** Sedation and other side-effects that appear similar to alcohol intoxication **Infrequent or rare:** Nausea/vomiting, diarrhoea, abdominal pain or cramps, respiratory depression (usually due to an excessive dose), withdrawal syndrome, hypotension, bradycardia, dependence and abuse, drowsiness and light-headedness the next day, confusion and ataxia (especially in elderly), amnesia, dependence, muscle weakness, paradoxical increase in aggression, visual disturbances, changes in libido, incontinence or urinary retention, blood disorders, raised liver enzymes/jaundice, hypotension with rapid IV administration	**Pregnancy:** Avoid regular use (use only if necessary, e.g. seizure control). Use minimum effective dose for shortest duration; associated with increased risk of cleft palate; withdrawal symptoms in newborns have been reported **Breastfeeding:** Use with caution; short-acting benzodiazepines preferred if needed. Adverse effects possible (monitor infant for drowsiness and poor feeding) **Contraindications:** Respiratory disease, acute pulmonary insufficiency, sleep apnoea, severe hepatic impairment, myasthenia gravis, acute angle closure glaucoma **Use with caution:** In muscle weakness, history of alcohol or drug abuse, marked personality disorder, elderly or debilitated, porphyria, hepatic impairment (avoid if severe), renal impairment. Repeated use even in therapeutic doses can lead to a dependence syndrome. This is unlikely when it is prescribed in standard doses for up to 4 weeks, but beyond this the risk increases in proportion to the duration of treatment and daily dose. Avoid abrupt withdrawal. **Counselling:** This medication may impair ability to perform skilled tasks such as operating machinery or driving.
Anxiety (10.11.7); adjuvant analgesia for muscle spasms and anxiety-related pain (20.3)	Oral: see Section 10.11.7		
Convulsions (QC pages 6 and 19, 3.5); organophosphate or chloroquine poisoning (3.8)	10 mg IV slowly, or rectally if no IV access; can be repeated after 10 minutes if convulsion does not stop. DO NOT give IM.		
Acute alcohol withdrawal (3.7.1)	Up to 20 mg, according to the severity of alcohol withdrawal, every 1-2 hours until patient is calm and mildly sedated (See Section 3.7.1 for how to titrate diazepam dose.)		
Amphetamine or cocaine acute intoxication with severe agitation or anxiety (3.6)	See Section 3.6.3.		
Insomnia	See Section 20.7.		
Diethylcarbamazine (DEC)	***Tablet: 50 mg, 100 mg***	**Common:** Nausea, vomiting; headache, dizziness **Infrequent or rare:** Immunological reaction	**Pregnancy/breastfeeding:** Not for use in pregnancy **Contraindications:** DEC should not be used in areas where onchocerciasis or loiasis is co-endemic, due to possible severe adverse reactions. Patients should be examined for co-infection before using DEC. **Use with caution:** In renal impairment, cardiac disorders
Filariasis (11.12)	Oral: 6 mg/kg in 3 divided doses for 12 days OR 6 mg/kg as a single dose AND albendazole 400 mg in a single dose. Repeat every 6 months if microfilaraemic or symptomatic.		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Dihydro-artemisinin + piperaquine A first-line antimalarial regimen for symptomatic, uncomplicated P. falciparum malaria (11.25.3)	***Co-formulated tablet of 40 mg dihydroartemisinin and 320 mg piperaquine*** See dosing in table in 11.25.3.	**Common:** Headache, eosinophilia, cough, potential for QTc prolongation	**Pregnancy:** Not recommended in the first trimester of pregnancy **Administration:** Take with water on an empty stomach. If a patient vomits within 30 minutes of taking drug, the whole dose should be re-administered; if a patient vomits within 30-60 minutes, half the dose should be re-administered.
Diloxanide Luminal amoebicide (11.1.1)	***Tablet: 500 mg (furoate)*** Oral: 500 mg 3 times daily for 5 days	**Common:** Flatulence **Infrequent or rare:** Vomiting, pruritus, urticaria	**Pregnancy:** Defer treatment until after the first trimester. **Breastfeeding:** Manufacturer advises to avoid.
Dithranol Moderate to severe psoriasis (10.2.7) Note: Stability is a problem with dithranol preparations, especially those of low strength. Addition of salicylic acid, ascorbic acid or oxalic acid as an antioxidant stabilises dithranol products and prevents discolouration and inactivation. Stability appears to be best in soft paraffin and least in cream bases.	***Ointment: 0.1-2%*** Topical: start with 0.1%, carefully apply directly to lesions only, leave in contact for 30 minutes, then wash off thoroughly; repeat application daily, gradually increasing strength to 2% and contact time to 60 minutes at weekly intervals; some 0.1–0.5% strength preparations are suitable for overnight use	**Common:** Local irritation; excessive erythema or spread of lesions (discontinue use); conjunctivitis following contact with eyes; staining of skin, hair, and fabrics.	**Precautions:** irritant (avoid contact with eyes, mucous membranes and healthy skin). **Contraindications:** hypersensitivity; avoid use on face, groin, acute eruptions, excessively inflamed areas. **Administration:** Localize application to plaques by application in Lassar's paste (zinc paste 96%, salicylic acid 2%, liquid paraffin 2) or white soft paraffin to surrounding skin. Dithranol must be protected from light and should be supplied in appropriate light-occlusive containers. **Counselling:** Wash hands thoroughly after use

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Dopamine Shock not responding to fluid boluses (3.1)	***Infusion, intravenous: 200 mg in 5 ml ampoule*** IV: See vasopressor dosing table and instructions in Section 3.1.	**Common:** Nausea/vomiting, tachycardia, ectopic beats, palpitations, anginal pain; hypotension with dizziness, hypertension (in overdosage), headache, dyspnoea **Infrequent or rare:** Allergic reaction including anaphylaxis (due to sodium metabisulphite in products), abnormal ventricular conduction, bradycardia, piloerction, uraemia, mydriasis, peripheral vasoconstriction, asthma exacerbation, necrosis/gangrene at injection site	**Pregnancy:** Use only if benefit is greater than risk and no alternatives are available. **Breastfeeding:** May be used at recommended doses if benefit is greater than risk; short half-life and rapidly destroyed in the GI tract. **Contraindications:** Tachyarrhythmia, ventricular fibrillation, ischaemic heart disease, phaeochromocytoma, hyperthyroidism. Correct hypovolaemia before administration; maintain blood volume during treatment. Correct hypoxia before or at same time as starting treatment. See Section 3.1. **Use with caution:** If history of peripheral vascular disease **Administration:** Dilute before use in glucose 5% or normal saline and infuse into a large vein. Do not add to sodium bicarbonate or other strongly alkaline solutions.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Doxycycline	***Capsule: 100 mg***	**Common:** Nausea/vomiting, diarrhoea, anorexia, epigastric burning, staining of growing teeth and occasional dental hypoplasia, photosensitivity **Infrequent or rare:** Tinnitus, hypersensitivity reactions, visual disturbances, hepatotoxicity, blood disorders, C. *difficile* colitis, oesophagitis and oesophageal ulceration	**Pregnancy/breastfeeding:** Not indicated after week 8 due to effects on fetal bone growth and dental discolouration; short courses can be used if alternative not appropriate; implicated in causing maternal hepatotoxicity, especially in third trimester (dose-related). May be used for a single short course of 7-10 days (monitor infant for side-effects). **Use with caution:** In hepatic impairment, porphyria, systemic lupus erythematosus **Counselling:** Advise patients to take capsules whole, with plenty of fluid, while sitting or standing to prevent oesophageal irritation; may give with milk/food to counter gastric irritation. Avoid exposure to sunlight or sunlamps.
Non-severe pneumonia (10.6.3)	Oral: 100 mg twice daily for 5- 7 days		
In combination with quinine or artesunate to complete course of treatment for severe malaria; as second-line *P. falciparum* antimalarial treatment; or for travellers (11.25)	See Section 11.25.		
Syphilis, early latent- only for non-pregnant and pencillian allergic (11.37)	Oral: 100 mg twice daily for 14 days		
Syphilis, late latent or undetermined duration (11.37)	Oral: 100 mg twice daily for 30 days		
Uncomplicated genital chlamydia (10.15.4); non-gonococcal urethritis; rickettsial diseases (11.33); leptospirosis (11.22)	Oral: 100 mg twice daily for 7 days		
Lympogranuloma venereum (10.14.3)	Oral: 100 mg twice daily for 14 days		
Granuloma inguinale (donovaniasis) (10.14.3)	Oral: 100 mg twice daily until healed		
PID (10.15.5)	Oral/IV: See table in Section 10.15.5.		
Trench fever (11.2.3)	Oral: 100 mg twice daily for 4-6 weeks		

Bacillary angiomatosis (11.2.4)	Oral: 100 mg twice daily for 3 weeks		
Cat scratch fever (11.2.2)	Oral: 100 mg twice daily for 10-14 days AND rifampicin		
Cholera (10.7d.2)	Oral: 300 mg as a single dose		
Severe acne (10.2.3)	Oral: 50 mg daily for 3-6 months		
Anthrax, cutaneous (10.2.10); uncomplicated cellulitis, furuncle, carbuncle, abscess (10.2.2)	Oral: 100 mg twice daily for 7-10 days		
Leptospirosis (11.22)	Oral: 100 mg twice daily for 7 days		
Eosinophilic folliculitis (10.2.3)	Oral: 100 mg twice daily for 8-12 weeks		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Eflornithine Human African trypanosomiasis - *T.b. gambiense* meningo-encephalitic stage (11.41)	***Injection: 200 mg/ml in 100 ml bottle*** IV (slow infusion over 2 hours): 200 mg/kg every 12 hours for 7 days AND oral nifurtimox (If nifurtimox is not available, give eflornithine 100 mg/kg IV every 6 hours for 14 days.)	**Common:** Anaemia, leukopenia, thrombocytopenia, convulsions, impaired hearing, vomiting, abdominal pain, headache, facial oedema	**Pregnancy/breastfeeding:** Contraindicated in pregnancy and breastfeeding U**se with caution:** In renal impairment hospitalize and supervise closely during treatment. **Administration:** Monitor blood count for bone marrow suppression.
Enalapril HIV-associated nephropathy (11.31.5) (**Other indications:** Hypertension; heart failure)	***Tablet: 2.5 mg*** Oral: 2.5 to 40 mg daily. See Section 11.31.5 for dose adjustment.	**Common:** Hypotension if diuretics co-prescribed, cough, hyperkalaemia, headache, dizziness, fatigue, nausea, renal impairment, stomatitis, glossitis **Infrequent or rare:** See current formulary such as BNF	**Pregnancy:** Avoid in pregnancy. **Breastfeeding:** Amount excreted probably too small to be harmful. **Contraindications:** Hypersensitivity to ACE inhibitors (including angioedema) **Use with caution:** In renal impairment, peripheral vascular disease, aortic stenosis, hepatic impairment **Administration:** When starting, stop diuretics for 24 hours and start with a low dose at bedtime. Check renal function and electrolytes before starting. **Counselling:** While taking this medicine, you may feel dizzy on standing. Get up gradually from sitting or lying to minimize this; sit or lie down if you feel dizzy. Do not take potassium supplements while you are taking this medicine unless prescribed by your clinician.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Epinephrine (adrenaline) Anaphylaxis (QC p. 11, 3.1.3) Septic shock not responding to fluid boluses (3.1.5); cardiogenic shock (3.1.4) Severe bronchospasm if no inhaled salbutamol available (3.2.4)	***Injection: 1 mg in 1 ml ampoule (1:1000)*** IM (1:1000): 0.5 ml in a single dose if 50 kg (0.3 ml if 30 kg, 0.4 ml if 40 kg) THEN may repeat at 5-minute intervals IV infusion: See vasopressor dosing table and instructions in Section 3.1 IM: 0.5 mg (0.5 ml of 1:1000)	**Common:** anxiety, headache, fear, palpitations, tachycardia, tremor, dizziness, sweating, pallor, nausea, vomiting, hyperglycaemia. **Infrequent or rare:** hypertension, arrhythmias, angina, pulmonary oedema (a sign of excessive dosage or extreme sensitivity), tissue necrosis (if injected IM or SC)	**Pregnancy:** May be used at the recommended doses **Breastfeeding:** Caution in breastfeeding. Monitor infant for side-effects such as irritability, restlessness, tremor. **Use with caution:** In hyperthyroidism, hypertension, diabetes mellitus, heart disease, arrhythmias, cerebrovascular disease, second stage of labour, and the elderly **Administration:** Intravenous epinephrine should be given only by those experienced in its use and in a setting where patients can be carefully monitored.
Ergometrine Haemorrhage in early pregnancy (QC p. 24) Postpartum haemorrhage: heavy bleeding continues with soft uterus after oxytocin given and placenta delivered or after manual removal of placenta (QC p. 25, 27)	**Injection: 200 mcg (0.2 mg) (hydrogen maleate) in 1 ml ampoule** IM: 0.2 mg in a single dose AND repeat IM or IV if bleeding continues IV (slow) or IM: 0.2 mg	**Common:** Nausea, vomiting **Infrequent or rare:** Headache, dizziness, tinnitus, abdominal pain, chest pain/palpitations, dyspnoea, bradycardia, transient hypertension, stroke, myocardial infarction, pulmonary oedema	**Pregnancy:** Contraindicated at induction of labour or first and second stages of labour as can cause premature uterine contractions and decrease uterine blood flow (possible fetal hypoxia and death) **Breastfeeding:** Single dose post-partum compatible with breastfeeding; avoid prolonged or multiple dosing **Contraindications:** Vascular disease, severe cardiac disease (angina pectoris), severe hypertension, severe renal or hepatic impairment, sepsis, pre-eclampsia or eclampsia Use with caution: In cardiac disease, hypertension, renal impairment, multiple pregnancy, porphyria

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Erythromycin	***Tablet: 250 mg*** ***Capsule: 250 mg*** ***Infusion: 500 mg vial***	**Common:** Nausea/vomiting, diarrhoea, abdominal pain or cramps **Infrequent or rare:** Allergic reactions, reversible hearing loss, jaundice, cardiac effects, myasthenia-like syndrome, erythema multiforme (Stevens-Johnson syndrome)/ toxic epidermal necrolysis, QT prolongation, *C. difficile* colitis	**Pregnancy/breastfeeding:** Not known to be harmful in pregnancy or breastfeeding **Contraindications:** Hypersensitivity to erythromycin or other macrolides, porphyria **Use with caution:** In hepatic impairment, predisposition to QT interval prolongation (including electrolyte disturbances and concomitant use of drugs that prolong the QT interval). Prone to multiple drug interactions. **Administration:** Reconstitute injection with water for injection only. Dilute further for administration. Parenteral erythromycin is an irritant and may cause thrombophlebitis. Infuse at a rate of 1-5 mg/ml over 60 minutes or slower, via a central vein where possible. Avoid extravasation.
Early syphilis (11.37)	Oral: 500 mg 4 times daily for 14 days		
Late latent syphilis (11.37)	Oral: 500 mg 4 times daily for 30 days		
Uncomplicated genital Chlamydia; non-gonococcal urethritis (10.15.4)	Oral: 500 mg twice daily for 7 days		
Lympogranuloma venereum (10.14.3)	Oral: 500 mg 4 times daily for 14 days		
Granuloma inguinale (donovaniasis) (10.14.3)	Oral: 500 mg 4 times daily until healed		
Chancroid (10.1.3)	Oral: 500 mg 4 times daily for 7 days		
Severe pneumonia (3.2.3) or non-severe pneumonia not responding to oral therapy after 3 days (10.6.3)	IV/oral: 500 mg 4 times daily AND ceftriaxone OR ampicillin + gentamicin for 10-14 days		
Non-severe pneumonia (10.6)	Oral: 500 mg 4 times daily for 5-7 days		
Rheumatic fever, primary treatment if allergic to penicillin (11.32)	Oral: 250 mg 4 times daily for 10 days		

Rheumatic fever, secondary prophylaxis (11.32) Streptococcal pharyngitis (10.17.9) Severe acne (10.2.3) Cholera in areas with tetracycline resistance (10.7d.2)	Oral: 250 mg twice daily Oral: 250 mg 4 times daily for 10 days Oral: 500 mg twice daily Oral: 500 mg 4 times daily for 3 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Erythromycin, topical Mild to moderate acne (10.2.3)	***Gel/lotion: erythromycin 2%*** Gel: Apply once a day in a thin film to affected area. Lotion: Apply twice daily in a thin film to affected area. See Section 10.2.3	**Common:** Dry skin, itch, stinging, burning feeling **Infrequent or rare:** Desquamation, erythema If irritation occurs, apply less frequently; if it persists, stop treatment.	**Pregnancy/breastfeeding:** Safe to use **Counselling:** Before applying, wash affected area with a mild soap and warm water, rinse thoroughly, and pat dry. Avoid contact with eyes, lips, and inside of your nose or mouth. Noticeable improvement may be seen in 3–4 weeks. However, 6–12 weeks of treatment may be required before maximum benefit is seen.
Ethambutol Tuberculosis, initial phase of combination therapy (15.3) MAC (in HIV-infected patients) (11.27)	***Tablets: 100 mg, 400 mg*** Oral: 15 mg/kg daily or 30 mg/kg 3 times a week 15 mg/kg/day AND clarithromycin or azithromycin for 6 months	**Common:** Optic neuritis **Infrequent or rare:** peripheral neuritis (especially in legs), rash, pruritus, urticaria, thrombocytopenia, gout, jaundice	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects, including jaundice) **Contraindications:** History of optic neuritis and severe renal impairment **Use with caution:** In elderly with ocular defects, renal impairment **Administration:** Ocular examination recommended before and during treatment; patients should report visual disturbances immediately and discontinue treatment. Renal dose adjustment required. **Counselling:** If you see less clearly or colour vision is affected, stop the medication and tell your clinician.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Ethanol Ethylene glycol or methanol poisoning (3.8.1)	***Oral liquid: 40–43% alcohol (vodka or whisky)*** Oral (or by NG): Loading: 1.8 ml/kg over 15–30 minutes (diluted). Maintenance dose: 0.2 ml/kg/hour (non-drinker) or 0.46 ml/kg/hour (heavy alcohol user)	**Common:** Signs of intoxication, confusion, drowsiness, coma, respiratory depression, hypoglycaemia	**Pregnancy/breastfeeding:** Judgement needed; however, fetus is more likely to be at risk from metabolic derangements from ethylene glycol/methanol poisoning than from ethanol as antidote. Avoid breastfeeding during ethanol treatment since ethanol passes into breast milk. **Contraindications:** Hypersensitivity to ethanol. **Use with caution:** Causes CNS depression, and effects are additive with other CNS depressants, e.g. benzodiazepines. Increased risk of hypoglycaemia in those with alcohol dependence. In patients taking drugs that inhibit aldehyde dehydrogenase, e.g. disulfiram, metronidazole, griseofulvin, use can result in acetaldehyde syndrome (nausea, flushing, autonomic instability).
Ferrous sulfate See elemental iron equivalents in Section 8.3. Iron-deficiency anaemia (10.18.3) Preventive iron supplementation in pregnant women without anaemia (14.1.1)	***Tablet: equivalent to 60 mg iron*** Elemental iron, 60 mg for mild anaemia, 120 mg (plus 400 mcg folic acid) for moderate to severe anaemia daily Elemental iron 100 mg AND 400 mcg folic acid daily	**Common:** Constipation (particularly in older patients; occasionally leads to faecal impaction), diarrhoea, dark stools, nausea, epigastric pain, gastrointestinal irritation **Infrequent or rare:** Haemosiderosis	**Pregnancy/breastfeeding:** Safe to use **Contraindications:** Haemosiderosis, haemochromatosis; any form of anaemia not caused by iron deficiency; patients receiving repeated blood transfusions; parenteral iron therapy **Administration:** If side-effects occur, the dose may be reduced; alternatively, another iron salt may be used, but an improvement in tolerance may simply be a result of a lower content of elemental iron. See Section 10.18.3 for monitoring, duration of treatment. **Counselling:** Although iron preparations are best absorbed on an empty stomach, they may be taken after food to reduce gastrointestinal adverse effects. Keep out of children's reach.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Fluconazole	***Capsule: 50 mg*** ***Infusion, intravenous: 2 mg/ml*** ***Oral liquid: 50 mg/5 ml***	**Infrequent or rare:** Nausea/vomiting, abdominal pain, diarrhoea, headache, hepatic disorders, dizziness, seizures, alopecia, rash (withdraw treatment), hypersensitivity reactions, blood disorders, hypokalaemia	**Pregnancy:** Single dose unlikely to pose a risk to fetus, but avoid high dose or prolonged treatment. **Breastfeeding:** Safe in usual dosage for short-term treatment (monitor infant for side-effects) **Use with caution:** In renal impairment, sensitivity to other azoles. Monitor liver function (discontinue if signs or symptoms of hepatic disease). Prone to multiple drug interactions. Renal dose adjustment required. **Counselling:** Tell your doctor if you feel unusually tired, nauseous, or are not eating, or if you notice dark urine, pale faeces, or yellowing of the white of your eyes or skin.
Vaginal candidiasis (10.15.4, 11.4)	Oral: 150 mg as a single dose		
Recurrent oral candidiasis (10.17.3, 11.4)	Oral: 100-200 mg daily for 7-14 days		
Oesophageal candidiasis (10.7b.3, 11.4)	IV/oral: 100-200 mg daily for 14-21 days		
Invasive candida disease and candidemia (11.4)	IV/oral: 400 mg daily, continued for 14 days after last fever		
Cryptococcal meningitis, with or without amphotericin B (11.5)	See options in Section 11.5		
Cryptococcal meningitis (secondary prophylaxis) (11.5)	Oral: 200 mg daily until the patient is on successful ART and CD4 count is maintained above 200 for 6 months		
Pityriasis versicolor (10.2.8)	Oral: 400 mg as a single dose		
Dermatophytosis (10.2.7)	Oral: 150-300 mg weekly until cure (6–12 months)		
Leishmaniasis, cutaneous (11.20.1)	Oral: 200 mg daily for 6 weeks		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Flucytosine (5-FC) Cryptococcal meningitis (as an adjunct to amphotericin) (11.5)	***Capsule: 250 mg*** ***Infusion: 2.5 g in 250 ml*** IV/oral: 100 mg/kg daily in 4 divided doses for 14 days	**Common:** Nausea/vomiting, rash, diarrhoea **Infrequent or rare:** Cardiotoxicity, confusion, hallucinations, convulsions, headache, sedation, vertigo, alterations in liver function tests (hepatitis and hepatic necrosis reported), toxic epidermal necrolysis; blood disorders including thrombocytopenia, leukopenia, aplastic anaemia	**Pregnancy:** Avoid in pregnancy (teratogenic in animal studies); consider alternatives; use only if benefit greater than risk. **Breastfeeding:** Not recommended until more information available; use only if benefit greater than risk; consider alternatives. **Use with caution:** In elderly, renal impairment, pre-existing bone marrow suppression **Administration:** Monitor liver function, kidney function, and blood counts when use with amphotericin B (check weekly in renal impairment or in blood disorders). Renal dose adjustment required. **Storage:** Keep at 15–25 0C (forms fluorouracil above 25 0C and can precipitate below 15 0C). **Counselling:** Take the capsule with food.
Fluoxetine Moderate or severe depression (10.11.6); chronic anxiety disorders (10.11.7)	***Capsule/tablet: 20 mg*** Oral: Initiate treatment with 20 mg daily (to reduce risk of side-effects that undermine adherence, may start at 10 mg (e.g. half a tablet) once daily and increase to 20 mg if the medication is tolerated); THEN if no response in 4–6 weeks or partial response in 6 weeks, increase dose by 20 mg (maximum dose 60 mg) according to tolerability and symptom response. For elderly and medically ill, see Section 10.11.6	**Common:** Restlessness, nervousness, insomnia, anorexia and other gastrointestinal disturbances, headache, sweating, decreased libido **Infrequent or rare:** Marked akathisia (inner restlessness), bleeding abnormalities in patients taking aspirin or non-steroidal anti-inflammatory drugs	**Pregnancy:** Use with caution; self-limiting withdrawal symptoms have been reported in newborns (e.g. distress, poor feeding, sleep disturbances). **Breastfeeding:** Not recommended; long half-life, may accumulate in breast milk; if required, use lowest effective dose. **Contraindications:** In combination with MAO-Is **Use with caution:** Renal or hepatic failure (consider dose reduction), diabetes mellitus. Prone to multiple drug interactions. **Administration:** Although symptomatic relief may be apparent within the first 1–3 weeks, optimum antidepressant effect usually requires at least 4 weeks or more of therapy. Watch for agitation and suicidal ideation and behaviour (see Section 10.11). If history of mania or bipolar disorder, use a mood stabilizer first (see Section 10.11.5 on bipolar disorder for details).

