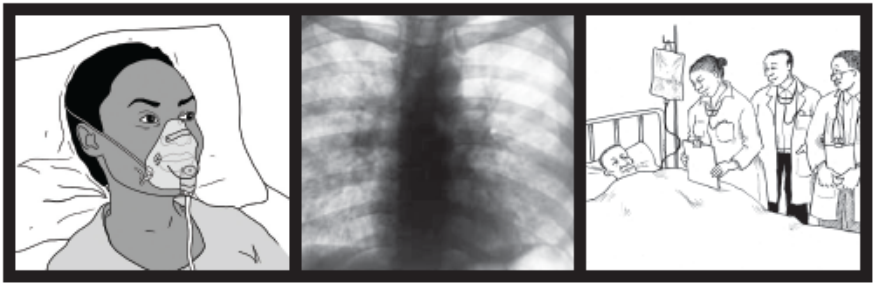
VOLUME 1

Uganda IMAI District Clinician Manual: Hospital Care for Adolescents and Adults



GUIDELINES FOR THE MANAGEMENT OF COMMON ILLNESSES

Integrated Management of Adolescent and Adult Illness (IMAI)

World Health Organization

imai imci Alliance

Foreword- Uganda IMAI District Clinician Manual: Hospital Care for Adolescents and Adults

This is the first edition of the Uganda Integrated Management of Adolescent and Adult Illness (IMAI) District Clinician Manual: Hospital Care for Adolescents and Adults which we expect will be highly relevant to our Clinicians working at both the regional and general hospitals and Health Centre IVs. The manual was developed by the World Health Organisation (WHO) then adapted for Uganda over the last 2 years to support hospital clinicians in diagnosing and managing adolescent and adult patients presenting to health units with limited essential medicines, laboratory tests, and equipment. The target audience thus includes doctors, clinical officers, and senior nursing staff. Although the manual will also be useful at referral care hospitals, it is not aimed at interns or subspecialists, but should help them in expanding the quality of adolescent and adult care at the general hospital level.

Good clinical care is a component of most effective public health approaches. Simplification and standardization of case detection and 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 case management then monitor the patient's response to treatment, and to promptly report notifiable diseases can contribute substantially to the patient's survival, the health of the patient' s contacts and the community in Uganda.

The manual supports clinical reasoning and provides an effective clinical approach and protocols for the management of common and serious or potentially life-threatening conditions at hospital level. Many Ugandan experts and hospital clinicians contributed to the development and field-testing of the original WHO generic manual. Then, to make it fully relevant to Uganda, each section was reviewed by a Ugandan clinical expert from the Ministry of Health (MOH), Mulago National Referral and Teaching Hospital and partner organizations, to identify and insert the adaptations essential for Uganda. The manual complements the Uganda Clinical Guidelines for the management of common conditions and goes deeper in explaining and supporting quality care for adolescents and adults at the general hospital level. The relevant medicines on the Essential Medicines and Health Supplies List for Uganda are included and their use explained; some additional medicines and laboratory tests available privately or through special projects are also included in italics.

The manual is divided into two volumes. Volume 1 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 in 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 neglected tropical diseases, opportunistic infections, and other common communicable diseases. A section on reporting notifiable diseases supports the Uganda Integrated Disease Surveillance and Response Programme. A summary of the medicines used in the manual includes not only the dosing for various indications but also the side effects and cautions required in using each medicine. The manual also includes the chronic or long-term management of HIV, TB, alcohol and substance use disorders, and palliative care. All the Sections represent the Uganda adaptation of the WHO generic, evidence-based chapters derived from current WHO normative guidelines from multiple disease-control programmes. To put these normative guidelines into operation within an integrated clinical manual supports the implementation of multiple disease-control strategies supported by the MOH. Ugandan Clinicians have also written new sections on the acute care for myocardial infarction, pulmonary embolism, and hypertensive emergencies, as well as the chronic management of non-communicable diseases including hypertension, heart failure, diabetes, cancer, sickle cell disease, and asthma/chronic obstructive pulmonary disease. The Sections on viral

haemorrhagic fever (VHF) case management and infection control have been expanded with material that also appears in the companion VHF pocket guide.

We thank the large number of Ugandan writers and reviewers who have given valuable input, comments and feedback on this manual to date; the WHO and the IMAI-IMCI Alliance for providing technical support for the adaptation and production of this manual; as well as the US DOD DTRA for providing financial support, both for the manual and the associated Quick Check+ training programme. We anticipate additional training programmes will be developed and implemented to improve hospital care based on this manual which can also be used to support pre-service medical, nursing, dental, pharmacy and biomedical student teaching.