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Fluphenazine Antipsychotic: maintenance treatment of schizophrenia and other psychosis (10.11.4)	***Injection: 25 mg, 1 ml ampoule*** Deep IM injection: Initially 12.5 mg in gluteal region THEN repeat every 2–4 weeks. Typical effective dose is 12.5-100 mg IM every 2-5 weeks. In elderly or medically ill patients: IM: Initially 6.25 mg deep injection in gluteal region AND repeat IM injections every 2-5 weeks using lowest effective dose.	See chlorpromazine. Additionally for fluphenazine: pain at injection site With the exception of tardive dyskinesia, fluphenazine has more prominent extrapyramidal side effects but fewer autonomic side-effects, than chlorpromazine.	**Pregnancy:** Use with caution; monitor infant for reversible extrapyramidal side-effects. **Breastfeeding:** Use, with caution, if drug of choice (monitor infant for side-effects such as sedation). **Contraindications:** See chlorpromazine. **Use with caution:** See chlorpromazine. **Elderly/debilitated** (**including HIV stage 3 or 4**): See chlorpromazine. **Counselling:** See chlorpromazine. Warn patients that this medication may impair ability to perform skilled tasks such as operating machinery or driving.
Folic acid Folate-deficiency megaloblastic anaemia (10.18.3) Sickle-cell disease prophylaxis (10.18.3) (**Other indications:** Prevention of neural tube defect in pregnancy; prevention of recurrence of neural tube defect)	***Tablet: 1 mg, 5 mg*** Oral: 5 mg daily for 4 months (in pregnancy, continue to term); up to 15 mg daily for malabsorption states if needed AND vitamin B12 Oral: 1 mg daily	**Infrequent or rare:** Nausea/vomiting, diarrhoea, abdominal pain or cramping	**Pregnancy/breastfeeding:** May be used at recommended dose in pregnancy and breastfeeding **Contraindications:** Folate-dependent malignant disease Women receiving antiepileptic therapy need counselling before starting folic acid. Should never be given without vitamin B12 in undiagnosed megaloblastic anaemia or other vitamin B12 deficiency states due to risk of precipitating subacute combined degeneration of the spinal cord.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Folinic acid (calcium folinate, calcium leucovorin) Methanol poisoning (3.8.1) Toxoplasmosis (11.40) (**Other indications:** Given with methotrexate and 5 FU chemotherapy)	***Injection, powder for reconstitution, folinic acid (as calcium salt) 3 mg/ml in 10 ml ampoule Tablet: 15 mg*** IV: 50 mg every 4 hours for 6 doses Oral: 10-25 mg with each dose of pyrimethamine	**Common:** Hypersensitivity reactions **Infrequent or rare:** Pyrexia after parenteral use	**Pregnancy/breastfeeding:** Not recommended during pregnancy or breastfeeding. Manufacturer advises use only if potential benefit outweighs risk. **Use with caution** and at lower doses if renal or hepatic impairment. Does not alter the CNS effects of drinking alcohol or withdrawal symptoms
Furosemide Oedema (not lymphoedema) (10.4.3) Acute pulmonary oedema (3.2.5) Oliguria in acute kidney injury (11.31.3)	***Tablet: 40 mg*** ***Injection: 10 mg/ml*** Oral: Initially 20–80 mg daily in morning (higher starting doses recommended when patient not naive to drug or renal impairment) Maintenance dose: 20–40 mg daily (may be increased to 80 mg daily or more in resistant oedema) IV (slow): 20–50 mg (if necessary, increase by 20 mg steps every 2 hours) (see flowchart in Section 3.2.5) IV: Initially give 20 mg; monitor urinary response. (see dosing in Section 11.31.3)	**Common:** Electrolyte imbalance (hypokalaemia, hyponatraemia, hypomagnesaemia), hyperuricaemia and gout, orthostatic hypotension, hypovolaemia, syncope, dizziness **Infrequent or rare:** Hypochloraemic alkalosis, hypocalcaemia, hyperglycaemia (less than with thiazide diuretics), paraesthesia, blood disorders (including thrombocytopenia, leukopenia, agranulocytosis, aplastic anaemia, haemolytic anaemia), bone marrow depression (withdraw treatment); deafness (with rapid administration of large parenteral doses and in renal impairment), hypotension, hypersensitivity reaction (including anaphylaxis), temporary increase in plasma cholesterol and triglyceride concentration	**Pregnancy:** Consider alternatives; loop diuretics not recommended unless absolutely necessary (e.g. cardiac failure). Neonatal ototoxicity has been reported. **Breastfeeding:** Limited data. Not recommended; theoretically, may suppress lactation due to diuresis **Contraindications:** Anuria due to renal failure, precomatose states associated with liver cirrhosis, electrolyte depletion **Use with caution:** In elderly (reduce dose), hypotensive patients, renal impairment, hepatic impairment, prostatic enlargement **Administration:** Dose to be diluted in suitable amount of infusion fluid (saline or LR; glucose solutions are unsuitable), depending on hydration of patient, at rate not to exceed 4 mg/minute. Monitor electrolytes, particularly potassium and sodium. Correct hypovolaemia before using in oliguria. IV to PO conversion is 1:2 (e.g. 20 mg IV is equal to 40 mg PO)

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Gabapentin Neuropathic pain (if poor response to amitryptiline in HIV patient on ART) (10.10a.6)	***Tablet: 300 mg*** Oral: Initial dose of 300 mg daily; THEN increase to 300 mg twice daily; THEN 300 mg 3 times daily as needed THEN titrate with 100 mg increments every 3 days to a maximum of 3.6 g daily (given as 1200 mg 3 times daily or 900 mg 4 times daily	**Common:** Nausea, vomiting, diarrhoea, dry mouth, dyspepsia, constipation, abdominal pain, flatulence; appetite changes, gingivitis, weight gain; hypertension, vasodilation, oedema; dyspnoea, cough, rhinitis **Infrequent or rare:** Confusion, depression, hostility, sleep disturbances, headache, dizziness, anxiety, amnesia, ataxia, dysarthria, nystagmus, tremor, asthenia, paraesthesia, hyperkinesia; influenza-like symptoms; impotence, urinary incontinence; leukopenia; myalgia, arthralgia; diplopia, amblyopia; rash, purpura, pruritus, acne; rarely, pancreatitis, hepatitis, jaundice, palpitation, hallucinations, movement disorders, thrombocytopenia, blood-glucose fluctuations in patients with diabetes, tinnitus, acute renal failure, Stevens-Johnson syndrome, alopecia	**Pregnancy:** Use with extreme caution; has been associated with fetal abnormalities such as hypospadias, unilateral renal agenesis. **Breastfeeding:** Use, with caution, in breastfeeding; monitor infant for sedation and lethargy. **Caution:** Monitor for depression, suicidal ideation, unusual mood, behaviour change; mixed seizure disorder (including absence seizure); renal impairment; encephalopathy **Administration:** Renal dose adjustment required. Avoid stopping abruptly, which may cause anxiety, insomnia, nausea, pain and sweating. Gradually reduce dose over at least 1 week. **Counselling:** This medicine may cause drowsiness or dizziness. If affected, do not drive or operate heavy machinery.
Ganciclovir Cytomegalovirus (CMV) retinochoroiditis in HIV-infected patients (11.8) CMV oesophagitis, gastritis, neurologic, in HIV-infected patients (11.8)	***Injection: 500 mg vial*** Induction dose: IV: 5 mg/kg twice daily for 3-4 weeks IV: 5 mg/kg twice daily for 3- 6 weeks See Section 11.8 for maintenance with valganciclovir, if available.	**Common:** Nausea, vomiting, diarrhoea, dyspepsia, abdominal pain, constipation, flatulence, dysphagia; hepatic dysfunction; dyspnoea, chest pain, cough; headache, insomnia, convulsions, dizziness, neuropathy, depression, anxiety, confusion, abnormal thinking, fatigue; weight loss, anorexia; infection, fever, night sweats; anaemia, leukopenia, thrombocytopenia, pancytopenia, renal impairment; myalgia, arthralgia; macular oedema, retinal detachment, vitreous floaters, eye pain; ear pain, taste disturbance; dermatitis, pruritus; injection-site reactions **Infrequent or rare:** Chest pain, chills, mouth ulceration, cough, dry mouth, drowsiness, arthralgia, pancreatitis, arrhythmias, hypotension, anaphylactic reactions, psychosis, tremor, male infertility, haematuria, disturbances in hearing and vision, alopecia	**Pregnancy/breastfeeding:** Avoid during pregnancy or breastfeeding unless need justifies the risk. To avoid pregnancy, advise use of an effective contraceptive. **Contraindications:** Neutropenia (ANC <500) or thrombocytopenia (platelets <25 000); concurrent use with zidovudine **Use with caution:** Ganciclovir is toxic. Personnel should be adequately protected during handling and administration. If solution comes into contact with skin or mucosa, wash off immediately with soap and water. In patients with renal impairment, renal dose adjustment required. Affects spermatogenesis and fertility. **Administration:** To avoid phlebitis at the injection site (related to high pH of solution), administer in veins with good flow. Maintain adequate hydration. Monitor blood counts 2–3 times per week.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Gentamicin	***Injection: 10 mg, 40 mg (as sulfate)/ml in 2 ml vial***	**Common:** Nephrotoxicity, ototoxicity **Infrequent or rare:** Neuromuscular blockade, renal electrolyte wasting (Mg, K, Ca), antibiotic-associated colitis, nausea/vomiting, hypersensitivity reactions	**Pregnancy:** Avoid unless essential for serious infections; monitor levels to minimize potential for ototoxicity and nephrotoxicity. **Breastfeeding:** May be used at recommended doses (monitor infant for thrush, diarrhoea) **Contraindications:** Hypersensitivity to aminoglycoside group of antibiotics **Use with caution:** In renal impairment, pre-existing tinnitus/ hearing loss, conditions with muscular weakness, obesity, the elderly (dosage adjustment required). Monitor renal, auditory, vestibular function, serum-gentamicin concentration. Avoid prolonged use. One-hour (peak) concentration not to exceed 5–10 mg/l (3–5 mg/l for endocarditis) and pre-dose (*trough*) concentration less than 2 mg/l (less than 1 mg/l for endocarditis). Avoid use with neuromuscular blocking agents (additive toxicity) and other renal/ototoxic agents. Avoid monotherapy with gentamicin especially for severe infections of unclear etiology. **Administration:** Renal dose adjustment required. Can be dosed daily (4.5 mg/kg every 24 hours) or 1.5 mg/kg every 8 hours. The empirical antibiotic dose for emergency management of 240 mg (QC p. 19) represents the full daily dose for a 60 kg person.
General dosing for infections, due to susceptible organisms, such as upper UTI (11.44); septic shock (3.1.5); severe pneumonia (3.2.3)	IM/IV (slow): 4–6 mg/kg daily in divided doses every 8 hours for 2 weeks AND ampicillin		
Initial empirical antibiotics for emergency management (QC p. 19)	IV: 240 mg in a single dose AND ampicillin 2 g IV/IM		
Endocarditis from viridans streptococci- non-complicated cases (as part of combination therapy) (11.10)	IV/IM: 3 mg/kg per 24 hours in 1 dose or in 2 or 3 equally divided doses for 2 weeks AND benzylpenicillin or ceftriaxone or vancomycin		
PID (10.15.5)	IV: 1.5 mg/kg every 8 hours AND clindamycin AND metronidazole		
Cholangitis and peritonitis (10.7a.2)	IV: 1.5 mg/kg every 8 hours AND ampicillin AND metronidazole		
Brucellosis (11.3)	IV: 5 mg/kg daily in divided doses every 8 hours AND doxycycline for 15 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Gentamicin eye drops Bacterial conjunctivitis (10.12.2); corneal ulcer or infective keratitis (10.12.2)	***Solution (eye drops): 0.3%*** 1 drop every 2 hours, reducing frequency as infection is controlled THEN continue for 48 hours after healing is complete.	**Common:** Burning, stinging, itching, dermatitis	**Use with caution:** Prolonged use may lead to sensitization and emergence of resistant organisms including fungi; discontinue if there is purulent discharge, inflammation, exacerbation of pain.
Griseofulvin Scalp, skin, groin infections (10.2.7); foot and nail infections (10.2.7)	***Tablets: 125 mg, 250 mg*** ***Capsules: 250 mg*** Oral: 500 mg to 1 g daily but not less than 10 mg/kg Duration of treatment depends on the infection and thickness of keratin at site of infection: at least 4 weeks for skin and hair, at least 6 weeks for scalp ringworm and, in severe infection, up to 3 months; 6 months for fingernails, 12 months or more for toe nails.	**Common:** Nausea, vomiting, diarrhoea, anorexia, headache **Infrequent or rare:** Leukopenia; hepatotoxicity; sleep disturbances; photosensitivity; systemic lupus erythematosus; rash, toxic epidermal necrolysis, erythema multiforme; peripheral neuropathy; confusion, impaired coordination	**Pregnancy:** Avoid pregnancy during and for 1 month after treatment; men should not father children within 6 months of treatment. Consider alternative treatments. **Breastfeeding:** Not recommended; use only if benefit is greater than risk; consider alternatives. Contraindications: Severe liver disease, porphyria, systemic lupus erythematosus **Use with caution:** In pre-existing hepatic insufficiency (closely monitor hepatic function throughout treatment), blood disorders (monitor blood count weekly during first month of treatment), penicillin allergy (cross-sensitivity may occur) **Counselling:** Take with milk or food. May impair ability to perform skilled tasks such as operating machinery or driving. Avoid sun exposure. During treatment and for 4 weeks after, drinking alcohol may cause increased heart rate and skin flushing.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Haloperidol Psychoses (including schizophrenia) (10.11) Short-term adjunctive management of agitation, violent behaviour, severe anxiety (QC p. 29) or severe symptoms of acute mania with agitation (10.11.5) Alcohol withdrawal delirium that persists after the stage of tremor and sweating has subsided (3.7) Antiemetic when other agents not available (10.7c)	***Tablet: 2 mg; 5 mg*** ***Injection: 5 mg in 1 ml ampoule*** Oral: Initially 1.5-3 mg once daily (typical effective dose is 3-20 mg daily) In elderly or medically ill patients: Oral: Initially 0.5–1 mg once daily (use the lowest effective dose) IM/oral: 2 mg every hour up to 5 doses (maximum dose 10 mg). In elderly and patients with complicating medical illness: IM/oral: 0.5-1 mg every hour up to 3 doses maximum dose 3 mg) See dosing in Section 3.7.	**See chlorpromazine.** With the exception of tardive dyskinesia, haloperidol has more prominent extrapyramidal side-effects but fewer autonomic side-effects than chlorpromazine.	**Pregnancy:** Use with caution and at lowest effective dose; reversible respiratory depression, extrapyramidal effects, difficulty feeding have been reported in newborn. **Breastfeeding:** Caution in breastfeeding (monitor infant for drowsiness) **Contraindications:** See chlorpromazine. **Use with caution:** See chlorpromazine. **Elderly/debilitated** (**including HIV stage 3 or 4**): See chlorpromazine. **Administration:** Monitor blood pressure and maintain supine position for 30 minutes after intramuscular injection. **Counselling:** This medication may impair your ability to perform skilled tasks such as operating machinery or driving.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Hydralazine IV Acute pulmonary oedema with severe hypertension if isosorbide dinitrate not available (3.2.5); severe hypertension in pre-eclampsia and eclampsia (3.2.5)- see IMPAC MCPC (**Other indications:** Heart failure; hypertension (oral); hypertensive crisis)	***Powder for injection: 20 mg (hydrochloride) in ampoule*** IV (slow): 5 mg diluted with 10 ml sodium chloride 0.9%; may repeat after 30 minutes	**Common:** Flushing, headache, dizziness, tachycardia, palpitation, oedema **Infrequent or rare:** Nausea/vomiting, ischaemia, postural hypotension, abnormal liver function, systemic lupus erythematosus-like syndrome, blood disorders (haemolytic anaemia, leukopenia, thrombocytopenia)	**Pregnancy:** Use only in acute treatment of hypertensive emergencies; avoid large boluses, as fetal distress and arrhythmias have been reported. **Breastfeeding:** Use, with caution, if benefits are greater than risks; monitor infant for effects such as hypotension, bradycardia, fatigue. **Contraindications:** Idiopathic systemic lupus erythematosus, severe tachycardia, high output heart failure, myocardial insufficiency due to mechanical obstruction, corpulmonale, dissecting aortic aneurysm, porphyria **Use with caution:** In hepatic impairment, renal impairment, coronary artery disease, cerebrovascular disease. May provoke angina (avoid after myocardial infarction until stabilized). **Administration:** Renal dose adjustment required. **Counselling:** This medicine may cause dizziness, especially at the start of treatment. If affected, do not drive or operate heavy machinery.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Hydrochlorothiazide Oedema (10.4.3); mild hyperkalaemia (5.2.2) HIV-associated nephropathy (11.31.5) (**Other indications:** Hypertension; heart failure)	***Tablet: 25 mg*** 25 mg once daily (12.5 mg in elderly). Increase to 50 mg as needed. See Section 11.31.5 for addition hydro-chlorthiazide to enalapril	**Common:** Dizziness, dry mouth, weakness, muscle cramps, polyuria, orthostatic hypotension, hypokalaemia, hyponatraemia, hypochloraemic alkalosis, hypomagnesaemia hyperuricaemia **Infrequent or rare:** Nausea/vomiting, weakness, lethargy, drowsiness, seizures, headache, oliguria, arrhythmias, hypercalcaemia, hyperglycaemia, rash, photosensitivity, altered plasma lipid concentration; rarely, impotence (reversible); blood disorders (including neutropenia, thrombocytopenia); pancreatitis, intrahepatic cholestasis, acute renal failure, hypersensitivity reactions (including pneumonitis, severe skin reactions	**Pregnancy:** Avoid use; may cause electrolyte disturbances or neonatal thrombocytopenia. Reduction in maternal blood volume may diminish uteroplacental perfusion. **Breastfeeding:** Use with caution but unlikely to suppress lactation. **Contraindications:** Severe renal or severe hepatic impairment; hyponatraemia, hypercalcaemia, refractory hypokalaemia, symptomatic hyperuricaemia; Addison's disease **Use with caution:** In elderly; electrolytes may need to be monitored with high doses; may aggravate diabetes mellitus and gout; may exacerbate systemic lupus erythematosus; porphyria **Counselling:** Take the medicine once daily in the morning. While taking this medicine, you may feel dizzy on standing. Get up gradually from sitting or lying to minimize this effect. Sit or lie down if you become dizzy.
Hydrocortisone Also see Section 8.2 steroid equivalents table. Anaphylaxis (3.1.3); moderate or severe bronchospasm, if suspect asthma or COPD or unable to take oral medication (3.2.4) Addison's syndrome (acute adrenal insufficiency) (3.4.3); urticaria (10.2.9)	***Injection: 100 mg (as sodium succinate) in vial*** IV (slow): 100 mg in a single dose IV: 100 mg initially AND repeat every 8 hours. Convert to oral dose once patient stable.	Associated with long-term treatment, which is not recommended with IV hydrocortisone. See prednisolone.	**Pregnancy:** May be used at the recommended doses; caution in first trimester due to possibility of oral cleft; limited fetal exposure due to inactivation by placenta **Breastfeeding:** May be used at recommended doses; caution with high parenteral/oral doses **Contraindications:** Not relevant to emergency use. For contraindications related to long-term use, see prednisolone.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Hydrocortisone cream Severe inflammatory skin conditions including papular lesions; eosinophilic folliculitis; pityrosporum folliculitis; papular urticaria; eczema; contact, atopic dermatitis; numular eczema; seborrhoeic dermatitis; psoriasis (10.2)	***Cream: 1%*** Topical: Apply a small quantity to the affected area 1–2 times daily until improvement occurs.	**Infrequent or rare:** Exacerbation of local infection, contact dermatitis, perioral dermatitis	**Pregnancy:** Topical preparations unlikely to cause any adverse effects in pregnancy or breastfeeding, as systemic absorption is expected to be minimal. **Breastfeeding:** Wipe excess cream from nipple area before feeding. **Contraindications:** Untreated skin infections, broken skin, rosacea, acne, perioral dermatitis. Occlusive dressings increase penetration into keratinized lesions. Treat secondary infection with an appropriate antimicrobial.
Hydroxypropyl methylcellulose (tears naturale) Chronic soreness of the eyes associated with reduced or abnormal tear secretion; acute viral conjunctivitis (10.12)	***Drops: 0.5%*** Instill frequently (e.g. hourly) for adequate relief.	**Common:** Eye irritation	
Ibuprofen Mild to moderate pain (20.2, 20.4); musculoskeletal disorders; arthritis (10.13); dysmenorrhoea (10.15); fever (10.1); erythema nodosum (10.2)	***Tablet: 200 mg, 400 mg*** 200–400 mg 3–4 times daily. Maximum 2.4 g daily	**Common:** Dyspepsia, nausea, diarrhoea; GI ulceration and haemorrhage, raised liver enzymes, headache, dizziness, salt and fluid retention, hypertension **Infrequent or rare:** Heart failure; hypersensitivity reactions; bronchospasm; renal failure; rarely, hepatic failure; erythaema multiforme, toxic dermal necrolysis; oesophageal ulceration, hyperkalaemia	**Pregnancy/breastfeeding:** Avoid unless potential benefit greater than risk; consider alternatives such as paracetamol or opioids; regular use in third trimester may cause closure of fetal ductus arteriosus *in utero*, possibly persistent pulmonary hypertension of the newborn, delayed onset and increased duration of labour. **Use with caution:** /;In renal and hepatic disorders, hypersensitivity, and in the elderly. Ibuprofen can reduce the antiplatelet activity of low-dose aspirin and potentially reduce or negate the cardioprotective effect. **Counselling:** Take with or after food.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Insulin (soluble) Diabetic ketoacidosis (3.4.1) Hyperkalaemia (5.2.2) Overdose of calcium-channel blockers and beta- blockers, given in combination with dextrose (3.8.1) (**Other indications:** Diabetes mellitus type I; type II after failing oral therapy)	***Injection: 40 IU/ml in 10 ml vial; 100 IU/ml in 10 ml vial*** See Section 3.4.1 IV: 10–15 units in 50 ml D50 (50% dextrose water) infused over 2 hours THEN dextrose infusion + regular blood glucose monitoring See Table in 3.8.1	**Common:** Hypoglycaemia, weight gain; hypersensitivity reactions; hypokalaemia, transient oedema; local reactions including erythema, itching, lipodystrophy, lipoatrophy	**Pregnancy:** Generally accepted as safe (insulin requirements should be assessed in each trimester) **Breastfeeding:** May be used at recommended doses **Use with caution:** In renal impairment, hepatic impairment, hypokalaemia
Ipratropium bromide Acute wheezing (QC p. 17); COPD, moderate (10.6)	***Inhalation (aerosol): 20 mcg / metered dose*** 20 to 40 mcg 4 times daily (2 puffs) AND inhaled salbutamol	**Common:** Dry mouth, throat irritation **Infrequent or rare:** Constipation, tachycardia, atrial fibrillation, urinary retention, acute angle-closure glaucoma	**Pregnancy/breastfeeding:** Safe in pregnancy. **Use with caution:** In prostatic hypertrophy. Medical supervision with first dose due to risk of paradoxical bronchospasm. **Counselling:** Do not use for immediate relief of symptoms.
Isoniazid (INH) (H) TB prevention for PLHIV (13.3)	**Tablet: 300 mg** Oral: INH 300 mg daily for at least 6 months is recommended, and up to 36 months in HIV-prevalent settings with a high prevalence and transmission of TB AND pyridoxine	**Common:** Burning, numbness or tingling sensation in hands and feet; drowsiness; anorexia, nausea, abdominal pain; jaundice (other causes excluded), hepatitis; skin rash with or without itching (rarely, but can be serious, e.g. Stevens-Johnson syndrome)	**Administration:** Desirable to give also pyridoxine 10 mg daily to prevent peripheral neuropathy in PLHIV. Defer IPT in the presence of active hepatitis (acute or chronic), regular and heavy alcohol consumption, and symptoms of peripheral neuropathy. Stop INH if jaundice or skin rash with or without itching. Stop IPT, and start treatment regimen if active TB develops.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Isosorbide dinitrate Pulmonary oedema with severe hypertension (3.2.5)	***Tablet (sublingual): 5 mg*** SL: 5 mg sublingual, repeat in 10–15 minutes, not to exceed 10 mg every 2–3 hours	**Common:** Throbbing headache, flushing, dizziness, fainting, postural hypotension, tachycardia **Infrequent or rare:** Paradoxical bradycardia	**Pregnancy:** Use with caution. Consider alternatives where possible; use minimum effective dose if required in acute situation. **Breastfeeding:** Use, with caution, if benefit is greater than risk; monitor infant for side-effects. **Contraindications:** Hypersensitivity to nitrates, hypotension, hypovolaemia, hypertrophic obstructive cardiomyopathy, aortic stenosis, cardiac tamponade, constrictive pericarditis, mitral stenosis; marked anaemia, head trauma, cerebral haemorrhage, angle-closure glaucoma **Use with caution:** In severe hepatic or renal impairment, hypothyroidism, malnutrition, hypothermia, elderly, or recent MI. Prone to multiple significant drug interaction through CYP3A4 enzyme.
Itraconazole Candidal oesophagitis when fluconazole not available (11.4) Histoplasmosis (11.16) Penicilliosis, mild disease (11.29) Severe disseminated penicilliosis (11.29) Pityriasis versicolor, recurrence (10.2.7)	***Capsule: 100 mg;*** ***Oral solution 10 mg/ml*** Oral: 100–200 mg twice daily for 10–14 days (may be increased to a maximum of 400 mg daily) 200 mg 3 times daily for 3 days. THEN 200 mg twice daily for 6–12 months 200 mg twice daily for 8weeks THEN, in PLHIV, 200 mg daily until 6 months after CD4> 100 Amphotericin B for 14 days THEN itraconazole 200 mg daily for 10 weeks, continuing in PLHIV until 6 months after CD4>100 Pulsed monthly treatment for 3 months	**Common:** Dyspepsia, anorexia, fatigue, itch **Infrequent or rare:** Nausea, vomiting, abdominal pain, diarrhoea, constipation, jaundice, hepatitis; heart failure, pulmonary oedema, headache, dizziness, peripheral neuropathy (discontinue treatment); menstrual disorders; hypokalaemia, rash, pruritus, Stevens-Johnson syndrome, alopecia Potentially life-threatening hepatotoxicity reported very rarely; discontinue if signs of hepatitis develop.	**Pregnancy:** Contraindicated in first trimester; use in second or third trimesters only if drug of choice and no alternatives. Breastfeeding: Not recommended – effects unknown. Use fluconazole if available and indicated. **Use with caution:** In patients with heart failure or risk factors for heart failure, pre-existing hearing loss, hypersensitivity to other azoles. Monitor liver enzymes in patients with liver disease. **Administration:** Prone to multiple significant drug interactions (many leading to severe cardiovascular compromise). (An alternative for candida oesophagitis is the itraconazole solution). **Counselling:** Take capsule with food for best absorption (oral solution should be taken on empty stomach). Do not take antacids within 2 hours of taking this medicine. Tell your doctor if you feel unusually tired or have loss of appetite, nausea, vomiting, abdominal pain, or dark urine.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Ivermectin	***Tablet: 3 mg, 6 mg***	**Common:** Strongyloidiasis: Diarrhoea, dizziness, nausea; mild ocular irritation; somnolence **Onchocerciasis:** Mild Mazzotti reaction within 3 days of treatment (fever, headache, cough, pruritus, conjunctivitis, arthralgia, lymphadenopathy, diarrhoea) **Infrequent or rare:** Cutaneous or systemic reactions	**Pregnancy/breastfeeding:** Delay treatment until after delivery and infant is 1 week old. **Administration/counselling:** Avoid food or alcohol for at least 2 hours before and after a dose. **Contraindications:** Do not give ivermectin for onchocerciasis in loaiasis co-endemic areas.
Strongyloidiasis (11.36)	200 mcg/kg as a single dose OR 200 mcg/kg daily for 2 days and then maintenance therapy 6 mg monthly		
Filariasis (11.12)	200–400 mcg/kg as a single dose AND albendazole 400 mg twice daily for 2 weeks		
Onchocerciasis (in non Loa Loa endemic areas) (11.28)	150 mcg/kg as a single dose every 6 or 12 months		
Scabies (10.2.4)	200 mcg/kg as a single dose and repeat in 2 weeks.		
Norwegian (crusted) scabies (10.2.4)	Combine ivermectin with topical scabicide (benzyl benzoate or permethrin)		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Ketamine Sedation during short procedures; induction for intubation (QC p. 28 and 31)	***Injection: 50 mg, 100 mg (as hydrochloride) /ml in 10 ml vial*** IV: 1–2 mg/kg IV over 2 minutes May repeat 0.5 mg/kg IV every 10 minutes as needed OR IM: 4 mg/kg	**Common:** Raised BP and pulse rate, increased muscle tone (sometimes tonic-clonic and resembling seizures), lacrimation, nausea, vomiting, nystagmus, raised intracranial pressure, diplopia; emergence reactions (may occur after recovery and up to 24 hours), which vary in severity between pleasant dream-like states to vivid imagery, hallucinations, nightmares and emergence delirium (often consisting of dissociative or floating sensations), confusion, excitement, irrational behaviour **Infrequent or rare:** Raised intraocular pressure, arrhythmias, hypotension, bradycardia, laryngospasm; anxiety, insomnia; increased salivation, apnoea, rashes, injection-site reactions, anaphylaxis	**Pregnancy:** Safe to use **Breastfeeding:** Limited data; avoid use. **Contraindications:** Where elevation of blood pressure would constitute a serious hazard, including eclampsia or pre-eclampsia, severe coronary or myocardial disease, cerebrovascular accident or cerebral trauma **Use with caution:** In increased cerebrospinal fluid pressure, predisposition to hallucinations or nightmares. Ketamine has abuse potential and can itself cause dependence. **Administration:** For intravenous injection, dilute 100 mg/ml strength to a concentration of not more than 50 mg/ml with dextrose 5% or sodium chloride 0.9% or water. Give IV slowly; rapid administration may result in respiratory depression and enhanced hypertensive response. Emergence reactions can be eliminated by co-administrating benzodiazepine such as diazepam or midazolam and by minimizing stimulation during the recovery period.
Lactulose Hepatic encephalopathy in cirrhosis (10.9.2)	***Lactulose solution: 3.1–3.7 g/5 ml*** 20–30 g (30–45 ml) 3–4 times daily; adjust dose every 1–2 days to produce 2–3 soft stools daily	**Common:** Flatulence, abdominal discomfort, cramps **Infrequent or rare:** Diarrhoea, dehydration, hyponatraemia, hypokalaemia	**Pregnancy:** No evidence of harm **Breastfeeding:** Use caution. **Use with caution:** In patients with electrolyte imbalance, diabetes mellitus; solution contains galactose and lactose. **Administration:** May mix with fruit juice, water, or milk. Onset of action is 1–3 days.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Levonorgestrel For emergency contraception (ECP) (14.5.2)	***Tablet: .75 mg; 1.5 mg*** 1.5 mg taken as a single dose within 120 hours of unprotected sex, sexual assault OR 0.75 mg followed by another dose of 0.75 mg 12 hours later	**Common:** Nausea/vomiting, breast tenderness, headache, dizziness, abdominal pain Irregular vaginal bleeding for 1–2 days; next menstrual bleeding starts earlier or later than expected	**Pregnancy:** No harm to fetus if pregnancy should occur Breastfeeding: Unknown safety in breastfeeding but duration of use of ECPs is brief. **Administration:** The duration of use of ECP is brief; thus less clinical impact is expected in severe cardiovascular complications, angina, migraine, severe liver disease. **Counselling:** If vomiting occurs within 2 hours after taking levonorgestrel, a replacement dose should be taken. An antiemetic can be taken one-half to one hour before the replacement dose. No protection against STI/HIV
Lidocaine (with or without epinephrine) Local anaesthesia (7.1.2); nerve block (20.3) (**Other indications:** Arrhythmias; spinal and other anaesthesia)	***Injection: 1%, 2% in vial*** ***Topical: 2–4%*** Local infiltration and nerve block, using 0.5% solution, up to 250 mg (50 ml) in adults Local infiltration and nerve block, using 1% solution, up to 250 mg (25 ml) in adults With epinephrine: 0.5% solution up to 400 mg (80 ml) or 1% solution up to 400 mg (40 ml) in adults	**Common:** Dizziness, paraesthesia, drowsiness, confusion; apnoea, respiratory depression; coma, seizures; hypotension, arrhythmias, heart, block, bradycardia (may lead to cardiac arrest); nystagmus (early sign of overdose)	**Pregnancy:** Avoid in third trimester **Breastfeeding:** Amount too small to be harmful **Contraindications:** Adjacent skin infection, inflamed skin, severe anaemia, heart disease **Use with caution:** In CHF (lower dosage) and following cardiac surgery, bradycardia, hepatic impairment, severe respiratory depression, and in the elderly

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Magnesium sulfate	***Injection: 500 mg/ml in 2 ml ampoule; 500 mg/ml in 10 ml ampoule (50%)***	**Common:** Nausea, vomiting, thirst, flushing of skin, hypotension, arrhythmias, coma, respiratory depression, drowsiness, confusion, loss of tendon reflexes, muscle weakness	**Pregnancy:** Safe for short-term use in third trimester (neonatal respiratory depression if excessive dose) **Breastfeeding:** Mother treated with parenteral magnesium for pre-eclampsia can breastfeed. **Contraindications:** Bradycardia or AV block, pre-existing hypermagnesaemia, renal insufficiency/failure **Use with caution:** In myasthenia gravis, liver or renal impairment **Administration:** For intravenous injection, dilute 1 part of magnesium sulfate injection 50% with at least 1.5 parts of water for injection. For intramuscular injection, mix magnesium sulfate injection 50% with 1 ml lidocaine injection 2%. Monitor urine output. Before giving next dose, ensure that: • knee jerk is present • urine output >100 ml/4 hours • respiratory rate >16/minute. Otherwise, do not give magnesium and consider calcium gluconate for toxicity. Note: Magnesium sulfate 1 g is approximately equivalent to Mg 4 mmol.
Prevention of seizures in severe pre-eclampsia; eclampsia convulsions and prevention of recurrence (QC p. 28)	See instructions in QC p. 28.		
Severe bronchospasm not responding to salbutamol (3.2.4); torsade de pointes/ VF/ pulseless VT from toxicity due to quinine (3.8.1)	IV: 2 g over 20 minutes		
Aluminium/zinc phosphide toxicity (3.8.1)	IV: 1 g every 6 hours		
Tetanus (11.39)	IM: 5 g OR IV: 75 mg/kg loading dose THEN 2–3 g hourly as needed until spasms controlled (with or without diazepam)		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Malathion Head lice (pediculosis capitis) (10.2.8) Crab lice (pediculosis pubis) (10.2.8)	***0.5% in an aqueous basis*** Rub 0.5% preparation into dry hair and scalp, allow to dry naturally; THEN remove by washing after 12 hours. THENRepeat application after 7 days. Apply 0.5% aqueous preparation over whole body, allow to dry naturally, THEN wash off after 12 hours or overnight. THEN repeat application after 7 days	**Infrequent or rare:** Skin irritation, contact dermatitis, allergy	**Pregnancy:** Avoid use; permethrin preferred. **Breastfeeding:** Safe to use **Counselling:** Avoid contact with eyes. Do not use on broken or secondarily infected skin. Use lotion no more than once a week for 3 consecutive weeks.
Mebendazole Hookworm (10.18); ascaris (10.7) Ascaris, hookworm prophylaxis every 6 months in adolescent girls and women of childbearing age (19.1) Persistent diarrhoea in immunocompromised patients (10.7d.2) (**Other indications:** Echinococcus infections prior to surgery or not amenable to surgery, nematode infections including enterobiasis, trichuriasis, capillariasis)	***Tablet: 500 mg, 100 mg*** 500 mg orally in a single dose OR 100 mg twice daily for 3 days (Repeat after 3–4 weeks if eggs persist in stool) 500 mg as a single dose every 6 months as prophylaxis 500 mg twice daily for 5 days	**Infrequent or rare:** Nausea, vomiting, diarrhoea, abdominal pain or cramps; headache, dizziness; hypersensitivity reaction; with high doses; increased liver enzymes; alopecia; bone marrow depression	**Pregnancy:** Contraindicated in first trimester; consider alternatives before using in second or third trimester. **Breastfeeding:** May be used; 2–10% of oral dose absorbed, and some excretion into breast milk expected. **Counselling:** Take dose between meals.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Meglumine antimoniate	***Injection: 30%, equivalent to approximately 8.1% antimony in 5 ml ampoule***	**Common:** Nausea, vomiting, abdominal pain, anorexia; ECG changes (possibly requiring dose reduction or withdrawal); cough; arthralgia, myalgia; elevated liver enzymes,jaundice, renal function impairment; lethargy	**Pregnancy:** Uncertain safety **Breastfeeding:** Contraindicated **Contraindications:** Severe cardiac, liver and kidney disorders. Use local therapy if lesion is close to the eyes, multiple (≥3), large (>3 cm diameter), sporotrichoid forms, on the joint, super-infected, or produced by L. brazilensis, L. guyanensis, or L. tropica. **Use with caution:** The risk of serious, even fatal, toxicity is increased in patients who concomitantly present with: cardiac disease (particularly arrhythmia), renal failure, liver disease, severe malnutrition, severely impaired general condition, advanced HIV infection; pregnancy. **Administration:** If any of the above cautions is present, provide protein-rich diet throughout treatment and correct iron and other nutritional deficiencies. Monitor cardiac, renal and hepatic function. Successful treatment of mucocutaneous leishmaniasis may induce severe inflammation around lesions (may be life-threatening if pharyngeal or tracheal involvement); may require corticosteroids.
Visceral leishmaniasis (11.20.2)	See table in Section 11.20.2.		
Secondary prophylaxis of leishmaniasis in HIV-infected patient (11.20.3)	IM/IV: 20 mg/kg every 3 or 4 weeks		
Cutaneous leishmaniasis, local treatment (11.20.1)	Intralesional injection: 1 to 5 intralesional injections, every few days or weekly, with or without cryotherapy		
Cutaneous leishmaniasis, systemic treatment (11.20.1)	IV/IM: 20 mg/kg for 21 days		
Mucocutaneous leishmaniasis (L. braziliensis) (11.20.1)	IM: 20 mg/kg daily until slit-skin smears are negative and for at least 4 weeks thereafter THEN, if inadequate response, 10–15 mg/kg every 12 hours for same period if inadequate response. Repeat for at least twice as long if relapse. (If unresponsive to this treatment, treat with pentamidine or amphotericin B.)		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Melarsoprol Trypanosomiasis, meningoencephalitic stage (11.41)	***Injection: 3.6% solution, 5 ml ampoule (180 mg active compound)*** 2.2 mg/kg slow IV injection per day for 7–10 days	**Common:** Jarisch-Herxheimer-like reaction (chills; fever; general feeling of illness or discomfort); headache; rigidity; sweating, peripheral neuropathy, reactive encephalopathy in 5-10% patients. **Infrequent or rare:** myocardial damage, hypertension, hypersensitivity, blood dyscrasias such as agranulocytosis; hepatic and renal dysfunction.	**Pregnancy/breastfeeding:** Contraindicated in pregnancy **Use with caution:** Hospitalization and close medical supervision (intensive care) required during treatment. Suspend treatment if reactive encephalopathy. Treat intercurrent infections such as pneumonia and malaria before treatment with melarsoprol. Use with caution in malnutrition (if possible, correct with a protein-rich diet); G6PD deficiency; leprosy (may precipitate erythema nodosum). **Administration:** Avoid extravasation–injection is very irritating. Patients should be supine and fast for at least 5 hours after injection.
Methadone Acute opioid withdrawal (3.6.2) Opioid substitution therapy (OST) (17.4)	***Concentrate for oral liquid: 5 mg/ml, 10 mg/ml (hydrochloride)*** ***Oral liquid: 5 mg/5ml, 10 mg/5ml*** Oral: Initially 15–20 mg. Gradually increase to 40 mg/day. Taper off over 3–28 days. (See Section 3.6.2.) Oral: Initially 20 mg, with an additional 10 mg after 4 hours. If tolerance is low or uncertain, start with a dose of 10 mg (see Section 17.4). (Optimal dosing range is 60–120 mg.)	**Common:** Drowsiness, dizziness, respiratory depression, QT interval prolongation, dysmenorrhoea, hyperprolactinaemia, dry eyes, dry mouth **Rare:** torsade de pointes, hypothermia, restlessness, raised intracranial pressure, agitation/confusion (especially in the elderly), urinary retention with high doses (especially in the elderly)	**Pregnancy:** May be used; not associated with birth defects; caution in third trimester as chronic use is associated with neonatal opioid withdrawal symptoms. **Breastfeeding:** Monitor adverse effects such as sedation (no adverse effects reported with 20 mg/day or less); infant withdrawal reported with sudden cessation. **Contraindications:** Acute bronchial asthma or hypercarbia, respiratory depression in absence of appropriate airway equipment, paralytic ileus **Do not give to patients showing signs of intoxication from alcohol or depressant drugs (such as diazepam).** **Use with caution:** In patients with renal or hepatic impairment, hypothyroidism, convulsive disorders, decreased respiratory reserve as in asthma, hypotension, elderly, prostatic hyperplasia, adrenal insufficiency, head trauma. Prone to multiple drug interactions. Dose adjustment recommended if severe renal and/or hepatic impairment. **Counselling:** This medication may impair your ability to perform skilled tasks such as operating machinery and driving.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Methylthioninium chloride (methylene blue) Acute methaemoglobinaemia (propanil poisoning) (3.8.1)	***Injection: 10 mg/ml in 10 ml ampoule*** IV (loading dose): 2 mg/kg over 5 minutes THEN further dose of 1 mg/kg if no improvement. See Section 3.8.1 for for monitoring and further dosing.	**Common:** Nausea/vomiting, abdominal pain, chest pain, headache, dizziness, confusion, profuse sweating, hypertension, hypotension, haemolytic anaemia (in G6PD deficiency); methaemoglobinaemia with high dosage; bluish skin discoloration; blue saliva, urine, and faeces	**Pregnancy/breastfeeding:** Uncertain safety in pregnancy and breastfeeding. Use with caution. **Contraindications:** Severe renal impairment, methaemoglobinaemia due to chlorate or induced by sodium nitrite in treatment of cyanide poisoning, G6PD deficiency (may cause haemolytic anaemia) **Use with caution:** Monitor blood methaemoglobin throughout treatment
Metoclopramide Nausea, vomiting (10.7.3, 14.1.11)	***Tablet: 10 mg*** ***Injection: 5 mg (hydrochloride)/ml in 2 ml ampoule*** Oral/IV: 10 mg every 8 hours 15–19 years (<60 kg): 5 mg 3 times daily	**Common:** Drowsiness, headache restlessness, dizziness **Infrequent or rare:** Extrapyramidal symptoms (especially children/young adults), hyperprolactinaemia, depression, diarrhoea, hypotension, hypertension, neuroleptic malignant syndrome (rare), rash, cardiac conduction abnormalities following IV administration (rare)	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects) **Contraindications:** Gastrointestinal obstruction (often used to empty the stomach of blood prior to EGD); within 3–4 days after gastrointestinal surgery, convulsive disorders, phaeochromocytoma **Use with caution:** In elderly, children, and young adults; hepatic or renal impairment; Parkinson´s disease, epilepsy, depression, porphyria. May mask underlying disorders such as cerebral irritation. Renal dosage adjustment required.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Metronidazole	***Tablet: 200 mg, 500 mg Suppositories: 0.5 g, 1 g Gel Injection: 500 mg in 100 ml vial***	**Common:** Nausea/vomiting, diarrhoea, unpleasant metallic taste, dizziness, headache **Infrequent or rare:** Furred tongue, glossitis stomatitis paraesthesia, increased liver enzymes, blood disorders, myalgia/arthralgia, peripheral neuropathy, epileptiform seizures, disulfiram-like reaction, bone marrow depression, alopecia	**Pregnancy:** May be used if drug of choice. Use has not been associated with increased risk of adverse outcomes. **Breastfeeding:** May be used at usual doses, but avoid high single-dose therapy or else withhold feeds for 12–24 hours; monitor infant for side-effects; may cause temporary changes to milk taste. **Contraindications:** Chronic alcohol dependence – disulfiram-like reaction with alcohol occurs. **Precautions:** Hepatic disease. Prone to multiple drug interactions through CYP enzyme system. Check for interactions with current and new medications. **Administration:** Tablets should be swallowed whole with water, with or after food. IV: Give over 15–30 minutes. **Counselling:** Take tablets with food to reduce stomach upset. This medicine may make you feel dizzy or confused. Avoid driving if you are affected. Avoid alcohol during treatment, and for 24 hours after stopping the drug, to prevent nausea, vomiting, flushing, headache, and palpitation. Stop the medicine and inform your doctor if you have any numbness, tingling, pain, or weakness in hands or feet
Bacterial vaginosis (10.15.4)	500 mg twice daily for 5 –7 days		
Pelvic inflammatory disease (10.15.5)	Oral: 400–500 mg twice daily for 14 days AND ceftriaxone + doxycycline or tetracycline		
Persistent or chronic diarrhoea in immunocompromised patients (empirical) (10.7d.3)	Oral: 500 mg 3 times daily for 7 days AND cotrimoxazole		
Leg ulcers/pressure sores (10.2.10)	Oral: 400 mg every 8 hours for 7 days		
Acute necrotizing ulcerative gingivitis or periodontitis (10.17.6)	Oral: 200 mg 3 times daily for 7–10 days		
Dental abscess (10.17.5)	Oral: 500 mg 3 times daily AND phenoxymethyl penicillin or amoxicillin		
Peritonsillar abscess (10.17.9)	Oral: 500 mg 3 times daily AND amoxicillin		
Antibiotic-associated colitis; *Clostridium difficile* colitis (10.7d.2)	Oral: 500 mg 3 times daily for 10–14 days; IV form effective if patient cannot take oral pills (same dose)		

Urogenital trichomoniasis (10.15.4)	Oral: 2 g as a single dose OR 400–500 mg twice daily for 7 days (also treat sexual partners)		
Helicobacter pylori eradication (if allergic to amoxicillin) (10.7a.2)	Oral: 400 mg twice daily AND clarithromycin + omeprazole		
Tetanus (11.39)	Oral/IV: 500 mg 4 times daily for 10 days		
Intestinal amoebiasis (11.1.1) or empirical treatment in dysentery after no clinical improvement from 2 courses antiobiotics locally effective for Shigella (10.7d.2)	Oral: 750 mg 3 times daily for 5–10 days THEN diloxanide or iodoquinol or paramomycin		
Amoebic liver abscess (11.1.2)	Oral/IV: 750 mg 3 times daily for 5–10 days		
Severe anaerobic infections- peritonitis or cholangitis (10.7a.2); septic abortion (10.15.6)	Oral/IV: 500 mg 3 times daily AND ceftriaxone or ampicillin + gentamicin		
(**Other indications:** Dracunculiasis; brain abscess; surgical prophylaxis; animal bites; giardiasis)			