Dr Aceng Jane Ruth
Director General Health Services
Ministry of Health Uganda July 2014

Uganda IMAI District Clinician Manual:
Hospital Care for Adolescents and Adults
Guidelines for the Management of Illnesses with Limited-Resources
Volume 1 – Table of Contents

Uganda IMAI District Clinician Manual: Volume 2 – Table of Contents

1. Introduction, assumptions, and principles of this manual

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 general hospital or health centre IV in Uganda. The manual assumes that many general 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 medicines** (see the medicine Section 8 at the end of the manual).
- **Limited equipment** – no mechanical ventilation except for during surgery
- **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 general hospital or Health Centre IV. 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 the general 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[1]

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) • Peripheral film report for leukamia and sickle cell disease **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[2] 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, thoracocentesis, and paracentesis • Saline and potassium hydroxide (KOH) wet mounts (for bacterial vaginosis (BV) or vaginal trichomonas) • Bilirubin determination for neonates • Blood and sputum cultures (may be sent out) • Cryptococcal antigen (CrAg- serum or CSF) or cryptococcal lateral flow assay and/ or India ink stain of CSF • Type and cross match for transfusion • Stool microscopy for ova and parasites • Tissue fixing with methanol

[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 or alternate device • Tuning Folks

Additional tests that may be available at regional or central laboratories

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*
- *Hepatitis B enzyme immunoassay (EIA)*
- *HIV viral load (VL)*
- *Fungal stains*
- *Urine culture*
- *Stool culture*
- *Toxoplasma serology*
- *Cytology (e.g. fine needle aspirate and cytology, CSF, pleural and Ascitic fluid cytology)*
- *Silver stain or direct fluorescent antibody (DFA) for Pneumocystis jiroveci* pneumonia *(PCP) diagnosis*
- *General fungal cultures, including blood*

Send patient for:

- *INR*
- *Histology (e.g. lesion/tissues like; lymph nodes, skin, GIT tissues etc.)*
- *Bone marrow aspirate and aspirate analysis.*
- *Serum protein electrophoresis (SPEP)*
- *Urine Benze Jones proteins in multiple myeloma.*
- *Tumor markers including PSA, CEA, CA 125, CA19-9, α-feto proteins.*

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.

1.3 Other companion Ugandan and WHO manuals

This manual supplements the Ugandan Clinical Guidelines. The manual also 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 2013)[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://www.who.int/maternal_child_adolescent/documents/child_hospital_care/en/index.html
[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 may be using simpler primary health care guidelines, including:

- IMAI *Acute Care*[1]*
- 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*[2]*
- IMPAC *Pregnancy, Childbirth, Postpartum and Newborn Care*[3] (PCPNC)*
- IMEESC toolkit (Integrated Management of Emergency and Essential Surgical Care)[4]

Those marked with an asterick have been adapted for use in Uganda. The IMAI-IMPAC training materials are being used to support scale-up of PMTCT interventions.

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.

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*.[5]

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

[1] IMAI/IMCI heath centre/primary care guideline modules available at http://www.who.int/hiv/pub/imai/primary/en/index.html
[2] http://www.who.int/child_adolescent_health/documents/9789241597388/en/
[3] http://www.who.int/making_pregnancy_safer/documents/924159084x/en/
[4] IMEESC toolkit that can be accessed at http://www.who.int/surgery/publications/imeesc/en/index.html
[5] http://www.who.int/child_adolescent_health/documents/9241546700/en/

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-** epidemic-prone communicable diseases and those targeted for eradication or elimination. These need to be reported rapidly 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 reporting of dangerous pathogens and diseases targeted for elimination. See Section 21.
	**Surgery may be needed** – call for help.
	**Presentations with high suspicion of cancer**

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 Non- communicable diseases and conditions: hypertension, heart failure, diabetes, cancer, asthma and COPD, sickle-cell disease, geriatric care
Section 19 Prevention in adolescents and adults
Section 20 Palliative care
Section 21 Patient monitoring and reporting

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 imaging and or laboratory services. 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

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, **C**onsciousness, **C**onvulsions) 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 2 to 9 (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

◆ 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 24–28).

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 = ringers lactate
NS = normal saline (0.9%)
RR = respiratory rate
SBP 90 = systolic blood pressure 90 mm Hg
SpO_2 90 = oxygen saturation 90%

[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
[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 C-spine (see p. 21).