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Miconazole Candida skin infection (11.4) Vulvovaginal candidiasis (10.15.4, 11.4) Oral candidiasis (11.4)	***Cream: 2% (nitrate)*** ***Suppository: 200 mg*** ***Oral gel*** ***Gum patch*** Topical: Apply cream twice daily to clean, dry lesions for 5–7 days; continue at least 10 days after the condition clears. Vaginal suppository: 200 mg inserted daily for 3 days Oral: gel 60 mg 4 times daily for 7 days OR gum patch once daily for 7 days	**Infrequent or rare:** Local irritation, contact dermatitis (discontinue if sensitization occurs)	**Pregnancy/breastfeeding:** May be used at recommended doses in pregnancy and breastfeeding. **Breastfeeding:** Remove excess cream from nipple areas before feeding. **Use with caution:** Contact with eyes and mucous membranes should be avoided. **Counselling:** Gum patch: Place rounded side of tablet on upper gum above an incisor tooth and hold upper lip firmly over the gum for 30 seconds using a finger. If tablet detaches within 6 hours, replace with a new tablet. With each dose, alternate sides of the gum.
Midazolam Pretreatment to prevent emergence reaction with ketamine (QC p. 28) Sedation for intubation if not comatose (QC p. 31) Sedation after intubation (QC p. 34)	***Injection: (as hydrochloride) 1 mg/ml*** IV: 0.05 mg/kg over 2 minutes just prior to giving ketamine IV: 0.2 mg/kg Infusion: 0.02–0.1 mg/kg/hour)	**Common:** hypotension, hiccup, cough **Infrequent or rare:** GI disturbances, heart rate changes, laryngospasm, bronchospasm, respiratory depression and respiratory arrest (particularly with high doses or on rapid injection); drowsiness, confusion, ataxia, amnesia, headache, euphoria, hallucinations, paradoxical excitement and aggression (in elderly); skin reactions, injection-site reactions, anaphylaxis	**Pregnancy:** Avoid use if possible. High doses during late pregnancy or labour may cause neonatal hypothermia, hypotonia, respiratory depression. **Breastfeeding:** Present in milk; manufacturer advises avoiding breastfeeding for 24 hours after administration. **Contraindications:** Marked neuromuscular respiratory weakness including unstable myasthenia gravis; severe respiratory depression; acute pulmonary insufficiency **Use with caution:** In cardiac disease; respiratory disease; myasthenia gravis. Midazolam is associated with profound sedation when high doses are given IV or when used with certain other drugs.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Miltefosine Visceral leishmaniasis (11.20.2) Secondary prophylaxis in HIV-infected patients with leishmaniasis (11.20.3)	***Capsule: 10 mg, 50 mg*** See table on treatment options in Section 11.20.2. Repeat 28-day courses	**Common:** Nausea, vomiting, anorexia, diarrhoea – usually brief and resolve as treatment continues. Occasionally severe, requiring treatment interruption. **Infrequent or rare:** Skin allergy, elevated hepatis transaminases, renal insufficiency	**Pregnancy/breastfeeding:** Do not use in pregnancy or during breastfeeding and assure adequate contraception for women of childbearing age during treatment and for 3 months afterwards.
Misoprostol Incomplete abortion (10.15.2) Postpartum haemorrhage not responding to oxytocin plus ergometrine (QC p. 26)	***Oral tablet: 200 mcg*** Oral: Single dose of 400 mcg sublingually or 600 mcg by mouth SL: 800 mcg	**Common:** Diarrhoea (may occasionally be severe and require withdrawal; reduced by giving single doses not exceeding 200 mcg and by avoiding magnesium-containing antacids); abdominal pain, dyspepsia, flatulence, nausea, vomiting; abnormal vaginal bleeding (including intermenstrual bleeding, menorrhagia, postmenopausal bleeding); rash; shivering and fever. **Infrequent or rare:** Uterine rupture	**Use with caution:** In conditions where hypotension might precipitate severe complications (cardiovascular or cerebral disease). See other sources for contraindications to use for induction of labour (such as placenta praevia, cephalopelvic distortion, history caesarean section or major uterine surgery, etc.)

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Morphine	***Injection: 10 mg (morphine hydrochloride or morphine sulfate) in 1 ml ampoule*** ***Oral liquid: 10 mg (morphine hydrochloride or morphine sulfate) in 5 ml*** ***Tablet: 10 mg (morphine sulfate)*** ***Tablet (prolonged-release): 10 mg, 30 mg, 60 mg (morphine sulfate)***	**Common:** Nausea/vomiting (particularly in initial stages), constipation, dry mouth, drowsiness, anorexia, spasm of urinary and biliary tract, bradycardia, tachycardia, palpitation, euphoria, hallucinations, confusion, hypersensitivity reaction, postural hypotension, dependence, miosis. Larger doses produce respiratory depression, hypotension, muscle rigidity.	**Pregnancy:** May be used if drug of choice. Not associated with birth defects; high doses or prolonged use near term can cause neonatal respiratory depression and withdrawal symptoms. **Breastfeeding:** Use caution; monitor adverse effects such as sedation; therapeutic concentrations in breastfeeding infant may be reached with repeated dosing or long-term use. **Contraindications:** Acute respiratory depression, acute alcoholism, risk of paralytic ileus, raised intracranial pressure or head injury (affects pupillary responses vital for neurological assessment), injection in phaeochromocytoma **Use with caution:** In renal and hepatic impairment, dependence (severe withdrawal symptoms if withdrawn abruptly), hypothyroidism, convulsive disorders, decreased respiratory reserve and acute asthma, hypotension, prostatic hypertrophy. Reduce dose or avoid in elderly and debilitated. Prone to multiple drug interactions through CPY enzymes; check for interactions with new or current medications. **Administration:** SC dosing not suitable for oedematous patients. Sustained-release tablets should be taken at regular intervals and not on an as-needed basis for episodic or breakthrough pain. Tablets can be crushed
Severe acute pain (20.4)	See dosing and precautions in Section 20.4.		
Chronic pain (20.2)	See dosing in Section 20.2.		
Myocardial infarction (QC p. 8)	IV (slow, 2 mg/min): 10 mg THEN 5–10 mg if necessary		
Difficult breathing in terminal illness (20.5)	2.5 mg every 4–6 hours if not on morphine for pain. If on morphine for pain, increase dose by 25%.		
Mupirocin	***Cream (as mupirocin calcium): 2%*** ***Ointment: 2%***	**Infrequent or rare:** Local reactions including urticaria, pruritus, burning sensation, rash	**Pregnancy/breastfeeding:** Safe in pregnancy and breastfeeding **Use with caution:** Avoid contact with eyes and mouth.
Impetigo (10.2.2); papular urticaria with secondary bacterial infection (10.2.3)	Apply up to 3 times daily for up to 10 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Naloxone Opioid overdose (QC p 18)	***Injection: 400 mcg/ml (hydrochloride) in 1 ml ampoule*** IV: 100 mcg in a single dose OR IM: 400 mcg in a single dose OR SC: 800 mcg in a single dose. May repeat every 5 minutes up to 3 times (maximum 10 mg) If response (i.e. respiratory rate >10/minute), start IV infusion: 0.4 mg/hour for 12 hours	**Common:** Hypotension, hypertension, ventricular tachycardia and fibrillation, cardiac arrest; hyperventilation, dyspnoea, pulmonary oedema **Infrequent or rare:** Agitation, excitement, paraesthesia	**Pregnancy:** Use only if potential benefit is greater than risk; may precipitate withdrawal in fetus of an opioid dependant mother **Breastfeeding:** Unknown safety; currently not recommended. **Use with caution:** In physical dependence on opioids, other situations where acute withdrawal syndrome may be precipitated; cardiovascular disease **Administration:** Naloxone effects last only 40 minutes.
Naltrexone Alcohol dependence (16.5)	***Tablet: 50 mg*** Start with 50 mg daily after withdrawal from alcohol or whilst still drinking some alcohol. Maintenance dose: 50–100 mg daily. Important that the patient has not taken any opioid drugs for previous 5 days	**Common:** Nausea/vomiting, abdominal pain, diarrhoea, constipation, reduced appetite, increased thirst; chest pain; anxiety, sleep disorders, headache, reduced or increased energy, irritability, emotional lability, dizziness; chills; urinary retention; delayed ejaculation, decreased potency; arthralgia, myalgia; increased lacrimation; rash, increased sweating **Infrequent or rare:** Hepatic dysfunction; suicidal ideation, speech disorders, hallucinations, tremor; idiopathic thrombocytopenia	**Pregnancy/breastfeeding:** Not recommended during pregnancy or breastfeeding **Use with caution:** In individuals with hepatic and renal impairment. If feasible, liver function tests should be routinely carried out. No ingestion of other opioid drugs for previous 5 days. Will block effects of other opioid drugs (if analgesia required)
Neostigmine Snake bite neurotoxicity (3.9) (**Other indications:** Myasthenia gravis, to reverse non-depolarizing muscle relaxants; post-operative non-obstructive urinary retention)	***Injection: 500 mcg in 1 ml ampoule*** ***Tablet: 15 mg*** See Section 3.9	**Common:** Nausea, vomiting, increased salivation, diarrhoea, abdominal cramps. Signs of overdosage: Bronchoconstriction, increased bronchial secretions, lacrimation, excessive sweating, involuntary defaecation and micturition, miosis, nystagmus, bradycardia, heart block, arrhythmias, hypotension, agitation, excessive dreaming, weakness eventually leading to fasciculation and paralysis	**Pregnancy:** Use with caution; no reports of malformation, but neonatal myasthenia gravis and bradycardia are possible in newborns exposed during pregnancy. **Breastfeeding:** May be used in breastfeeding (monitor infant for adverse effects) **Use with caution:** In asthma, urinary and intestinal surgery, infection

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Nifurtimox Chagas disease (American trypanosomiasis) (11.42)	***Tablet: 30 mg,120 mg, 250 mg*** Oral: 8–10 mg/kg daily divided in 2 or 3 doses, for 60 consecutive days	**Common:** Nausea/vomiting, diarrhoea, abdominal pain, anorexia, central nervous system alterations (sleep disturbances, excitatory states, seizures, psychotic behaviour), tremors, muscle weakness, paraesthesia and polyneuritis	**Pregnancy:** Uncertain safety in pregnancy, no human data; animal studies have not shown evidence of birth defects. **Breastfeeding:** Unknown safety in breastfeeding; not currently recommended; use only if potential benefit is greater than risk. **Contraindications:** Psychiatric or neurological disorders **Counselling:** Take after meals.
Nitrofurantoin Acute lower urinary tract infection (11.44)	***Tablet: 100 mg*** Oral: 100 mg twice daily for 5 days	**Common:** Nausea, vomiting, anorexia, diarrhoea, abdominal pain; allergic skin reactions; headache **Infrequent or rare:** Hepatitis, jaundice; erythema multiforme; pancreatitis; blood disorders; with long-term use, pulmonary fibrosis; possible association with lupus erythematosus-like syndrome; peripheral neuropathy	**Pregnancy:** May be used at recommended doses. Due to risk of fetal haemolysis, avoid use at or near term in patients with G6PD deficiency. **Breastfeeding:** May be used at recommended dose except with neonates and infants who are G6PD-deficient; monitor infants for adverse effects. **Contraindications:** Impaired renal function, G6PD deficiency, porphyria **Use with caution:** In pulmonary disorders or hepatic impairment, neurological or allergic disorders, anaemia, diabetes mellitus, elderly and debilitated, vitamin B and folate deficiency **Counselling:** Take with food or milk to reduce nausea and improve absorption. This drug can make your urine a brownish colour.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Omeprazole Gastritis/peptic ulcer disease (PUD) (10.7a.2) *Helicobacter pylori* gastritis (10.7a.2)	***Tablet: 20 mg*** Oral: 20 mg daily for 4–8 weeks Oral: 20 mg twice daily AND clarithromycin + amoxicillin	**Common:** Nausea, vomiting, abdominal pain, flatulence, diarrhoea, constipation; headache. **Infrequent or rare:** Dry mouth, peripheral oedema, dizziness, sleep disturbances, fatigue, paraesthesia, arthralgia, myalgia, rash, pruritus, taste disturbance, stomatitis, hepatitis, jaundice, agitation, impotence, fever, depression, hallucinations, confusion, gynaecomastia, interstitial nephritis, hyponatraemia, blood disorders (including leukopenia, leucocytosis, pancytopenia, thrombocytopenia), visual disturbances, sweating, photosensitivity, alopecia, Stevens- Johnson syndrome, toxic epidermal necrolysis. By decreasing gastric acidity, proton pump inhibitors may increase the risk of gastro-intestinal infections (including C. *difficile* infection).	**Pregnancy/breastfeeding:** Caution in pregnancy and breastfeeding. Use only when treatments with antacids and H2 antagonists have failed. **Use with caution:** In renal impairment, hepatic impairment, and the elderly. Prone to multiple drug interactions. Do not administer in combination with clopidogrel. **Counselling:** Swallow the tablet whole. Do not crush or chew it.
Ondansetron Hyperemesis gravidarum (14.1.11); moderate nausea or vomiting or after chemotherapy for 1–2 days (10.7c.3, 20.2) Severe vomiting (**Other indications:** Prior to chemotherapy causing severe vomiting)	***Tablet: 4 mg, 8 mg*** ***Injection: 2 mg/ml in 2ml ampoule*** ***Liquid: 4 mg in 5 ml*** Oral: 4 mg every 12 hours- increase to 8 mg if this dose not effective. IV: 8 mg over 15 minutes every 12 hours OR 1 mg/hour infused continuously for up to 24 hours. Oral: Up to 24 mg daily oral or IV	**Common:** Constipation, headache, flushing; injection-site reactions; transient rise in hepatic enzymes **Infrequent or rare:** Hiccups, hypotension, bradycardia, chest pain, arrhythmias, movement disorders, seizures; on IV administration, rarely, dizziness, transient visual disturbances (very rarely, transient blindness)	**Pregnancy/breastfeeding:** No increased risks found in pregnancy or breastfeeding **Administration:** Give IV doses ≤8 mg over at least 5 minutes and doses >8 mg over at least 15 minutes. No dose adjustment in the elderly or if renal impairment. In severe liver impairment, do not exceed maximum dose of 8 mg.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Oseltamivir Pandemic H1N1; patients with severe influenza-like illness or at risk for severe ILI (QC p 20, 11.17)	***Capsule: 30 mg, 45 mg, 75 mg*** ***Suspension: 12 mg/ml*** >40 kg: 75 mg twice daily for 10 days (Note: In severe illness may use 150 mg twice daily)	**Common:** Nausea, vomiting, abdominal pain, diarrhoea; headache; conjunctivitis **Infrequent or rare:** Rash, hepatitis, arrhythmias, neuropsychiatric disorders (in children and adolescents), visual disturbances, Stevens-Johnson syndrome, toxic epidermal necrolysis	**Pregnancy:** Unknown safety in pregnancy **Breastfeeding:** Not recommended until more known; use only if potential benefit is greater than risk.
Oxytocin Treatment of postpartum and post-abortion haemorrhage (QC pp. 25–26) (Other indictions: prevention of postpartum haemorrhage- when the anterior shoulder is delivered or immediately after delivery)	***Injection: 10 IU in 1 ml ampoule*** IM: 10 IU AND Start IV fluids with 20 IU oxytocin at 60 drops/minute See QC p. 25. Continue oxytocin at 20 IU at 20 drops/minute for at least 1 hour after bleeding stops.	**Common:** Nausea/vomiting, arrhythmia, headache **Infrequent or rare:** Disseminated intravascular coagulation, rash; anaphylactoid reactions (with dyspnoea, hypotension, or shock); uterine spasm (may occur at low doses), uterine hyperstimulation (usually with excessive doses; may cause fetal distress, asphyxia, and death, or may lead to hypertonicity, tetanic contractions, soft-tissue damage or uterine rupture); water intoxication and hyponatraemia associated with high doses with large infusion volumes of electrolyte-free fluid; in overdose, placental abruption, amniotic fluid embolism	**Pregnancy/breastfeeding:** Not known to be harmful in breastfeeding, as rapidly inactivated in GI tract **Contraindications:** Hypertonic uterine contractions, mechanical obstruction to delivery, fetal distress, any condition where spontaneous labour or vaginal delivery inadvisable. Avoid prolonged administration in oxytocin-resistant uterine inertia, severe pre-eclamptic toxaemia, severe cardiovascular disease. **Use with caution:** Monitor fetal heart rate and uterine motility (discontinue immediately if uterine hyperactivity/fetal distress). To avoid water intoxication with hyponatraemia: (1) use electrolyte-containing diluent (not glucose); (2) increase oxytocin concentration to reduce fluid; (3) restrict fluid intake by mouth; (4) monitor fluid and electrolytes.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Paracetamol (acetaminophen) Mild to moderate pain (20.2, 20.4); fever (10.1) (**Other indications:** Acute migraine attacks; tension headache)	***Tablet: 250 mg, 500 mg*** ***Dispersible tablets: 500 mg*** ***Suppositories: 250 mg, 500 mg*** Oral: 0.5–1 g every 4–6 hours (max 4 g daily; max 2 g daily if hepatic impairment, cirrhosis) Rectally: 0.5–1 g every 4–6 hours	**Common:** Increased transaminases **Infrequent or rare:** Urticarial or erythematous rash, blood disorders, liver damage following overdosage	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects) **Use with caution:** In hepatic impairment, renal impairment, alcohol dependence **Counselling:** Do not exceed 4 grams in 24 hours.
Paromomycin Local treatment of cutaneous leishmaniasis (11.20.1) Visceral leishmaniasis caused by certain species	***Injection: 750 mg base (11 mg base = 15 mg paramomycin sulfate)*** ***Ointment: 15% paramomycin + 12% methyl benzethonium chloride*** Ointment twice daily for up to 20 days See table in Section 11.20.2	**Common:** Injection site reactions, elevated liver enzymes **Infrequent or rare:** Ototoxicity (reversible at recommended dosage), nephrotoxicity, neurotoxicity (numbness, skin tingling, muscle twitching, convulsions; neuromuscular blockage, respiratory paralysis reported following high doses)	**Pregnancy:** Unknown safety in pregnancy; no human data. Use only if potential benefit is greater than risk. **Breastfeeding:** Unknown safety in breastfeeding, but poorly absorbed from GI tract so excretion into breast milk likely to be minimal. **Contraindications:** Hypersensitivity to aminoglycosides, course of paromomycin treatment in preceding 3 months, concurrent administration of nephrotoxic or ototoxic drugs including aminoglycosides, renal impairment

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Pentamidine	***Powder for injection: 200 mg, 300 mg (isetionate) in vial***	**Common:** Nausea, vomiting, diarrhoea, taste disturbances; severe reactions, sometimes fatal (hypotension, hypoglycaemia, pancreatitis, arrhythmias); leukopenia, thrombocytopenia; acute renal failure, hypocalcaemia **Infrequent or rare:** Azotaemia, abnormal liver-function tests, anaemia, hyperkalaemia, dizziness, syncope, flushing, hyperglycaemia, rash, Stevens-Johnson syndrome; on inhalation, bronchoconstriction (may be prevented by prior use of bronchodilators), cough, shortness of breath; discomfort, pain, induration, abscess formation, muscle necrosis at injection site	**Pregnancy:** Potentially fatal visceral leishmaniasis and PCP pneumonia (cotrimoxazole is preferred) should be treated in pregnancy. **Breastfeeding:** Manufacturer advises avoiding unless essential; not known to be harmful, as rapidly inactivated in GI tract. **Contraindications:** In severe renal impairment **Administration:** Risk of severe hypotension following administration. Establish baseline blood pressure and administer with patient lying down; monitor blood pressure closely during administration and at regular intervals until treatment concluded. Avoid direct intravenous injection whenever possible and never give rapidly. Reconstitute with 3–5 ml of water for injection; dilute further to 50–250 ml with glucose 5% or normal saline; give over at least 60 minutes. IM injections should be deep and preferably given into the buttock. **Pentamidine is toxic** – protect health workers during handling and administration.
Cutaneous leishmaniasis (due to severe side-effects, recommended only if no other treatment available) (11.20.1)	IM/IV: 2–3 mg/kg once daily or every second day for 4–7 doses		
Leishmaniasis, secondary prophylaxis in HIV-infected patients (11.20.3)	4 mg/kg (300 mg) every 3–4 weeks		
Severe *Pneumocystis jirovecii* (PCP) pneumonia, treatment if not able to tolerate or unresponsive to cotrimoxazole (10.6.3)	Slow IV/deep IM: 4 mg/kg daily for 5 days; then reduce dose to 2 mg/kg daily to complete 21 days		
Human African trypanosomiasis (*T. b. gambiense*)- haemo-lymphatic stage (11.41)	IM (deep): 4 mg/kg daily for 7 consecutive days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Permethrin Scabies (10.2.3); pediculosis (body lice) (10.2.8) Pediculosis capitis (head lice) (10.2.8)	***Cream: 5%*** Topical: Apply cream over whole body AND Wash off after 8–12 hours (if hands washed with soap within 8 hours after application, treat again) THEN Repeat after 7 days as necessary. Apply to damp hair and leave for 10 minutes before washing off.	**Common:** Temporary increase in itch, redness, swelling that usually accompany lice or mite infestation **Infrequent or rare:** Local irritation, rash, oedema	**Pregnancy:** May be used; systemic absorption expected to be minimal. **Breastfeeding:** May be used; systemic absorption expected to be minimal, but avoid application to nipple areas (or withhold breastfeeding during treatment). **Contraindications:** Do not use on inflamed or broken skin. **Counselling:** Avoid contact with eyes, mouth, and inside the nose. Itch may persist for 2–3 weeks after scabies treatment or 7–10 days after lice treatment. This may not indicate ongoing infection. Scabies: Remember to apply also between fingers and toes, under nails, in skin folds, navel, between the buttocks, and in groin area. If you wash your hands or any other treated parts of the body during the treatment period, you should reapply the lotion to the washed areas.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Phenobarbital Status epilepticus (3.5) Epilepsy (10.10c.2)	***Injection: 200 mg/ml (phenobarbital sodium)*** ***Tablet: 15–100 mg (phenobarbital)*** Loading dose: IV: 5–15 mg/kg bolus over 1 hour Oral: Initiate at 60 mg daily; then maintain at 60–180 mg daily.	**Common:** Drowsiness, incoordination, restlessness and confusion (in elderly), impaired memory and cognition, hyperactivity (particularly in the elderly), allergic skin reactions, paradoxical excitement, sleep disorders. With IV: hypotension, respiratory depression, laryngospasm **Infrequent or rare:** Hepatitis, cholestasis; behavioural disturbances, nystagmus, irritability, lethargy, depression, ataxia, hallucinations; osteomalacia; megaloblastic anaemia (may be treated with folic acid), agranulocytosis, thrombocytopenia; allergic skin reactions; very rarely Stevens-Johnson syndrome and toxic epidermal necrolysis; status epilepticus (on treatment withdrawal); Dupuytren's contracture; lymphadenopathy	**Pregnancy:** Not recommended; adverse effects on neurobehavioural development have been reported. **Breastfeeding:** Use with caution in breastfeeding; avoid large doses and monitor for adverse effects; may accumulate in breast milk. **Contraindications:** Porphyria, absence seizures **Use with caution:** In the elderly, impaired renal or hepatic function, respiratory depression Avoid sudden withdrawal. Prone to multiple drug interactions through CYP enzymes; check for interactions with all new and current medications. **Counselling:** Take once daily at bedtime. May cause drowsiness and affect your ability to drive or operate machinery. Avoid these activities at least until you know how this medicine affects you. Do not stop taking this medicine suddenly without your clinician's advice. Avoid drinking alcohol, as the medicine may increase the effects of alcohol.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Phenoxymethyl-penicillin (penicillin V)	***Tablet: 500 mg***	See benzylpenicillin.	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects) **Contraindications:** Hypersensitivity to penicillins **Use with caution:** In renal impairment. Oral penicillin should not be used for the treatment of severe infections. **Counselling:** Take 1 hour before meals or on an empty stomach.
Streptococcal pharyngitis (10.17.9, 11.32)	Oral: 500 mg twice daily for 10 days		
Cutaneous anthrax, non-severe, if known antibiotic sensitivity (10.2.10)	Oral: 500 mg every 6 hours for 7–10 days		
Dental abscess (10.17.5)	Oral: 250 mg every 6 hours for 5 days		
Prevention of recurrent rheumatic fever (11.32)	Oral: 500 mg twice daily		
Erysipelas (10.2.2) (**Other indications:** Otitis media; post-splenectomy prophylaxis)	Oral: 500 mg every 6 hours for 5–10 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Phenytoin Generalized tonic-clonic seizures; partial seizures (10.10c.2) Status epilepticus (3.5)	***Capsule: 25 mg, 50 mg, 100 mg*** ***Injection: 50 mg/ml in, 5 ml vial*** ***Tablet: 25 mg, 50 mg, 100 mg*** ***Tablet (chewable): 50 mg*** Oral: Start at 150–200 mg daily, increase by increments of 25–30 mg to reach maintenance at 200–400 mg daily Loading dose: IV (slowly over 60): 15 mg/kg in normal saline, at a rate of not more than 50 mg/ minute (monitor BP and ECG). Then oral maintenance dose as above.	**Common:** Nausea, vomiting, constipation; insomnia, transient nervousness, tremor, paraesthesia, dizziness, headache, anorexia; gingival hypertrophy and tenderness; rash (discontinue; if mild, re-introduce cautiously but discontinue immediately if recurrence), acne, hirsutism, coarse facies **Infrequent or rare:** Hepatotoxicity, peripheral neuropathy, dyskinesia, lymphadenopathy, osteomalacia; blood disorders (including megaloblastic anaemia (may be treated with folic acid)), leukopenia (if severe, progressive, or clinically apparent leukopenia develops, withdraw drug, replacing with suitable alternative), thrombocytopenia, aplastic anaemia; polyarteritis nodosa, lupus erythematosus, Stevens-Johnson syndrome, toxic epidermal necrolysis; pneumonitis, interstitial nephritis; with excessive dosage, nystagmus, diplopia, slurred speech, ataxia, confusion, hyperglycaemia	**Pregnancy:** Risk of teratogenicity; use only if benefit is greater than risk (provide adequate folic acid supplementation to mother); monitor for neonatal bleeding if vitamin K not given at birth. Breastfeeding: May be used in breastfeeding; monitor for sedation and decreased sucking; consider infant serum level monitoring. **Contraindications:** Porphyria. Avoid parenteral use in sinus bradycardia, sinoatrial block, second- and third-degree heart block, Adams-Stokes syndrome. **Use with caution:** In hepatic impairment, diabetes mellitus, hypotension, heart failure. Resuscitation facilities must be available for intravenous administration. **Administration:** Administer phenytoin IV in normal saline and not in same line as diazepam. IV line should be running well, as the drug is caustic and will cause local damage if it extravasates. Monitor blood counts. When decision is made to withdraw treatment, do so preferably over 6 months at a rate not greater than 25 mg each week or 100 mg each month. **Counselling:** Seek immediate medical attention if you have symptoms such as sore throat, rash, mouth ulcers, bruising, or bleeding. This medication may impair ability to perform skilled tasks such as operating machinery or driving; avoid these activities at least until you know how this medicine affects you. Take with or after food. Good dental hygiene can help to prevent gum enlargement. Do not stop this medicine suddenly without your clinician's advice.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Pilocarpine eye drops Chronic open-angle glaucoma (10.12.4) Emergency treatment of acute angle-closure glaucoma (before surgery) (10.12.2) (**Other indications:** Ocular hypertension; to antagonize effects of mydriasis and cycloplegia following surgery or ophthalmoscopic examination)	***Drops: 2%, 4% (hydrochloride or nitrate)*** 1 drop (2% or 4% solution) up to 4 times daily 1 drop (2% solution) every 10 minutes for 30–60 minutes; then 1 drop every 1–3 hours until intraocular pressure subsides	**Common:** Eye pain, blurred vision, ciliary spasm; ciliary spasm leads to headache and brow ache, which may be most severe in the initial 2–4 weeks of treatment. **Infrequent or rare:** Lacrimation, myopia, conjunctival vascular congestion, superficial keratitis, vitreous haemorrhage, increased pupillary block; lens opacities (following prolonged use); rarely, systemic effects including hypertension, tachycardia, bronchial spasm, pulmonary oedema, salivation, sweating, nausea, vomiting, diarrhoea	**Contraindications:** Acute iritis, acute uveitis, anterior uveitis, some forms of secondary glaucoma; acute inflammation of anterior segment. Use not advisable after angle-closure surgery (risk of posterior synechiae). **Use with caution:** In retinal disease, conjunctival or corneal damage (monitor intraocular pressure in chronic open-angle glaucoma and in long-term treatment); cardiac disease, hypertension, asthma, peptic ulceration, urinary tract obstruction, Parkinson's disease. Withdraw treatment if symptoms of systemic toxicity develop. **Administration:** A darkly pigmented iris may require higher concentration of the miotic or more frequent administration; care should be taken to avoid overdosage. **Counselling:** If you are using more than one type of eye drop, put in pilocarpine drops last. Causes difficulty with adapting to the dark and may cause accommodation spasm. Avoid skilled tasks, for example, operating machinery or driving, until vision is clear.
Podophyllum resin External anogenital warts; plantar warts (10.2.3)	***Solution: 10–25%*** Apply carefully, avoiding contact with normal tissue; rinse off after 1–6 hours. May be repeated at weekly intervals but no more than 4 times in all. Only a few warts should be treated at any one time.	**Common:** Irritation, staining of the skin **Infrequent or rare:** Systemic effects resulting from cutaneous absorption include nausea, vomiting, abdominal pain, diarrhoea; also, transient leukopenia and thrombocytopenia; renal failure; delayed neurotoxicity including visual and auditory hallucinations, delusions, disorientation, confusion, delirium following excessive application	**Pregnancy/breastfeeding:** Contraindicated in pregnancy and breastfeeding **Use with caution:** Avoid use on large areas; very irritant to eyes (keep away from face); avoid contact with normal skin, mucus membranes, open wounds. **Administration:** Must be applied by a trained health worker **Counselling:** Avoid contact with face and other sensitive areas.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Polyvidone iodine (povidone–iodine) Skin disinfection (10.2) Antiseptic for minor wounds and burns (4)	***Solution: 10%*** Apply undiluted solution to the skin area. Apply undiluted solution to the affected area twice daily.	**Infrequent or rare:** Irritation of skin and mucous membranes; may interfere with thyroid function tests	**Contraindications:** Avoid regular or prolonged use in patients with thyroid disorders or those taking lithium. **Administration:** Do not use on large open wounds: may produce systemic adverse effects such as metabolic acidosis, hypernatraemia, impairment of renal function.
Polyethylene glycol electrolyte solution (osmotically balanced mixture) Acute iron poisoning and overdose with highly toxic sustained-release preparations, e.g. calcium channel blockers (3.8.1)	***Solution*** Bowel irrigation: 2 litres per hour for adults if tablets are present beyond the stomach	**Common:** Nausea, vomiting, abdominal cramps, bloating **Infrequent or rare:** Aspiration pneumonia Note: Risk of fluid and electrolyte imbalance if solution is not correctly formulated	**Pregnancy:** Unknown safety in pregnancy. **Breastfeeding:** Not recommended until more known; use only if potential benefit is greater than risk. **Contraindications:** Ileus, GI haemorrhage, haemodynamic instability, uncontrollable vomiting, bowel obstruction or perforation, decreased consciousness with unprotected airway.
Potassium permanganate Wet dressings to assist healing of suppurating superficial wounds, tropical ulcers; pemphigus; tinea pedis; infected eczema (10.2)	***Aqueous solution: 1:10 000 (0.01%)*** Apply dressings soaked in a 1:10 000 solution to affected area until superficial crusts can be gently separated. Change dressings 2 or 3 times daily. Bathe severe weeping lesions in a 1:10 000 solution every 8 hours.	**Common:** Irritant to mucous membranes; skin and fabrics can be stained brown.	**Use with caution:** Avoid occlusive dressings. **Administration:** In exudative eczematous areas, treatment should be stopped when the skin becomes dry. Note: Potassium permanganate is sometimes supplied as an aqueous stock solution of 1:1000 (0.1%) for dilution before use. To be diluted 1 in 10 to provide a 0.01% (1 in 10 000) solution.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Potassium chloride (KCl) Hypokalaemia, mild to moderate (5.2.2) Hypokalaemia, severe (5.2.2)	***Solution: 11.2% in 20 ml ampoule (equiv to K+ 1.5 mmol/ml, Cl– 1.5 mmol/ml); Oral preparations*** Oral: 20–50 mmol daily after meals Slow IV infusion: 20–40 mmol/l in normal saline (not to exceed 10-20 mmol/hour)	**Common:** Nausea/vomiting (severe symptoms may indicate obstruction of oesophagus or small bowel), hyperkalaemia (especially in renal insufficiency), rapid infusion toxic to heart	**Pregnancy/breastfeeding:** May be used for supplementation in pregnancy and breastfeeding; monitor electrolytes to keep maternal serum levels within normal range. **Contraindications:** Severe renal impairment and plasma potassium concentration above 5 mmol/l **Use with caution:** In elderly, mild/moderate renal impairment, history of peptic ulcer **Administration:** Monitor potassium levels. Potassium salts cause nausea and vomiting; therefore, poor compliance is a major limitation to their effectiveness; where appropriate, potassium-sparing diuretics are preferable. **Counselling:** If you have severe nausea and vomiting, stop the medicine and inform your clinician.
Praziquantel Schistosomiasis (11.34)	***Tablet: 600 mg*** Oral: 40 mg/kg as a single dose	Usually mild and transient with short course. Many adverse effects result from death of the parasite and are more severe with high parasite burden. **Common:** Dizziness (dose dependent), headache, malaise, drowsiness; nausea, vomiting, abdominal pain, diarrhoea, anorexia, colic; reversible rises in hepatic transaminases; rectal bleeding Infrequent or rare: arrhythmia	**Pregnancy:** Use not recommended in first trimester; consider alternatives. Caution in second and third trimesters; use only if treatment of choice. **Breastfeeding:** May be used for single-day treatment during breastfeeding **Contraindications:** Ocular cysticercosis **Counselling:** Take with food. Swallow with plenty of water to prevent vomiting due to bitter taste. Tablet may be cut into halves or quarters, but do not chew. The medicine may make you feel drowsy or dizzy; if you are affected, do not drive or operate machinery until 24 hours after finishing your course.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Prednisolone Also see Section 8.2 steroid equivalents table.	***Tablet; 5 mg, 25 mg***	Overdosage or prolonged use can exaggerate some of the normal physiological actions of corticosteroids, leading to mineralocorticoid and glucocorticoid side-effects. *Mineralocorticoid side-effects:* Hypertension, sodium and water retention, potassium and calcium loss **Common:** Dyspepsia, increased susceptibility to infection (oral, vaginal, intertriginous candidiasis), masking of signs of infected acne, oedema, hypertension, hypokalaemia, hyperglycaemia, weight gain, osteoporosis, spontaneous fractures, increased appetite, delayed wound healing, skin atrophy, growth retardation in children, myopathy, muscle weakness, wasting (particularly symptomatic on drug withdrawal), fat redistribution (producing cushingoid appearance), amenorrhoea, psychosis. euphoria, depression, adrenal suppression, bruising	**Pregnancy:** May be used at the recommended doses; caution in first trimester due to possibility of oral cleft; limited transplacental transfer. Monitor blood glucose, especially in diabetics. **Breastfeeding:** May be used at recommended doses; amount in milk low at doses up to 80 mg (monitor infant's adrenal function if dose is higher) **Contraindications:** Systemic infection (unless life-threatening or specific antimicrobial therapy given). Avoid live virus vaccines in those receiving immunosuppressive doses. **Use with caution:** In infections, hypertension, recent myocardial infarction, congestive heart failure, renal impairment, hepatic impairment, diabetes mellitus including family history, osteoporosis, glaucoma including family history, corneal perforation, severe affective disorder, epilepsy, psoriasis, peptic ulcer, hypothyroidism, history of steroid myopathy, and in the elderly; can activate or exacerbate TB, amoebiasis, strongyloidiasis. Prolonged treatment leads to adrenal suppression, which persists for years after stopping treatment. Cushingoid features are increasingly likely with doses above 7.5 mg daily. Risk of chickenpox, measles, and activation of tuberculosis increased.
Moderate to life-threatening wheezing (3.2.4)	Oral: 40–60 mg		
Pneumocystis jirovecii pneumonia (PCP pneumonia) (10.6.3)	Oral: 40 mg twice daily for 5 days THEN 40 mg daily for 5 days THEN 20 mg daily for 11 days to complete 21 days of treatment		
Management of severe persistent asthma (10.6.4)	Oral: 0.5 mg/kg daily (reassess weekly; taper when patient stable for 1 week)		
Type 2 lepra reaction (11.21)	See Section 11.21 for dosing.		

Other indications: With antineoplastic drugs for acute and chronic leukaemias; lymphoma; suppression of inflammatory and allergic reactions; inflammation of the eye; myasthenia gravis)	**Note on steroid dosing:** Patients on long term steroid therapy are at risk for a blunted stress response in conditions causing physiologic stress (e.g., severe infection, trauma, during surgery). As a result, standard steroid doses may need to be supplemented. Patients on steroid replacement for primary dysfunction of the hypothalamus-pituitary-adrenal axis HPA axis (for example, Addison disease, hypopituitarism) SHOULD receive higher dose of steroids in conditions causing physiologic stress. A common IV regimen is hydrocortisone 50-100 mg every 8 hours for 2 days. Consult a specialist for assistance on how to provide this supplemental steroid treatment.	**Infrequent or rare:** Acute pancreatitis, peptic and oesophageal ulceration, vertebral compression fracture, aseptic necrosis of the talus or femoral and humoral heads; facial erythema, suppression of skin test reactions, hyperhidrosis, skin bruising, telangiectasia, myocardial rupture following recent myocardial infarction, congestive heart failure, leucocytosis, hypersensitivity reactions (including anaphylaxis), thromboembolism, malaise, hiccups, headache, vertigo. *Glucocorticoid side-effects:* Diabetes and osteoporosis can result in osteoporotic fractures, particularly in the elderly. CNS side-effects: Psychological dependence, insomnia, aggravation of schizophrenia, aggravation of epilepsy. Ophthalmologic side-effects: Glaucoma, papilloedema, posterior subcapsular cataracts, corneal or scleral thinning, exacerbation of ophthalmic viral or fungal disease, increased intra-ocular pressure, exophthalmos	**Administration:** Monitor weight, blood pressure, fluid and electrolyte balance, and blood glucose levels throughout prolonged treatment. The suppressive action of a corticosteroid on cortisol secretion is least when it is given as a single dose in the morning. During corticosteroid withdrawal the dose may be reduced rapidly down to physiological doses (equivalent to prednisolone 7.5 mg daily) and then reduced more slowly. Assessment of the disease may be needed during withdrawal to ensure that relapse does not occur. **Counselling:** Take with food to reduce stomach upset. Tell your doctor immediately if you have any signs of infection. If you have been on this medicine for more than 3 weeks, don't stop the treatment suddenly. Tell your doctor, dentist, or pharmacist that you are on steroids before undergoing any new treatment.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Primaquine Radical treatment of P. vivax and P. ovale malaria (after standard chloroquine therapy) (11.25.3)	***Tablet: 7.5 mg, 15 mg*** Oral: 250 mcg/kg daily for 14 days OR 30 mg daily for 14 days	**Common:** Nausea, vomiting, anorexia, abdominal cramps; dizziness, headache **Infrequent or rare:** Haemolytic anaemia (frequently in G6PD deficiency; withdraw treatment); methaemoglobinaemia (withdraw treatment); haemoglobinuria; agranulocytosis, granulocytopaenia, leukopenia	**Pregnancy:** Uncertain safety in pregnancy; use not recommended. **Breastfeeding:** Use with caution; limited data. Monitor infants for adverse effects (e.g. haemolysis, jaundice). Avoid in neonates and infants who are G6PD-deficient. **Contraindications:** Conditions that predispose to granulocytopenia. Monitor blood count. Exclude G6PD deficiency before radical treatment for *P. vivax* and *P. ovale* but not before single-dose gametocytocidal treatment. **Counselling:** Give with food if severe nausea/vomiting or abdominal cramps occur.
Procaine benzylpenicillin G Neurosyphilis (11.37) Tropical ulcer (10.2.10) Borreliosis (louse-borne relapsing fever) if not able to take orally (10.1) (**Other indications:** Diphtheria; animal bites)	***Powder for Injection: 1 g vial (1 million IU); 3 g vial (3 million IU)*** IM: 2.4 g (2.4 million IU) daily AND *oral probenecid* 500 mg 4 times daily) for 10–14 days 0.6 g (600 000 IU) daily for 2–4 weeks IM: 0.6 to 0.8 g (600 000 to 800 000 IU) as a single dose	See benzylpencillin. Pain and inflammation at injection site; Jarisch-Herxheimer reaction (rigors, fever, and hypotension) usually within several hours after treatment of syphilis or borreliosis; probably due to release of endotoxin. Accidental intravascular administration may result in anxiety, agitation, fear of death, hallucinations. These usually resolve in 15–30 minutes and rarely last beyond 24 hours.	**Pregnancy/breastfeeding:** Considered safe in both pregnancy and breastfeeding (monitor infant for side-effects). **Contraindications:** Hypersensitivity to penicillins or if IV administration needed **Use with caution:** In renal failure. Observe patient with syphilis or borreliosis for several hours after treatment. **Administration:** Give by deep IM injection. (Do not give IV.) Can be used for daily outpatient treatment. Probenecid is added to increase serum penicillin levels in neurosyphilis.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Propranolol Primary prevention of variceal bleeding in patients with documented varices (10.9) (**Other indications:** migraine prophylaxis, essential tremor, stable angina, hypertension, some arrhythmias)	***Tablet: 20 mg; 40 mg (hydrochloride)*** Titrate to achieve a 25% reduction in the heart rate	**Common:** Nausea/vomiting, diarrhoea, bradycardia, bronchospasm, cold extremities, fatigue, sleep disturbances including nightmares; heart failure, hypotension, conduction disorders, peripheral vasoconstriction, exacerbation of intermittent claudication, Raynaud's phenomenon; alteration of glucose and lipid metabolism **Infrequent or rare:** Rash, dry eyes (reversible), sexual dysfunction, exacerbation of psoriasis. purpura, thrombocytopenia	**Pregnancy:** Use with caution. May cause intrauterine growth restriction, neonatal hypoglycaemia, and bradycardia; risk greater in severe hypertension. **Breastfeeding:** Present in milk; safe in usual dosage; monitor infant. **Contraindications:** Asthma or history of obstructive airway disease, uncontrolled heart failure, Prinzmetal's angina, marked bradycardia, hypotension, sick sinus syndrome, second- or third-degree atrioventricular block, cardiogenic shock, metabolic acidosis, severe peripheral arterial disease; phaeochromocytoma **Use with caution:** In first-degree atrioventricular block; renal impairment; liver disease; portal hypertension; diabetes mellitus; myasthenia gravis; history of hypersensitivity **Administration:** When stopping treatment, reduce dosage gradually over at least 2 weeks. **Counselling:** Do not stop taking this medicine suddenly without your clinician's advice.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Pyridoxine (vitamin B6) Ethylene glycol poisoning (3.8.1) Peripheral neuropathy (10.10a.6); neuropathic signs on INH (13.3, 15.4.2) Prevention of peripheral neuropathy with INH for prophylaxis or treatment for TB (15.4.2) Antiemetic in pregnancy (14.1.11)	***Tablet: 25 mg*** Oral: 50 mg every 6 hours for 6 doses Oral: 50–75 mg daily Oral: 10 mg daily Oral: 25 mg, up to 3–4 times daily	**Infrequent or rare:** Sensory neuropathy reported with high doses given for extended periods	**Pregnancy/breastfeeding:** May be used in pregnancy and breastfeeding; doses >200 mg/day may suppress lactation.
Pyrimethamine Toxoplasmosis in immunodeficiency (11.40) Chorioretinitis (10.12.6)	***Tablet: 25 mg, 50 mg*** Oral: 100–200 mg as a single dose THEN 50 mg daily for at least 6 weeks AND sulfadiazine + folinic acid for 6 weeks Oral: 75 mg daily for 3 days THEN 25 mg daily for 4 weeks AND sulfadiazine + folinic acid for same duration (In unresponsive patients, 50 mg daily for a further 4 weeks)	**Common:** Nausea/vomiting, diarrhoea, depression of haematopoiesis with high doses, megaloblastic anaemia, rashes, insomnia, CNS toxicity (at high doses)	**Pregnancy:** May be used during pregnancy if it is the drug of choice; avoid in first trimester when possible. **Breastfeeding:** Use, with caution, if it is the drug of choice. **Contraindications:** Megaloblastic anaemia **Use with caution:** In hepatic and renal impairment For treatment of toxoplasmosis, pyrimethamine must always be taken with sulfadiazine and should be administered with folinic acid when available. **Administration:** Give with food if GI disturbances occur. Monitor blood counts in prolonged treatment and give folate supplements throughout treatment.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Quinine Severe *P. falciparum* malaria if parenteral artesunate not available (QC p. 20, 11.25.5)	***Tablet: 300 mg Infusion: 300 mg/ml in 2 ml ampoule*** IV/IM (in anterior thigh): 20 mg/kg over 4 hours; THEN 10 mg/kg every 8 hours until oral medication is possible Oral: 600 mg quinine sulfate 3 times daily for 7 days AND clindamycin or doxycycline	**Common:** Nausea, vomiting, diarrhoea, CNS disturbances, reversible hearing loss, cinchonism, tinnitus, headache, hot and flushed skin, nausea, abdominal pain, rashes, visual disturbances (including temporary blindness), confusion, fever, rash, hypoglycaemia (after parenteral administration), thrombocytopenia, ECG changes **Infrequent or rare:** Angioedema, intravascular haemolysis, acute renal failure, prolonged QT interval	**Pregnancy:** Use only if benefit is greater than risk; avoid in first trimester when possible, as high doses (>1 g total) may cause fetal deafness. **Breastfeeding:** Caution; monitor for adverse effects. Avoid in G6PD-deficient infants. Contraindications: Haemoglobinuria, optic neuritis, tinnitus **Use with caution:** In atrial fibrillation, conduction defects, heart block, renal impairment, G6PD deficiency, myasthenia gravis. With IV use, monitor signs of cardiac toxicity and blood glucose levels. **Administration:** Oral: If part of all of a dose is vomited within 1 hour, the same amount must be re-administered immediately. I**V: Do not give as intravenous bolus injection.** Infuse IV quinine over 4 hours, preferably in glucose 5% to reduce risk of hypoglycaemia.
Quinine + clindamycin Non-severe *P. falciparum* malaria in first-trimester pregnancy (11.25.7); *P. falciparum* malaria in travellers (11.25.3); second-line treatment for malaria (11.25.4)	***Separate blisters with tablets of 150 or 300 mg quinine and tablets of 100 mg doxycycline*** Oral: 600 mg of quinine salt given 3 times a day (every 8 hours) for 7 days and 600 mg of clindamycin base twice daily for 7 days	As for quinine and clindamycin	See doxycycline and quinine. Additionally: **Use with caution:** Rifampicin reduces the plasma concentration of quinine, leading to increased treatment failures. Avoid antiarrhythmics, such as flecainide and amiodarone. Antihistamines, such as terfenadine, and antipsychotic drugs, such as pimozide and thioridazine, can increase risk of arrhythmias. Cimetidine can increase quinine levels.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Rifampicin Buruli ulcer (in combination therapy with streptomycin) (10.2.10) Leprosy- paucibacillary (11.21) Leprosy- multibacillary (11.21)	***Capsule or tablet: 150 mg, 300 mg*** See Section 10.2 for dosing. Oral: 600 mg rifampicin once monthly for 6 months AND daily dapsone 600 mg rifampicin once monthly for 12 months AND dapsone + clofazimine. See Section 11.21 for details of dosing.	**Common:** Nausea, vomiting, diarrhoea, anorexia; headache, drowsiness; arthralgia, myalgia (in the first weeks of treatment). Those occurring mainly on intermittent therapy include influenza-like symptoms (chills, fever, dizziness, bone pain); urine, saliva, other body secretions coloured orange-red. **Infrequent or rare:** Respiratory symptoms (including shortness of breath); collapse and shock; haemolytic anaemia, thrombocytopenic purpura, disseminated intravascular coagulation, leukopenia, eosinophilia; acute renal failure; alterations of liver function, jaundice; flushing, urticaria, rashes, exfoliative dermatitis, toxic epidermal necrolysis, Stevens-Johnson syndrome, pemphigoid reactions; oedema; psychoses; adrenal insufficiency; muscular weakness, myopathy; menstrual disturbances	**Pregnancy:** Considered safe **Breastfeeding:** May be used, with caution, at recommended doses **Counselling:** Urine, tears, saliva, and sputum may become coloured orange-red- do not worry about it as the colour change is harmless.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Rifampicin + isoniazid + pyrazinamide + ethambutol hydrochloride (R + H+ Z+ E) Tuberculosis (13.10 HIV/TB co-management, 15 TB)	***Tablet: fixed dose combination rifampicin 150 mg, isoniazid 75 mg, pyrazinamide 400 mg, ethambutol 275 mg*** 2HRZE/4HR Oral: Rifampicin 10 mg/kg daily (max 300 mg) AND isoniazid 5 mg/kg (max 600 mg) AND pyrazinamide 25 mg/kg AND ethambutol 15 mg/kg once daily OR rifampicin 10 mg/kg daily (maximum 600 mg) AND isoniazid 5 mg/kg (maximum 900 mg) AND pyrazinamide 25 mg/kg AND ethambutol 15 mg/kg 3 times weekly (given as DOT; 3 times weekly regimen NOT recommended for HIV-positive patients and those from high HIV prevalent settings)	See rifampicin, isoniazid, ethambutol, pyrazinamide. **Common:** Hyperuricaemia, polyarthritis, nausea **Infrequent or rare:** Hepatotoxicity (including fever, anorexia, hepatomegaly, splenomegaly, jaundice, liver failure); flushing, dysuria, sideroblastic anaemia, photosensitivity	**Pregnancy/breastfeeding:** Considered safe in pregnancy; Benefits of treating TB in pregnant and breastfeeding women outweigh risks of drug side-effects to either mother or infant. Monitor infant for signs of pyridoxine deficiency or jaundice; consider maternal or fetal supplementation. **Contraindications:** Hypersensitivity to rifampicin, hepatic disease, porphyria, optic neuritis, severe renal impairment **Use with caution:** In hepatic or renal impairment, diabetes mellitus, gout, chronic alcohol dependence, elderly, epilepsy, history of psychosis. Prophylactic pyridoxine 10 mg daily indicated, particularly in HIV-positive patients. **Administration:** Ocular examination recommended before and during treatment. Three times per week is acceptable alternative provided that patient is receiving directly observed therapy, and is not living with HIV or living in an HIV-prevalent setting. See Section 15. **Counselling:** Discontinue treatment and seek immediate medical attention if you develop persistent nausea, vomiting, malaise, yellow discoloration of the white of your eye or urine. Tell your health care provider immediately about any changes in your vision. If you are using a combined oral contraceptive (the Pill), patch, vaginal ring, or progestin-only pills, use additional contraception, such as condoms.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Salbutamol Acute bronchospasm (QC p. 17, 3.2.4) Asthma and COPD (10.6) Hyperkalemia (5.2.2)	***Inhalation respirator solution for use in nebulizers: 5 mg (as sulfate)/ml*** ***Aerosol: 100 mcg (as sulfate) per dose*** See QC p 17 and 3.2.4 for dosing. See Sections 10.6.4, 10.6.5. By nebulizer: 10–20 mg OR IV: 0.5 mg (500 mcg). Administration should be slow, over 15–20 minutes. If neither of these are available, give salbutamol 1200 mcg by metered-dose inhaler with spacer (12 puffs).	C**ommon:** Palpitations, fine tremor (usually hands), headache. **Infrequent or rare:** With inhaled dosage forms, hyperglycaemia and hypokalaemia after high doses; muscle cramps; arrhythmias, tachycardia, insomnia, paradoxical bronchospasm, urticaria/angioedema	**Pregnancy:** May be used at recommended doses; asthma management for pregnant and non-pregnant women should be the same. **Breastfeeding:** May be used at recommended doses (monitor infant) **Use with caution:** In hyperthyroidism, myocardial insufficiency, arrhythmias, susceptibility to QT interval prolongation, hypertension, diabetes mellitus
Salicylic acid Hyperkeratotic conditions, including warts; adjunct in treatment of psoriasis, ringworm, seborrhoeic dermatitis, ichthyosis (10.2)	***Solution: 5%*** Apply directly to affected area once daily, starting with lower strength preparations; gradually increase strength until satisfactory response obtained.	**Infrequent or rare:** Local irritation, dermatitis, toxicity with excessive application or treatment of large areas	**Contraindications:** Broken or inflamed skin. **Use with caution:** In significant peripheral neuropathy; in diabetics at risk of neuropathic ulcers **Administration:** Avoid application to large areas. **Counselling:** Avoid contact with eyes, lips, and inside of your nose. Protect surrounding skin; rub warts gently with file or pumice stone once weekly.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Selenium sulfide Pityriasis versicolor (10.2.7) Seborrhoeic dermatitis (10.2.7)	***Detergent-based suspension 2%, lotion*** Apply lotion with small amount of water to entire affected area; rinse off after 10 minutes. Repeat daily for 7–14 days. OR Apply to affected area at bedtime; rinse off in morning; repeat 1–6 times over 2 weeks; repeat course if necessary. Detergent-based suspension/ shampoo: Massage 5–10 ml into wet hair and leave for 2–3 minutes before rinsing thoroughly; repeat twice weekly for 2 weeks; then once weekly for 2 weeks; thereafter only when needed.	C**ommon:** Local irritation, hair discolouration or loss. Absorption may result in systemic toxicity including tremors, weakness, lethargy, pain in lower abdomen, occasional vomiting (symptoms usually resolve within 10 days)	**Pregnancy:** May be used on the scalp; it should not be used on the body to treat skin infections, as it may be absorbed through the skin. **Breastfeeding:** Uncertain safety in breastfeeding; use with caution. **Use with caution:** Do not apply to damaged skin (risk of systemic toxicity); avoid contact with eyes; do not use within 48 hours of applying preparations for hair colouring, straightening, or permanent wave. **Administration:** To minimize absorption, rinse hair thoroughly after use and remove all traces from skin (including nails). Note: Selenium sulfide is widely used in proprietary shampoos.
Senna Constipation (10.7d.4, 20.2)	***Tablet: 7.5 mg (sennosides)*** Oral: 2–4 tablets, usually at night. Initial dose should be low; then gradually increased to 30 mg.	**Common:** Abdominal discomfort, cramps **Infrequent or rare:** Hypokalaemia (with prolonged use or overdosage)	**Pregnancy:** If dietary and lifestyle changes fail to control constipation in pregnancy, moderate doses of poorly absorbed laxatives may be used. A bulk-forming laxative should be tried first. An osmotic laxative, such as lactulose, can also be used. Bisacodyl or senna may be suitable, if a stimulant effect is necessary. **Breastfeeding:** Not known to be harmful **Use with caution:** Avoid prolonged use unless indicated to prevent faecal impaction.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Sodium bicarbonate Treatment of cardiotoxicity from drug overdose (e.g. tricyclic antidepressant, carbamazepine); alkalinization of urine to enhance excretion of salicylate and chlorphenoxy pesticides; correction of metabolic acidosis (3.8.1)	***Injection: IV: 4.2%, 8.4% (intravenous concentrations 1 ampoule = 50 meq = 4.2 grams = 100 mmol)*** IV: Emergency dosing: Initially, 1–2 mmol/kg over 1–2 minutes. Additional dose: 0.5 mmol/kg every 10 minutes. Maintenance: 100–150 mmol sodium bicarbonate in 1 litre 5% dextrose at 250 ml/hour.	No common side-effects. **Infrequent or rare:** severe allergic reactions (rash; hives; difficulty breathing; tightness in chest; swelling of mouth, face, lips, or tongue); irritability; muscle spasms or twitching; pain, redness, or swelling at the injection site Overly aggressive therapy with sodium bicarbonate injection can result in metabolic alkalosis (associated with muscle twitching, irritability, tetany) and hypernatraemia. Therefore, blood pH and electrolytes should be monitored.	**Pregnancy/breastfeeding:** Unknown safety in pregnancy and breastfeeding; use with caution, if benefit is greater than risk.
Sodium cromoglycate Allergic conjunctivitis; seasonal keratoconjunctivitis (10.12)	***Ophthalmic drops: 2%*** Apply 4 times daily.	**Common:** Burning, stinging	**Administration:** Start treatment with cromoglicate 1 month before the onset of the hay fever season. **Counselling:** It can take 3–4 weeks to reach full effect.
Sodium nitrite Cyanide poisoning (3.8.2)	***Injection: 30 mg/ml in 10 ml ampoule (3% solution)*** Slow IV infusion: 10 ml of 3% solution over 2–4 minutes THEN sodium thiosulfate	**Common:** Nausea/vomiting, abdominal pain, vasodilatation (resulting in syncope, hypotension, tachycardia, flushing), headache, methaemo-globinaemia, cyanosis, dyspnoea/ tachypnea	**Pregnancy/breastfeeding:** Unknown safety in pregnancy and breastfeeding; use with caution; cyanide poisoning likely to be the more significant risk. **Use with caution:** In severe cardiovascular or cerebrovascular disease. Monitor plasma methaemoglobin levels.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Sodium nitroprusside MAO-I toxicity (3.8.1) (**Other indications:** Hypertensive crisis)	***Powder for infusion: 50 mg in ampoule*** IV: Initially 0.3–0.5 mcg/kg/minute increase gradually to 0.5–6 mcg/kg/minute for the desired hemodynamic effect or the appearance of headache or nausea (maximum 8 mcg/kg/minute). Stop infusion if response satisfactory after 10 minutes.	**Common:** Severe hypotension, headache, dizziness, retching, abdominal pain, perspiration, palpitation, arrythmias, apprehension, retrosternal discomfort	**Pregnancy:** Not recommended in hypertensive crisis in pregnancy. **Breastfeeding:** Use, with caution, if benefits are greater than risks; monitor infant for effects such as hypotension, bradycardia, fatigue. **Contraindications:** Severe hepatic impairment, compensatory hypertension, severe vitamin B12 deficiency
Sodium stibogluconate (pentavalent antimony compound) Cutaneous leishmaniasis (11.20.1) Secondary prophylaxis of visceral leishmaniasis (11.20.3) Post kala-azar dermal leishmaniasis, alternative treatment (11.20.2)	***Injection: 100 mg/ml vial*** IV/IM: 20 mg/kg daily for 21 days IV/IM: 20 mg/kg per month See table in Section 11.20.2	**Common:** Nausea/vomiting, anorexia, abdominal pain, diarrhoea; ECG changes; coughing (see Cautions); headache, lethargy; arthralgia, myalgia **Infrequent or rare:** Jaundice, flushing, bleeding from nose or gum, substernal pain, vertigo, fever, sweating, rash; also reported, pancreatitis and anaphylaxis; pain and thrombosis on intravenous administration; intramuscular injection also painful	**Pregnancy:** Uncertain safety in pregnancy; use, with caution, if benefit is greater than risk. **Breastfeeding:** Limited information suggests that doses up to 1.4 g daily produce low levels in milk, not expected to cause any adverse effects, especially if the infant is older than 2 months; if withholding nursing during therapy is preferred, breastfeeding can be resumed 24–48 hours after last dose. **Contraindications:** Cardiac, liver and kidney disorders. **Use with caution:** Successful treatment of mucocutaneous leishmaniasis may induce severe inflammation around the lesions (may be life-threatening if pharyngeal or tracheal involvement); may require corticosteroid. **Administration:** IV injections must be given slowly over 5 minutes (to reduce risk of local thrombosis) and stopped if coughing or substernal pain.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Sodium thiosulfate Cyanide poisoning (together with sodium nitrite) (3.8.1) Pityriasis versicolor (10.2.7)	***Injection: 250 mg/ml in 50 ml ampoule (25% solution)*** ***Topical solution: 15%*** IV: 50 ml of 25% solution (12.5 g) over 10 minutes Topical: Apply twice daily for 4 weeks.	Sodium thiosulfate has low toxicity. Osmotic disturbances may occur but at the recommended doses are usually mild. **Infrequent or rare:** When used in cyanide poisoning, symptoms of thiocyanate toxicity may occur: pain in the joints, blurred vision, hyperreflexia, muscle cramps, nausea and vomiting, agitation, delusions, hallucinations, tinnitus	**Pregnancy/breastfeeding:** Unknown safety in pregnancy and breastfeeding; use with caution. Cyanide poisoning likely to be the more significant risk.
Spectinomycin Alternative treatment for gonorrhoea without dissemination (11.13); gonococcal conjunctivitis (10.12.2) Disseminated gonococcal infection (11.13)	***Powder for injection: 2 g (as hydrochloride) in vial*** IM: 2 g as a single dose IM: 2 g twice daily for 7 days (some data suggest that 3 days is adequate)	**Infrequent or rare:** Dizziness; nausea; urticaria; chills; fever; headache, insomnia, mild to moderate pain after injection, anaphylaxis	**Pregnancy/breastfeeding:** Use only if indicated. No controlled studies or reports teratogenicity. **Use with caution:** In renal impairment
Spironolactone Oedema (10.4.3); ascites (10.9) (**Other indications:** Nephritic syndrome; primary hyperaldosteronism; moderate to severe heart failure in patients taking an ACE inhibitor and a beta-blocker)	***Tablet: 25 mg*** Oral: 100–200 mg daily. Increase if necessary to 400 mg daily in resistant oedema (usual maintenance dose 25–200 mg daily) AND furosemide	**Common:** Hyperkalaemia, hyponatraemia, hyperchloraemic acidosis, weakness, headache, nausea, vomiting, diarrhoea, breast tenderness **Infrequent or rare:** GI cramps, drowsiness, menstrual irregularities, transient increase in blood urea nitrogen, gynaecomastia, impotence, rash, ataxia, hepatotoxicity	**Pregnancy:** Not recommended; consider alternatives where possible. **Breastfeeding:** Use, with caution, if benefit is greater than risk; amount to infant appears very small, unlikely to cause adverse effects; theoretically may suppress lactation due to diuresis **Contraindications:** Hyperkalaemia, hyponatraemia, severe renal impairment, Addison's disease. Monitor blood urea nitrogen and plasma electrolytes; discontinue if hyperkalaemia. **Use with caution:** In elderly; in patients with diabetes mellitus, renal impairment, hepatic impairment, porphyria Avoid concurrent administration of potassium supplements.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Streptomycin Tuberculosis (initial phase of combination therapy in TB patients returning after defaulting or relapsing from their first treatment course) (15) Buruli ulcer (10.2.10)	***Injection: 1 g vial*** IM: 15 mg/kg daily. Indicated in combination as 2HRZES/1HRZE/5HRE. IM: 15 mg/kg daily for 8 weeks (in combination therapy with rifampicin 10 mg/kg daily)	See gentamicin. Also, hypersensitivity reactions, paraesthesia of mouth	**Pregnancy:** Avoid streptomycin during pregnancy; auditory or vestibular nerve damage possible **Breastfeeding:** May be used at recommended doses (monitor infant for thrush or diarrhoea) **Contraindications:** Hearing disorders, myasthenia gravis **Use with caution:** In patients with renal impairment; elderly patients. Patients over 60 years or those weighing <50 kg may not tolerate doses above 500–750 mg daily. **Administration:** Monitor auditory, and vestibular function. If poor renal function, adjust dose.
Sulfadiazine Toxoplasmosis in immunodeficiency (11.40); chorioretinitis (10.12) Toxoplasmosis (in second and third trimesters of pregnancy if fetal infection has been documented) Rheumatic fever, secondary prophylaxis (11.32)	***Tablet: 500 mg*** Oral: 4–6 g daily in 4 divided doses for at least 6 weeks AND *folinic acid* + pyrimethamine for 6 weeks Oral: 4 g daily in 4 divided doses AND *folinic acid* + pyrimethamine Oral: 1 g daily	**Common:** Nausea/vomiting, diarrhoea **Infrequent or rare:** Hypersensitivity reactions (Stevens-Johnson syndrome and toxic epidermal necrolysis; discontinue if rash develops); systemic lupus erythematosus, myocarditis, serum sickness, crystalluria resulting in haematuria, blood disorders (discontinue if develops), liver damage, cough/shortness of breath, pancreatitis, CNS problems (convulsions, ataxia, hallucinations), electrolyte disturbances	**Pregnancy:** Uncertain safety in pregnancy. Use, with caution, only if potential benefit is greater than risk; avoid in first trimester due to bone marrow toxicity; avoid in third trimester due to risk of neonatal jaundice. **Breastfeeding:** Limited data; use with caution. Avoid in G6PD-deficient neonates and infants; monitor infants for adverse effects (e.g. haemolysis, jaundice). **Contraindications:** Hypersensitivity to sulphonamides, porphyria **Use with caution:** In hepatic or renal impairment. Maintain adequate fluid intake to avoid crystalluria. Avoid in blood disorders (except with specialist supervision); monitor blood counts; predisposition to folate deficiency, elderly, asthma, G6PD deficiency **Administration:** For the treatment of toxoplasmosis, pyrimethamine must always be taken with sulfadiazine.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Sulfadoxine with pyrimethamine (SP) Intermittent preventive therapy in pregnancy (IPTp) where stable transmission of *P. falciparum* malaria (11.25.8)	***Tablet: sulfadoxine 500 mg + pyrimethamine 25 mg*** Oral: sulfadoxine 1.5 g with pyrimethamine 75 mg (3 tablets) as a single dose under direct observation- give twice during pregnancy, in second and third trimester, 4 weeks apart; if HIV-positive, give 3 doses (see Section 11.25.8.).	**Common:** Nausea, vomiting, diarrhoea, feeling of fullness; rash, itch **Infrequent or rare:** Hypersensitivity reaction (Stevens-Johnson syndrome and toxic epidermal necrolysis); hepatitis; cough, dyspnoea; blood disorders (leukopenia, thrombocytopenia, megaloblastic anaemia, purpura)	**Pregnancy:** Use during pregnancy if treatment of choice; consider folic acid supplementation 5 mg/day. **Breastfeeding:** Unknown safety; not recommended **Contraindications:** Already taking cotrimoxazole, hypersensitive to sulfonamides or pyrimethamine, severe hepatic or renal impairment. Avoid in blood disorders (except with specialist supervision). Withdraw treatment if blood disorder, rash, sore throat, mouth ulcers, shortness of breath, or cough occurs. **Use with caution:** In G6PD deficiency, predisposition to folate deficiency
Suramin Trypanosomiasis (first stage, *T.b. rhodesiense* **infection**) (11.41)	***Powder for injection: 1 g in vial*** Slow IV injection: 3.3 mg/kg as single dose (after test dose) followed by weekly increments of 6.7 mg/kg, then 10 mg/kg, 13.3 mg/kg,16.7 mg/kg, 16.7 mg/kg in weeks 2 through 6, respectively	**Infrequent or rare:** Immediate and potentially fatal shock and unconsciousness; abdominal pain, diarrhoea, stomal ulceration, dermatitis, abscess, painful joints	**Pregnancy:** Uncertain safety in pregnancy; use, with caution, only if potential benefit is greater than risk (e.g. in trypanosomiasis). Breastfeeding: Unknown safety in breastfeeding; avoid if possible. **Contraindications:** Hypersensitivity; totally blind patients with onchocerciasis (unless they require relief from the intensely itchy lesions not relieved by safer alternative) **Use with caution:** In anaphylaxis, renal/hepatic impairment, total blindness, elderly

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Terbinafine	***Cream: 1% Ointment: 1% (hydrochloride)***	**Infrequent:** Occasional local irritation and hypersensitivity reactions include mild burning sensation, erythema, itching. If severe, treatment should be discontinued.	**Use with caution:** Avoid contact with eyes and mucous membranes.
Dermatophytosis (ringworm) (10.2.7)	Apply thinly 1–2 times daily for up to 1 week (tinea pedis), 1–2 weeks (tinea corporis and tinea cruris)		
Cutaneous candidiasis (10.2.9, 11.4); pityriasis versicolor (10.2.7)	Apply thinly 1–2 times daily for up to 2 weeks		
Tetracaine (amethocaine) eye drops	***Drops: 0.5% (hydrochloride)***	**Common:** Burning, stinging, redness Infrequent or rare; allergic reactions	**Contraindications:** Hypersensitivity to ester-type local anaesthetics; eye inflammation or infection. **Use with caution:** Avoid prolonged use (risk of severe keratitis, permanent corneal opacification, scarring, delayed corneal healing). Protect eye from dust and bacterial contamination until sensation is fully restored. Never give patients anaesthetic drops to take home.
Short-acting local anaesthesia of the cornea and conjunctiva	Instill 1 drop		
Tetracycline	***Tablet: 500 mg***	**Common:** Nausea/vomiting, diarrhoea, increased BUN, phototoxicity, rash, increased intracranial pressure, discoloration of teeth/ enamel hypoplasia (young children), antibiotic-associated colitis, hypersensitivity reaction **Infrequent or rare:** Hepatotoxicity, burning or stinging	**Pregnancy:** Contraindicated after week 8 due to effects on fetal bone growth and dental discolouration; short courses can be used if alternative not appropriate; implicated in causing maternal hepatotoxicity, especially in third trimester (dose-related) **Breastfeeding:** Uncertain safety; avoid if possible. **Contraindications:** Tetracycline hypersensitivity. **Use with caution:** In renal or hepatic impairment
Cholera (10.7d.2)	Oral: 500 mg 4 times daily for 3 days		
Acne (10.2.3)	Oral: 250–500 mg twice daily		
Late latent syphilis, syphilis of undetermined duration, and late syphilis (11.37)	Oral: 500 mg 4 times daily for 30 days		
Syphilis with penicillin allergy in non-pregnant patient (11.37)	Oral: 500 mg 4 times daily for 15 days		

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Tetracycline eye ointment Cobra spit (3.9); bacterial conjunctivitis; corneal erosion (10.12.2) Trachoma, continuous intensive treatment (10.12.5)	***Ointment: 1% (hydrochloride)*** Apply directly to the eye, 1 application 3–4 times daily Apply directly to the eye, 1 application of ointment in each eye twice daily for at least 6 weeks.	**Infrequent or rare:** Rash; stinging, burning. No reports of tooth discoloration at usual topical doses	**Contraindications:** Hypersensitivity to tetracycline group of antibiotics **Use with caution:** Prolonged use may lead to overgrowth of non-susceptible organisms.
Thiamine Chronic thiamine deficiency (as may occur in alcohol abuse and dependence) (3.5) Ethylene glycol poisoning (3.8.1) Persistent vomiting in pregnancy >2 weeks (14.1.11)	***Tablet: 50 mg Injection (vitamin B1) (hydrochloride)*** IM/IV: 100 mg daily for 5 days THEN switch to oral 100 mg daily IM/IV: 100 mg every 8 hours for 6 doses Oral: 100 mg daily- until persistent vomiting stops	Toxic effects are unlikely since any excess thiamine is excreted. **Infrequent or rare:** Anaphylaxis	**Pregnancy/breastfeeding:** Severely thiamine-deficient mothers should avoid breastfeeding. **Administration:** If IV, infuse over 30 minutes.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Tranexamic acid (TXA) Trauma patients with ongoing significant haemorrhage or at risk of significant haemorrhage, within 3-4 hours (4.2)	***Injection, solution: 100 mg/ml (10 ml)*** IV: loading dose of 1 g over 10 minutes THEN infusion of 1 g over 8 hours.	**Common:** Nausea/vomiting, diarrhoea, allergic skin reactions. Rapid intravenous injection may cause dizziness and/or hypotension. To avoid this response, the solution should not be injected more rapidly than 1 ml per minute. **Infrequent or rare:** Thromboembolic events, disturbances in colour vision (discontinue)	**Pregnancy:** TXA has been used in pregnancy and no harmful effects have been reported. In the CRASH-2 trial, pregnancy was not an exclusion criteria. Weigh the potential risks and benefits for each woman. **Breastfeeding:** Very small amounts pass into breast milk; an antifibrinolytic effect in the infant is unlikely. **Contraindications:** History of thromboembolic disease **Administration:** As early as possible, within 3–4 hours of injury. Reduce injection dose in patients with renal insufficiency. TXA solution for injection should not be mixed with blood for transfusion or with infusion solutions containing penicillin or mannitol.
Tretinoin Severe acne (10.2.3)	***Gel: tretinoin 0.01% (tretinoin is the acid form of vitamin A)*** Apply thinly 1–2 times daily. Several months of treatment may be needed to achieve optimal response. Treatment should continue until no new lesions develop in 2 weeks.	**Common:** Local reactions include burning, erythema, stinging, pruritus, dry or peeling skin (discontinue if severe). Increased sensitivity to UVB light or sunlight; temporary changes of skin pigmentation reported **Infrequent or rare:** Eye irritation and oedema, blistering or crusting of skin	**Pregnancy:** Topical retinoids contraindicated in pregnancy; women of child-bearing age must use effective contraception (oral progestogen-only contraceptives not considered sufficiently effective). **Use with caution:** Topical retinoids should be avoided in severe acne involving large areas. Avoid contact with eyes, nostrils, mouth, mucous membranes; eczematous, broken, or sunburned skin. Avoid exposure to UV light (including sunlight, solariums). If sun exposure is unavoidable, an appropriate sunscreen or protective clothing should be used. Avoid use of retinoids with abrasive cleaners, comedogenic or astringent cosmetics. Allow peeling (e.g. resulting from use of benzoyl peroxide) to subside before using a topical retinoid. **Counselling:** Some redness and skin peeling may occur initially but settles with time.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Triclabendazole Fascioliasis (11.11)	***Tablet: 250 mg*** Oral: 10 mg/kg in a single dose In treatment failure re-administer 10 mg/kg, THEN follow by another dose 12–24 hours later (giving a total dose of 20 mg/kg)	**Common:** Nausea, vomiting, diarrhoea, headache, biliary colic due to obstructing worms	**Use with caution:** In severe fascioliasis, biliary colic can occur due to obstruction by dying worms.
Urea Hydrating agent and keratolytic for dry, scaling, and itching skin conditions, including mild psoriasis, xeroderma (10.2)	***Cream or ointment: 5%, 10%*** Apply directly to affected area twice daily, preferably to damp skin.	**Common:** Transient stinging and local irritation	**Use with caution:** Avoid application to face or broken skin; avoid contact with eyes.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Valproic acid (sodium valproate) Epilepsy (10.10c) Mood stabilization in bipolar disorder, acute mania (10.11.5)	***Tablet: 200 mg, 500 mg*** ***Liquid: 200 mg/ml*** Oral: Initiate at 400 mg daily; increase by 200 mg daily to maximum of 2 g daily in divided doses. Oral: Initiate at 500 mg at night; gradually increase by 200 mg every 7 days until response; typical dose: 1–2 g daily In elderly or medically ill patients incuding HIV stage 3 or 4: initiate at 200 mg in morning and at night. Increase dose 200 mg every 7 days until clinical response. See 10.11.5	**Common:** Nausea, gastric irritation, diarrhoea, increased appetite; weight gain; ataxia, tremor; paraesthesia, drowsiness: elevated liver transaminases, hyperammonaemia **Infrequent or rare:** Hepatotoxicity (can be fatal), pancreatitis, hyponatraemia from drinking excess fluid; blood dyscrasias (anaemia, leukopenia, pancytopenia, thrombocytopenia); severe allergic reaction (including toxic epidermal necrolysis, Stevens-Johnson syndrome). Transient hair loss (regrowth may be curly); increased alertness, aggression, hyperactivity, behavioural disturbances, vasculitis; lethargy, drowsiness, confusion, stupor, hallucinations, menstrual disturbances, hearing loss, rash; peripheral oedema, increase in bleeding time, extrapyramidal symptoms, dementia, encephalopathy, coma, gynaecomastia, Fanconi's syndrome, hirsutism, acne, enuresis, hyponatraemia. **Withdraw treatment immediately if persistent vomiting and abdominal pain, anorexia, jaundice, oedema, malaise, drowsiness, loss of seizure control.**	**Pregnancy:** Risk of teratogenicity; use only if benefit is greater than risk; consider folic acid supplementation 5 mg/day and vitamin K supplementation. **Breastfeeding:** May be used in breastfeeding. Small amounts excreted in breast milk; use minimum effective dose and monitor infant for adverse effects (e.g. jaundice). **Use with caution:** Monitor coagulation studies and liver function tests regularly during therapy. Prone to multiple drug interactions through CYP enzymes; check for interactions with all new and current medications. Elderly: See cautions in Section 10.11.5. **Administration:** Do not use for alcohol withdrawal. **Counselling:** Take with food to reduce stomach upset. Your appetite may increase when taking this medicines; pay attention to your diet to avoid weight gain. This medication may impair your ability to perform hazardous activities requiring mental alertness. Tell your clinician immediately if fever, rash, abdominal pain, vomiting, yellow eyes or urine, bruising, or bleeding develops. Do not stop taking this medicine suddenly unless advised by your doctor.

Drug Indication	*Formulations Dosage*	Adverse effects	Special groups/comments
Vitamin B12 (hydroxocobalamin) Pernicious anaemia and other macrocytic anaemia without neurological involvement Pernicious anaemia and other macrocytic anaemias with neurological involvement Prophylaxis and treatment of other macrocytic anaemias due to vitamin B12 deficiency	***Intramuscular anhydrous hydroxo-cobalamin 1 mg/ml*** IM: 1 mg 2–4 times weekly for 2 weeks; then 1 mg every 3 months. IM: 1 mg on alternate days until no further improvement; then 1 mg every 2 months IM: 1 mg IM every 2–3 months	**Infrequent or rare:** Nausea, headache, dizziness; fever, hypersensitivity reactions including rash and pruritus, anaphylaxis; injection-site pain; hypokalaemia during initial treatment	**Pregnancy:** Safe, but megaloblastic anaemia of pregnancy is usually due to folate deficiency and should be treated with folate plus vitamin B12. **Breastfeeding:** Safe to use Contraindications: Sensitivity to B12 (hydroxocobalamin). **Use with caution:** Establish which deficiency is present – vitamin B12 or folate – with a marrow examination and treat the underlying cause. Always give B12 with folic acid in pernicious anaemia; folic acid given alone can precipitate neuropathy if there is underlying unrecognized vitamin B12 deficiency. Cardiac arrhythmias secondary to hypokalaemia have been reported during initial therapy; therefore, potassium should be monitored during this period. **Administration: Do not give by IV injection**. Store below 25 °C; protect from light.
Vitamin K (phytomenadion) Rodenticide poisoning (3.8.1) with no bleeding but prolonged INR Warfarin therapy (3.8.1) with INR > 9.0 but no bleeding Rodenticide poisoning or warfarin therapy (3.8.1) with severe haemorrhage	***Injection: 10 mg/ml in 5 ml ampoule Tablet: 10 mg*** Oral: 10–20 mg; may need to continue for weeks if long-acting anticoagulant rodenticide Oral: 2.5–5 mg IV: 10 mg	**Common:** Pain, tenderness, erythema at IM site **Infrequent or rare:** Hypersensitivity reactions	**Pregnancy:** Use only if benefit is greater than risk. **Breastfeeding:** May be used short-term; caution if chronic dosing required **Use with caution:** In elderly and hepatic impairment **Administration:** IV vitamin K should be given slowly over 20 minutes. Note: Vitamin K is not an antidote to heparin.

Index to syndromes, diseases, conditions (in both Volumes 1 and 2)

To find the indications and Section locations of specific medicines, as well as dosing, adverse effects, use in pregnancy/breastfeeding, contraindications, cautions, administration details, and patient counselling, see Section 8.4.

The Quick Check and Emergency Treatments (Section 2) is referenced as QC followed by the page number. With this exception, the subsections are provided below.

Abbreviations, acronyms for both Volumes 1 and 2

/r	boosted with ritonavir
3TC	lamivudine
ABC	abacavir
ACE	angiotensin-converting enzyme
ACT	artemisinin-based combination therapy
AFB	acid-fast bacillus
AIDS	acquired immune deficiency syndrome
AKI	acute kidney injury
ALI	acute lung injury
ALT	alanine aminotransferase
ANC	antenatal care
ARD	acute respiratory diseases
ART	antiretroviral therapy
ARV	antiretroviral
AST	aspartate aminotransferase
ATS	amphetamine-type stimulants
ATV	atazanavir
AVPU	alert, voice, pain, unresponsive
AZT	azidothymidine (zidovudine)
BMI	body mass index
BP	blood pressure
BPM	beats per minute (pulse)
BUN	blood urea nitrogen
BVM	bag valve mask
C&S	culture and sensitivity
Ca	Calcium
CBT	cognitive behavioural therapy
CD4	count of the lymphocytes with a CD4 surface marker per cubic millimetre of blood (mm^3)
CHF	congestive heart failure
CIN	cervical intraepithelial neoplasia
CKD	chronic kidney disease
CMV	cytomegalovirus
CNS	central nervous system
COPD	chronic obstructive pulmonary disease
CPK	creatine phosphokinase
CPT	cotrimoxazole prophylaxis (cotrimoxazole preventive therapy)
CrAg	cryptococcal antigen
CrCl	creatinine clearance
CRP	C-reactive protein
CSF	cerebral spinal fluid
CT	computed tomography
CVA	cerebrovascular accident
d4T	stavudine
DBS	dried blood spot
ddI	didanosine
DDx	differential diagnosis
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
DOTS	directly observed therapy short course
DR TB	drug-resistant tuberculosis
DS	double strength
DST	drug-susceptibility testing
DTP	diphtheria-tetanus-pertussis vaccine
DVT	deep vein thrombosis
E	ethambutol
EBV	Epstein-Barr virus
ECG	electrocardiogram
EEG	electroencephalogram
EFV	efavirenz

ELISA	enzyme-linked immunosorbent assay
EPTB	extrapulmonary tuberculosis
ESR	erythrocyte sedimentation rate
ETAT	emergency triage assessment and treatment
Eto	ethionamide
FAST	focused assessment of sonography in trauma (ultrasound exam)
FBC	full blood count (also known as CBC)
FDC	fixed dose combination
FEV1	forced expiratory volume in one second
FFP	fresh frozen plasma
FNA	fine needle aspiration
FTA-ABS	fluorescent treponemal antibody absorption test
FTC	emitricatabine
FVC	forced vital capacity
G6PD	glucose 6 phosphate dehydrogenase
GCS	Glasgow coma scale
GERD	gastroesophogeal reflux disease
GFR	glomerular filtration rate
GI	gastrointestinal
GU	genitourinary (system or urogenital system)
H	isoniazid
Hb	haemoglobin
HBsAg	hepatitis B surface antigen
HBV	hepatitis B virus
Hct	haematocrit
HCV	hepatitis C virus
HDL	high density lipoprotein
HELLP	haemolysis, elevated liver enzymes & low platelets
HIV	human immunodeficiency virus
HIVAN	HIV-associated nephropathy
HONK	hyperosmolar non-ketotic coma
HPV	human papillomavirus
HR	heart rate
HSV	herpes simplex virus
HTC	HIV testing and counselling
HZ	herpes zoster
IC	infection control
IDU	injecting drug user
IDV	idinavir
IgA	immunoglobulin A
IgG	immunoglobulin G
IgM	immunoglobulin M
IM	intramuscular
IMAI	Integrated Management of Adolescent and Adult Illness
IMCI	Integrated Management of Childhood Illness
IMEESC	Integrated Management of Emergency and Essential Surgical Care
IMPAC	Integrated Management of Pregnancy and Childbirth
INH	isoniazid
INR	international normalized ratio (to express prothrombin time)
IPC	infection prevention and control
IPT	isoniazid preventive therapy
IPTp	intermittent preventive therapy (for malaria in pregnant women)
IRIS	immune reconstitution inflammatory syndrome
ITP	idiopathic thrombocytopenic purpura
IU	international unit
IUD	intrauterine device
IV	intravenous

JVP	jugular venous pressure
K	potassium
Kcal	kilocalorie
KCL	potassium chloride
KJ	kilojoule
KOH	potassium hydroxide
LAM	lactational amenorrhea
LDH	lactate dehydrogenase
LDL	low density lipoprotein
LEEP	loop electrosurgical excision procedure
LFT	liver function tests
LGV	lymphogranuloma venereum
LMN	lower motor neuron
LMP	last menstrual period
LP	lumbar puncture
LPV/r	lopinavir boosted with ritonavir
LR	lactated ringers solution
MAC	*Mycobacterium avium* complex
MCH	maternal and child health
MCPC	Managing Complications in Pregnancy and Childbirth
MDI	metered-dose inhaler
MDR TB	multi-drug resistant tuberculosis
MDT	multiple drug therapy
mEq	milliequivalents
Mg	magnesium
MNCH	maternal, newborn, and child health
MRI	magnetic resonance imaging
MRSA	methicillin-resistant *Staphylococcus aureus*
MSM	men who have sex with men
MTCT	mother-to-child transmission
MUAC	mid upper arm circumference
Na	sodium
NaCl	sodium chloride
NFV	nelfinavir
NG	nasogastric
NNRTI	non-nucleoside reverse transcriptase inhibitor
NPO	Nil per os (nothing through the mouth or nil by mouth)
NRTI	nucleoside reverse transcriptase inhibitor
NS	normal saline
NSAID	nonsteroidal anti-inflammatory drug
NTD	neglected tropical diseases
NtRTI	nucleotide reverse transcriptase inhibitor
NVP	nevirapine
OI	opportunistic infection
ORS	oral rehydration salts
OST	opioid substitution treatment
PAS	para-aminosalycilic acid (4-aminosalycilic acid)
PBS	peripheral blood smear
PCP	*Pneumocystis jirovecii* pneumonia
PCPNC	Pregnancy, childbirth, postpartum, and newborn care
PCR	polymerase chain reaction
PEFR	peak expiratory flow rate
PEP	post exposure prophylaxis
PI	protease inhibitor
PID	pelvic inflammatory disease
PITC	provider-initiated testing and counselling
PLHIV	people living with HIV
PML	progressive multifocal leukoencephalopathy
PMN	polymorphonuclear neutrophils

PMTCT	prevention of mother-to-child transmission
PO	per os (by mouth)
PPE	personal protection equipment
PPH	post-partum haemorrhage
PR	per rectum
PRBC	packed red blood cells
PT	prothrombin time
PTB	pulmonary tuberculosis
PTSD	post- traumatic stress disorder
PTT	partial thromboplastin time
PUD	peptic ulcer disease
PV	per vaginal
QC	Quick Check (Section 2)
R	rifampicin
RAPD	relative afferent pupillary defect
RBC	red blood cells
RDT	rapid diagnostic test
RPR	rapid plasma reagin (a syphilis test)
RR	respiratory rate
RTV	ritonivir
Rx	treatment
S	streptomycin
SAAG	serum-to-ascites albumin gradient
SARS	severe acute respiratory syndrome
SBP	spontaneous bacterial peritonitis
SC	subcutaneous
SCJ	squamocolumnar junction
sd-NVP	single-dose nevirapine
SIADH	syndrome of inappropriate ADH (antidiuretic hormone) secretion
SJS	Stevens-Johnson syndrome
SLE	systemic lupus erythematosis
SMX	sulfamethoxazole
SP	sulphadoxine-pyrimethamine
SpO_2	oxygen saturation
spp	species
SQV	saquinavir
SS	single strength
SSRI	selective serotonin reuptake inhibitors
STB	Stop TB
STI	sexually transmitted infection
T	temperature
TB	tuberculosis
TBSA	total body surface area
TCA	tricylic anti-depressants
Td	tetanus-diphtheria toxoid adult vaccine
TDF	tenofivir
TEN	toxic epidermal necrosis
TIG	tetanus immune globulin
TMP	trimethoprim
TMP-SMX	trimethoprim- sulfamethoxazole (cotrimoxazole)
TPHA	treponema pallidum haemagglutanation assay
TSH	thyroid stimulating hormone
TST	tuberculin skin test
TT	tetanus toxoid
TTP	thrombotic thrombocytopenic purpura
UMN	upper motor neuron
UO	urinary output
UTI	urinary tract infection
VDRL	venereal disease research laboratory- a syphilis test
VIA	visual inspection with ascetic acid
VL	viral load

VLDL	very low density lipoproteins
VT	ventricular tachycardia
VZV	varicella zoster virus
WBC	white blood cell count
WHO	World Health Organization
W/W	weight of solute/weight of solution
XDR TB	extensively drug resistant tuberculosis
Z	pyrazinamide
ZDV	zidovudine (also azidothymidine - AZT)

Writers and reviewers, Volume 1, and process of development, Volumes 1 and 2

Overall clinical editing and writing of Volume 1 of the *IMAI District Clinician Manual*

Sandy Gove (WHO HIV/AIDS – IMAI team leader), Kirsty McHarry (U KwaZulu-Natal Centre for Rural Health, South Africa), Hillary Cohen (Maimonides Medical Center, NY, USA), Neeri Moodley (U KwaZulu-Natal Centre for Rural Health, South Africa), Ed Zuroweste (Migrant Clinicians Network, USA), Janet Diaz (WHO GIP consultant and UCSF/SFGH, USA), Matthew Chersich (Centre for Health Policy, U Witwatersrand, South Africa), and
Shevin Jacob (U Washington).

Editors: Sarah Johnson, Emily Tuthill, John Liddy, Sandra Woods, Ward Rinehart, Cynthia Bloomquist

Overall development of the manual was coordinated at WHO on the IMAI team by Fareed Ramzi Asfour (2005–2006), Kirsty McHarry (2006–2009), Sandy Gove (2009–publication), and Neeri Moodley (2009–2011). Other writers contributing to specific sections are indicated in bold in the lists at the end of this section.

Process for development of the *IMAI District Clinician Manual*, Volumes 1 & 2

The implementation of many clinical interventions for public health at the The implementation of many clinical interventions for public health at the primary care level requires district hospital clinicians who are able to manage uncomplicated and complicated cases, patients who fail initial empirical treatment interventions, and patients with severe illness requiring urgent treatment and inpatient care. Therefore, a manual outlining the key steps for this clinical management can make an important contribution to improving the quality of care in a district network and thus strengthening the health system.

The WHO *IMAI District Clinician Manual* is a how-to manual addressed to the district clinician, who may be a doctor, clinical officer, senior nurse, or other senior health worker at a district hospital in a limited-resource setting. The manual covers adolescents from 10 years of age and adults through to old age and death. It consists of simplified, operationalized prevention and treatment recommendations for the primary care of patients on initial presentation to a district-level facility. The manual assumes that district hospitals in resource-limited settings have general multipurpose practitioners such as a medical or clinical officer but do not have specialist clinicians such as an internist, paediatrician, or psychiatrist (although it may be possible to consult with one).

This manual is divided into two volumes, each comprising a number of sections. This, the first Volume, covers emergency triage assessment and treatment, and acute care for a severely ill or acutely injured patient within approximately the first 24 hours of care. This Volume also describes the clinical procedures commonly applied in this care and gives a summary of drugs used and the steps necessary for infection control. The companion Volume 2 provides a symptom-based approach

to clinical care for acute and subacute conditions (including mental health) and to the chronic or long-term care of HIV, TB, and alcohol and substance use disorders.

Within the manual operationalized guidelines are provided for second-level outpatient and inpatient care of severely ill or complicated patients as well as for primary care of uncomplicated patients. The primary care guidelines for the outpatient care of uncomplicated patients are consistent with the IMAI first-level facility guideline modules for chronic HIV care with ART and prevention, acute care, palliative care (symptom management and end-of-life care), MDR and TB-HIV co-management, as well as the IMPAC PCPNC and mhGAP guidelines. In addition to clinical guidelines, the manual emphasizes the district clinician's role in the district as clinical mentor and supervisor to nurse-led clinical teams at the health centre level.

Development of the manual

The development of each Section has been overseen by WHO, with input from expert subgroups. The work for each Section was a collaborative effort between the IMAI team and each applicable WHO department, as part of joint and ongoing activities between IMAI and these departments. Many recommendations in the manual are based on WHO normative guidelines developed by various WHO departments and disease control programmes, and they support their disease-control strategies. These include HIV/AIDS, Stop TB, Global Malaria Programme, Neglected Tropical Diseases, Mental Health Gap (mhGAP), RHR STI and cervical cancer guidelines, IMEESC, IMPAC, Global Influenza Programme (GIP), Global Alert Response (GAR), and others. Where WHO guidelines do not yet exist or are outdated, a review of evidence was conducted.

Experts in the subgroups (each subgroup addressed a particular content area) were chosen based on their experience in providing or organizing clinical care in resource-limited settings and their up-to-date knowledge of both the relevant literature and the public health approach to delivering HIV, TB, and other adult medical services through strengthened district networks. Most external experts are either global content experts from academic institutions or active clinicians with in-depth expertise in their content areas. Selection of experts was also based on recommendations from collaborating WHO departments and the academic publications of experts, especially aiming to identify those who have experience with supporting implementation of services at district hospitals and health centres in countries with high HIV and TB burdens. Experts were drawn from all WHO regions. Preference was given to those familiar with the realities of working with a limited drug formulary and with limited laboratory and equipment at the district hospital level in limited-resource settings.

The subgroups also include WHO medical officers. Moreover, the manual reflects a broader collaboration of medical and technical officers from multiple WHO Departments, themselves advised by expert groups, who contributed their updated normative guidelines and operational tools.

Whenever possible, the expert subgroups simplified and operationalized existing evidence-based WHO normative guidelines. Treatment recommendations are consistent with the WHO Formulary unless superseded by more up-to-date WHO guidelines or evidence. The relevant WHO normative guidelines are listed in footnotes in each Section, including, where available, an indication of when these will next be revised.

Drafts of the sections were developed in the following manner: Writers from the expert subgroups, WHO medical officers, or consultants produced first drafts of each Section. Wherever available, they based the Sections on WHO guidelines from various departments. When evidence-based WHO guidelines had not yet been developed, they added to these initial drafts on the basis of evidence and expert consensus. These drafts were then circulated for peer review and comment, revised, and then circulated again. This iterative improvement entailed multiple cycles of review and discussion for each Section. Each Section was sent for review to the relevant WHO departments, while the general reviewers reviewed all sections. Each Section thus reflects evidence reviews of the literature combined with practical experience and/or constitutes operationalized derivatives of WHO evidence-based normative guidelines, which themselves often have been developed to reflect a public health and clinical care approach feasible in limited-resource settings.

Expert subgroups also contributed to the evidence reviews, suggested best practice approaches, discussed drafts, reached consensus through discussion in meetings and by email, and assisted in preparing draft sections for field-testing and with the field-testing itself. The core group members identified other experts for consultation when necessary.

For many of the conditions considered, there was a lack of evidence from limited-resource settings with limited diagnostic capabilities; thus, evidence reviews often identified evidence predominantly from developed-country settings. Although this is indirect evidence, it was used to inform decisions, while taking into account the experts' extensive clinical and programme experience that suggested modifications based on feasibility, cost, and other resource considerations.

Two initial developmental meetings were held in Geneva, in March and October 2006.

Development of specific sections in Volume 1

Section 2 (Quick Check and emergency treatments) was developed to be compatible with the existing emergency triage assessment and treatment guidelines for paediatrics (ETAT), for pregnant women (from IMPAC PCPNC), and for adults (from IMAI Acute Care). Section 3, Approach to the severely ill patient, draws on WHO formulary recommendations, the evidence review described below, and input from the emergency, pulmonary, and sepsis expert subgroups. The WHO departments of HIV/AIDS (IMAI team), GAR, and GIP initially constituted these as separate subgroups but then combined them to work together, as the WHO Working Group on Critical Care in Limited-Resource Settings, to develop the emergency guidance on management of septic shock and severe respiratory distress (and other severe illnesses). In 2009 expert meetings were held in March (Geneva, Switzerland), April (Addis Ababa, Ethiopia), June (Geneva), and September (Florence, Italy). This Group was composed of highly qualified professionals who have expertise and experience in the areas of pneumonia, acute lung injury, septic shock, influenza, and the treatment of critically ill patients in general. The recommendations provide both guidance to countries experiencing outbreaks of febrile disease causing critical illness (including, but not limited to, pandemic influenza) where local resources are not able to provide mechanical ventilation for medical patients and the full spectrum of «ICU-level care» and guidance for the management of patients severely ill from HIV/AIDS, TB, severe malaria, maternal sepsis, dengue, and other endemic diseases. On an emergency basis, an extract of these guidelines for management of severe complications of influenza H1N1 was released.

The mental health recommendations in Section 3 (and Section 10.11) were developed by an expert group that originally met during the March and December 2006 second-level learning programme meetings in Geneva and then shared drafts and references by email and teleconferences. Several members of the expert subgroup met in November 2008 to finish the Section and to review the mental health content of all other sections. In view of the limited evidence in this field from resource-limited settings and the often relatively neglected mental health and psychiatric services in many developing country settings, the Section was written using evidence from resource-rich countries, with adaptations to developing country settings. To ensure that the recommendations are feasible, the Section was further reviewed and adapted by psychiatrists and psychologists who have significant expertise in adapting mental health interventions to developing country settings. The WHO mhGap GRADE reviews were completed in late 2009, and all recommendations on mental health, neurology, and substance use in the Manual were then made fully compatible with the mhGAP recommendations.

Various treatment recommendations in the Quick Check, Section 3.10 Burns, Section 4 Trauma (management of the acutely injured patient) were adapted from *Surgical care at the district hospital (SCDH)* (WHO, 2003), with updates based on the expert meeting in Addis Ababa in April 2009 (convened collaboratively by the IMAI and IMEESC teams). These sections then underwent the evidence check detailed below.

Review of Section 3.8, on poisoning, was organized by the WHO International Programme on Chemical Safety, Evidence & Policy on Environmental Health (EPE). A panel of clinical toxicologists reviewed the first draft by email. The revised draft was submitted to an evidence check as described below. The management recommendations for specific substances, together with the outcomes of the evidence check, were then distributed to individual clinical toxicologists to check for completeness and to comment on questions raised by the evidence check. The outcome of this process was tabulated and reviewed once again by a guideline panel of clinical toxicologists convened by EPE in July 2010 in Edinburgh, Scotland.

Process of evidence check

In 2009–2010 an additional check of the evidence was carried out based on a protocol agreed with the WHO Guideline Review Committee for each treatment recommendation in the manual, unless these recommendations came from a current WHO guideline. A team of reviewers was contracted to perform these evidence reviews. The process was used as an opportunity to build capacity in evidence-based medicine; thus, a considerable portion of the evidence reviews were done by reviewers from Ethiopia and South Africa. A two-week training course was held in Addis Ababa in 2009 on the review protocol and topics such as assessing the quality of evidence and data extraction.

The evidence check process aimed to be fully transparent and replicable. Thus, several steps were taken to enhance standardization of the processes used by the review team. These included use of a protocol outlining the pre-specified review methods and having an overall coordinator responsible for overseeing the evidence review (Matthew Chersich, assisted by Janet Diaz). Each step, including the listing of treatment recommendations, searches made, and the results of evidence identification and evidence retrieval, was stipulated in the evidence review protocol.

Details of each search strategy were documented in an evidence review log, together with the date that the final search was done and the evidence located

for each recommendation. Review questions were formulated as an "answerable review question", containing the components of the PICO acronym: the target population (P), the intervention (I), the intervention it is compared with (C), and the outcome of interest (O). The full detailed evidence summary logs are posted on the IMAI EZcollab site and are available to the public on request. The outputs from the evidence review will also be used to inform adaptation of the manual to the circumstances in different countries. Evidence retrieval addressed only treatment recommendations and not prevention or counselling messages. Economic evaluations were not systematically reviewed.

The WHO Library & Information Networks for Knowledge Database (WHOLIS, http://dosei.who.int) was searched to locate existing WHO normative or policy recommendations; these were assessed to determine if they were current and valid guidelines and their state of revision. The reviewer then assessed whether recommendations in the IMAI manual were fully consistent with recommendations in current WHO guidelines. For some topics WHO guidelines have recently been developed and cover all the treatment recommendations within a Section of the IMAI manual. In these instances – after cross-checking that all treatment recommendations in the Manual Section are consistent with the WHO guideline – no evidence summaries were made. The WHO Model Formulary (http://apps.who.int/emlib/Medicines.aspx?Language=EN) was searched for all treatment recommendations that involve administration of drug therapy. Treatment recommendations located in the WHO Model Formulary were checked for consistency with the manual and other evidence, and the reviewer documented this in the evidence log. If drugs are mentioned in the IMAI manual and not included in the WHO Formulary, then evidence for their effectiveness was sought, as with all other interventions. These drugs are in italics in Section 8 Medicines/therapies.

When no WHO guidelines currently address a treatment recommendation in the manual, selected national-level authorities were searched. These authorities were chosen because they develop guidelines using clearly documented methodology, including conducting systematic reviews. The sources searched were: the UK National Institute for Clinical Excellence (NICE, http://guidance.nice.org.uk), the Scottish Intercollegiate Guidelines Network (SIGN, http://www.sign.ac.uk), and the US AIDSInfo Clinical Guidelines Portal (http://www.aidsinfo.nih.gov/guidelines). Some of these authorities make use of the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system in developing their guidelines. When a treatment recommendation was located in a national authority guideline, a reviewer determined whether the national-level guideline is consistent with the WHO treatment recommendation and extracted information from the guideline to complete the evidence log form.

If the intervention and population in the district clinician manual recommendation were not located in a national-level guideline, then evidence-based medicine sources were searched, provided they use acceptable systematic methods: namely, British Medical Journal Clinical Evidence (http://clinicalevidence.bmj.com), the Cochrane Collaboration (http://www.thecochranelibrary.org), and the Database of Abstracts of Reviews of Effects (http://www.crd.york.ac.uk/CRDWeb), which systematically identifies and assesses the quality of systematic reviews. UpToDate (http://www.utdol.com) was searched only if no systematic reviews were identified in the other sources. As the next step in the hierarchical system, a reviewer searched for systematic reviews of evidence in the MEDLINE database, using the PubMed interface. A search strategy was developed using a validated search filter for systematic reviews. An evidence summary of systematic review findings was made, as applicable. Where independent systematic reviews were

not located, randomized controlled trials were sought on MEDLINE and, if located, summarized in a table in the evidence logs.

Once the evidence summaries were completed for a Section, the evidence review team then searched the log forms to identify the new WHO recommendations in the manual and instances where the evidence check showed a discrepancy between new WHO recommendations and recommendations in the manual. WHO then organized small, unconflicted guideline panels to consider each of these new or discrepant recommendations. Members of these final unconflicted guideline panels are included in the related expert groups in the table of expert writers and reviewers, below, with a superscript designating the guideline panel they participated in. Reports can be found on the EZcollab site under "Y expert panel report."

These panellists assessed the evidence extracted from the evidence-based medicine sources or primary evidence located by the review and considered the overall balance of risks and benefits (including such considerations as feasibility, resource constraints, and diversity of values and preferences). Each guideline panel then decided if the evidence review findings were applicable – most importantly, the *directness (or external validity)* of the evidence with respect to the populations, the interventions, and the settings where the proposed intervention will be used. For example, the panels considered whether the recommendation required modification to limited-resource settings, based on the level of technology available in these settings. When review findings were not directly applicable to limited-resource settings, the experts had to decide whether this *indirectness* introduced important uncertainty as to whether the effectiveness of an intervention is likely to differ according to setting. It was necessary, at times, to modify recommendations based on appropriate technology use in limited-resource settings, as the diagnostic process and treatment protocols in this manual assume that only the minimum essential laboratory tests are available. Through consensus techniques, the expert panels agreed whether the recommendation required modification to make it relevant and feasible in resource-constrained settings or to leave the recommendation unchanged if the difference with the evidence check was due to resource implications of alternative recommendations, which may include health system implications, such as training and supervision requirements, referral support, equipment and infrastructure requirements.

Because the recommendations for septic shock, severe pneumonia, and acute pulmonary oedema might be used in caring for adult patients whose conditions reflect different etiologies, (e.g. maternal sepsis, disseminated TB, severe malaria, severe influenza, and dengue), the appropriateness of the recommendations for these conditions was reviewed against current WHO condition-specific guidelines (for TB, dengue, and malaria). In addition, two guideline panels discussed their appropriateness for pregnant or postpartum patients and those with severe malaria.

Field-testing of the manual

Field-testing of the entire draft manual was carried out with representatives of the intended audience in 6 countries – Uganda, Rwanda, Ethiopia, India, Zambia, and Tanzania – in 2009–2010, in parallel with the evidence check. Field-testing provided valuable feedback on feasibility and utility of the manual and on district clinicians' preferences, as well as practical suggestions to improve the relevance and presentation of the manual. The Quick Check and the guidelines on severe respiratory distress and septic shock were field-tested with a training course in

Uganda, Rwanda, Ethiopia, and Malawi in the same period. A second field test was conducted in the same 6 countries after the district clinicians had used the manual for more than a year. Over the course of field-testing, a detailed survey in Survey Monkey and focus group discussions provided specific information on the usefulness and adaptability of the various Sections of the manual, based on district clinicians' use of the first version and then review of the new version.

Country and Principle Investigator in country for the field tests		District clinician representative at external review meeting	Completed second field test survery
Ethiopia	Ghion Tirsite Mengistu, WHO	Tekle Beyene Weldemeskel, Dibrhe Birhane Hospital	Seblewengel Eshetu, Daniel Zewde, Zemen Hassen, Merid Mersha
India	John Stephen, St. John's Medical College	Preethy Harrison, Snehadaan Hospital	Preethy Harrison, Prathana, Sr. Anies, Rajendar Prasad
Rwanda	Ashwin Vasan, Chadi Cortas, Partners In Health	Chadi Cortas, Partners In Health	Vincent Cubaka, Alfred Rutagengwa, Rene Kabera, Michael Miller, Rogers Musafiri, Gabriel Kabilwa, Vedaste Nkurunziza, Theoneste Rubanzabigwi, Alain Uwumugambi, Issaka Biximana, Richard Bmark, Jean Dieudonnee Damascene, Maaike Flinkenflogel, Emile Karinganire, Jean Paul Kimenyi, Anaclet Mugali, Sebibibi Munyamaliza, Jean Bosco Ndacyaliho, Jean Paul De Charles Umurungi
Tanzania	Jan van den Homberg, Pharmaccess	Sixtus Assey, Turiani Hospital	
Uganda	Patrick Banura, Masaka Regional Hospital; Leah Thayer, Infectious Disease Institute, Makerere University	Patrick Banura, Masaka	Richard Kyakuwa, Edwig Namwanga, Resty Mukwaya, Justine Nakatumba
Zambia	Eleanor Turnbull, Stewart Reid, CIDRZ	Keith Mweebo, Ministry of Health	

Final steps in development of the manual

Modifications in format, flow, and clarity, based on the results of field-testing, further review suggestions by expanded expert subgroups, and internal WHO review after submission to the WHO Guideline Review Committee (GRC), and the decisions of the final guideline panels were incorporated into the manual Sections. The GRC chair and DGO referred the manual to an external review prior to its publication. The members of the external review group, which met 20–22 June 2011, are listed in the table below. Technical recommendations from this review were incorporated into the manual.

Plans for updates

It is important that this manual remains consistent with new WHO guidelines as these are updated or newly developed. Within 3 months of the revision or release of a relevant WHO normative guideline, an updated Section of the manual will be posted on the manual web site (IMAI second-level EZcollab web site). Revisions will also take into account further field-testing and experience from closely monitored

early use. The updated Sections of the IMAI manual will be incorporated into an annual revision of each Volume, which will be reprinted yearly. Before adapting the manual, users are advised to check for the most up-to-date Sections on the EZcollab site.

Declarations of interest

Declarations of interest were received from the contributors to Volume 1. Nine of the contributors declared an interest, two of which were relevant to the development of the *IMAI District Clinician Manual*. Drs Moore and Jacob had conflicts of interest related to the manual. They received funding from Pfizer™ through grants to their institutions for a research training programme for students and fellows and for a study of fluid resuscitation, PRISM-U2.

For those contributors with potential conflicts of interest, declarations are summarized below:
1. Dr Ortiz received a travel allowance from Merck to attend the American Thoracic award conference. 2. Dr Runyon received funds from Abbot Tanzania for developing an emergency department and a training programme at Muhimbili Hospital in Dar es Salaam. 3. Dr Molyneux received a 2–3 year grant for malaria research in Malawi from The Leverhulme Trust. 4. Dr Bukham received a grant for equipment from Sonosite Inc. 5. Dr Vuylsteke received a grant from iMDsoft Fukuda Denshi, a software developer, for research on application in a clinical environment. 6. Dr Cruz received honoraria for lectures from GSK, Mantecorp, LIBBS, Astrazencea, and Novartis and a further donation from Novartis for public work in a health facility and donations from Mantecorp, CHIESI, Novartis, and Ache for NGO work in Brazil. 7. Dr Dawson received funds from Wellcome Trust for capacity-building in the management of poisoning and for research on activated charcoal and gastric decontamination. All of the above were considered unconflicted.

Declarations of potential conflicts of interest were also received from all participants of the final expert review meeting. Dr David Cohn declared having received funds from NIAID and CDC for research on HIV and TB when employed by Denver Health Hospital Authority, from which he retired in 2011. His past participation in publicly funded research was not considered to constitute a conflict of interest. Dr Michael Runyon declared that his institution has been reimbursed by Abbott Fund Tanzania for his work on the development of and support to an emergency department at Muhimbili Hospital in Dar Es Salaam in the United Republic of Tanzania. He was considered unconflicted.

External Review Members

David Cohn, Chair University of Colorado School of Medicine, Denver, CO, USA	
Andrea Atzori,* Walter Inojosa, Gianpiero Pellizer, Bruno Turri, Vinicio Manfrin	Medici con l'Africa CUAMM, Padova, Italy
Yusuf Ahmed**	University Teaching Hospital, Lusaka, Zambia
John Saunders	Youth Substance Abuse Research, University of Queensland and Faculty of Medicine, Sydney Medical School, University of Sydney, Australia
Valérie D'Acremont,* Christoph Hatz, Johannes Blum, P. Kocher	Swiss Tropical and Public Health Institute, Basel
Rohini Fernadopulle	Department of Pharmacology and Pharmacy, Faculty of Medicine, University of Colombo, Sri Lanka
Concepta Merry**	Infectious Diseases Institute. Makerere University, Kampala, Uganda
Tewodros Haile Gebremariam	Axum St Mary Hospital, Axum, Ethiopia
Veronique Bortolotti	Consultant, sabbatical, Paris, France
Ramaiya Kaushik	Shree Hindu Mandal Hospital, Tanzania
Michael Runyon	Carolinas Medical Center, University of North Carolina, USA, and Muhimbili Hospital, Dar es Salaam, Tanzania
Abebaw Fekadu	Associate Professor, Dept of Psychiatry, College of Health Sciences, Addis Ababa University, and Consultant Psychiatrist, Amanuel Hospital
Tsitsi Magure	Cervical cancer screening research, University of Zimbabwe
Elizabeth Sentongo	Makerere University, College of Health Sciences, Kampala, Uganda
Abebaw Fekadu Wassie**	School of Medicine, Addis Ababa University, and Tikur Ambassa Hospital, Addis Ababa, Ethiopia

*Attended the meeting and represented other reviewers from same institution
**Attended by teleconference and emailed comments

Expert writers and reviewers for Volume 1

Superscript numbers refer to involvement in final guideline panels as shown below. Writers' names appear in boldface.		
1 Shock 2 Pulmonary 3 Trauma/surgery	5 Burns 6 Maternal 7 Malaria 8 Delirium	9 Seizures 10 Electrolyte abnormalities 11 Altered consciousness/diabetes 12 Poisoning

Critical care expert group

Emergency expert group	
Chris Curry	University of Western Australia
John Kennedy	New South Wales Medical Retrieval Services, Australia
Michael Runyon	Carolinas Medical Center, USA
Eric Walter, Eoin West	University of Washington, USA
Amalia Laborde	Universidade de la Republica, Uruguay
Walter Kloeck	Division of Emergency Medicine, University of Witwatersrand, South Africa
Mark Blaylock	Crusader Health, Ghana
Eric Simoes	University of Colorado, USA
Elizabeth Molyneux	Queen Elizabeth Hospital, Malawi
Ruth Suckling	Liverpool School of Tropical Medicine, UK
Justin Ortiz[2]	PATH, USA
Olive Chifefe Kobusingye	WHO AFRO
Gene Buckham	Partners In Health, Rwanda
Melanie Little	Northern Territory Health, Australia

Pulmonary expert group	
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Alvaro Cruz	Universidade Federal da Bahia, Brazil
Len Hudson	University of Washington, USA
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Patrick Lee	Partners In Health
Salah Ottmani	WHO StopTB, Switzerland
Paul Torzillo[2]	University of Sydney, Australia
Anthony Harries, Chen Yuen Chaing	International Union Against TB and Lung Disease
Clement Yeh, Luke Davis, Adithya Cattmanchi, Anh Innes	UCSF/SFGH, USA
Neill Adhikari[1,2]	Sunnybrook Health Sciences Centre, Toronto, Canada
Kwonjune Seung	Partners In Health and Harvard Brigham and Women's Hospital, USA
Phil Hopewell[2]	UCSF/SFGH, USA

Sepsis working group convened by WHO GAR	
Allen Cheng	School of Health Research, Australia
Jeremy Farrar	Oxford University Clinical Research Unit, Viet Nam
Julian Bion[1]	University Dept of Anaesthesia & Intensive Care Medicine, Queen Elizabeth Hospital, Birmingham, UK
Satish Bhagwanjee[1]	Anaesthesiology, University of Witwatersrand, South Africa
Alain Vuylsteke	Cambridge University Health Partners, UK
Shevin Jacob	Division of Allergy and Infectious Diseases, University of Washington, USA
Natalie Van Meerbeeck	Médicins Sans Frontière, Belgium
Patrick Banura	Masaka Regional Hospital, Uganda
Christopher Moore	Department of Medicine, University of Virginia, USA
Matthew Lim[1]	WHO GAR, Switzerland

Clinical reasoning, approach to lab investigations	
Chris Mathews	UCSD, USA
Chris Behrens[10]	ITech, University of Washington, USA
Fareed Ramzi Asfour	WHO IMAI; then private infectious diseases practice, USA
Valérie D'Acremont	Swiss Tropical and Public Health Institute

Malaria (11.40)	
Andrew Brent[7]	KEMRI–Wellcome Trust Research Programme, Kenya
Nicholas White[7]	Mahidol University, Thailand
Malcolm Molyneux[7]	College of Medicine, University of Malawi
Peter Olumese Marian Warsame Andrea Bosman	WHO GMP, Switzerland

Burns (3.10)	
Richard Gosselin[3]	University of California Berkeley, USA
Massey Beveridge[5]	University of Toronto, Canada
Remy Zilliox[5]	Université Hôpital, Lyon, France
Gebreegziabher Tekie[5] Anthony Magoda[5]	Ifikara Health Institute, Tanzania
Meena Nathan Cherian	WHO EHT, Switzerland

Surgery/trauma (Quick Check, 4)	
Richard Gosselin[3]	University of California Berkeley, USA
Aberra A. Gobezie	Awassa University, Ethiopia
Pascience Kibatala[3] N. Mkandawire	Ifikara Health Institute, Tanzania
Hillary Cohen[1,3,5]	Maimonides Medical Center, USA
Lawrence Sherman[3]	Ministry of Health, Liberia
David Speigel[3]	Children's Hospital, Philadelphia, USA
Charles Mock	WHO Violence and Injury Prevention, Switzerland
Meena Nathan Cherian	WHO EHT – IMEESC team leader, Switzerland

Neurology (Quick Check, 3.4, 10.10)	
Corrado Barbui[8]	University of Verona, Italy
Charles Newton[9]	Kenya Medical Research Institute, Kenya
Gretchen Birbeck[9]	Chikankata Hospital, Zambia

Zenebe Melaku Yirsaw	International Center for AIDS Care and Treatment Programs (ICAP), Ethiopia
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Penny Lewthwaite	University of Liverpool, UK
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Martin Dedicoat	Africa Centre and Hlabisa Hospital, South Africa
Kevin Robertson	University of North Carolina, USA
Miriam Taegtmaeyer	LSTM, UK
Tarun Dua	WHO, MSD, Switzerland
Chris Duncombe	WHO HIV,, Switzerland

Mental health (Quick Check, 3.4, 10.11)	
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Joseph K. Mbatia	Ministry of Health and Social Welfare, Tanzania
Helen McColl	Pattison Centre, UK
John Palen	USAID, USA
Melvyn Freeman	Department of Health, South Africa
Zoe Rush	Johns Hopkins University, USA
Rita Thom	University of Witwatersrand, South Africa
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Vikram Patel	London School of Tropical Medicine, UK
Jose Manuel Bertolote	WHO MSD, retired.
Jose Catalan	Imperial College, UK
Pamela Collins	Columbia University, USA
Shekhar Saxena, Tarun Dua	WHO MSD, Switzerland

Diabetes and hypoglycaemia (Quick Check, 3.4)	
Ayesha Motala[11]	Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, South Africa
Bahendeka K. Silver[11]	Chair, International Diabetes Federation Africa Region, Uganda
Ramu Ramachandran[11]	India Diabetes Research Foundation, India
Sidartawan Soegondo[11]	SS Diabetes Care, Indonesia
Gojka Roglic	WHO CHP, Switzerland

Pregnant and postpartum severely ill patients	
Jean Anderson[6]	Johns Hopkins University, USA
Kisore Pichamuthu[6]	Christian Medical College and Hospital, Vellore, India
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Organizational abbreviations

CDC	Centers for Disease Control and Prevention, Atlanta, USA
KEMRI	Kenya Medical Research Institute
LSTM	Liverpool School of Tropical Medicine
USAID	United States Agency for International Development
UCSD	University of California San Diego
UCSF/SFGH	University of California San Francisco/San Francisco General Hospital
WHO AFRO	WHO Regional Office for Africa
WHO CHP	WHO Department of Chronic Diseases and Health Promotion
WHO EHT	WHO Department of Essential Health Technologies
WHO GAR	WHO Global Alert Response
WHO GMP	WHO Global Malaria Programme
WHO MPS	WHO Department of Making Pregnancy Safer
WHO MSD	WHO Department of Mental Health and Substance Use
WHO EPE	WHO Evidence & Policy on Environmental Health

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