- **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. 11).
- **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. 11).

For all patients:

- **Manage airway** (see p. 12).
- **Give oxygen 5 litres** (see p.14–16).
- **If inadequate breathing, assist ventilation with bag valve mask** (see p. 13).
- **Help patient assume position of comfort**.
- **If wheezing, give salbutamol** (see p. 17).

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 C-spine (see p. 21)

Look for

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

→ Treat tension pneumothorax with emergency needle decompression (see p. 22)

- Give oxygen 5 litres (see p. 14–16).
- If wound to chest wall which sucks air in when patient breathes in —> treat sucking chest wound (see p. 22).
- Treat pain (Section 20).
- If chest trauma, prepare 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.17). See Section 3.2 for other causes wheezing
Pinpoint pupils and suspect organophos-phate 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. 18 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.

Quick Check for adolescents and adults

EMERGENCY SIGNS

FIRST-LINE EMERGENCY TREATMENT

THEN ASSESS: CIRCULATION (SHOCK or heavy BLEEDING)

Do not move neck if cervical spine injury possible – immobilize spine (see p. 21).

- **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?

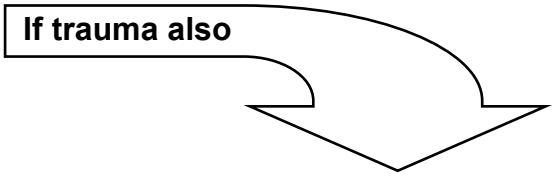
If SBP <90 mmHg or pulse >110 per minute or heavy bleeding:

- **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. 18)
- **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. 11).

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), suspect significant internal or external bleeding

- Give oxygen 5 litres if SpO_2 <90 or respiratory distress.
- Give rapid IV fluids (see p.18).
- Urgently send blood for type and cross match.
- Keep warm.

If external bleeding:
- Apply pressure immediately to stop bleeding (see p. 22).

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. 22).

- Call for help
- Plan for emergency surgical intervention (see Section 4).

- If patient remains in shock after 2 litres of IV fluids – transfuse (see Section 4).

If…..	**Then.....**
Fever, consider septic shock and malaria	Give empirical antibiotics (see p. 19), antimalarial if RDT positive 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. 24 to 26.
Large nosebleed	See p. 23.
Vomiting blood	See p. 23.

EMERGENCY SIGNS

FIRST-LINE EMERGENCY TREATMENT

ALTERED LEVEL CONSCIOUSNESS/CONVULSING

Do not move neck if cervical spine injury possible – immobilize C-spine (see p. 24).

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

***Is she pregnant*?**

For all:

- **Protect from fall or injury– make sure they are in a safe place.**
- **Manage airway and assist into recovery position** (see p.19).
- **Give oxygen 5 litres.**
- **Call for help** but do not leave patient alone.
- Do not put anything in mouth.
- **Give glucose** (if blood glucose is low or unknown) (see p. 19).
- Check (then monitor and record) level of consciousness on AVPU scale.

If convulsing:

- If convulsing in second half of pregnancy or post-partum up to one week, give magnesium sulfate rather than diazepam (see p. 28).[4]

- For the others, **give diazepam** IV or rectally (see p. 19). Do not give diazepam intramuscularly.

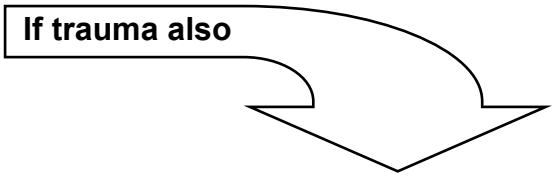
Then check SBP, pulse, RR, temperature.

If convulsions continue after 10 minutes:

- Continue to monitor airway, breathing, circulation.
- Insert IV line and give fluids slowly.
- Recheck glucose.
- Give second dose diazepam (unless pregnant/ post-partum).
- **Do not give more than 2 doses of diazepam.**
- 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 C-spine** (see p. 21).
- **Give oxygen 5 litres.**
- **Log-roll patient when moving.**

- Expose patient fully.
- Look/feel for deformity of skull.
- Assess:
  - Glascow coma scale or AVPU
  - 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. 19) Give antimalarials if RDT positive ~~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. 18 and Section 3.6.
Alcohol intoxication or withdrawal	See Section 3.7.
Poisoning	See Section 3.8.
Snake-bite	See Section 3.9.

EMERGENCY SIGNS — FIRST-LINE EMERGENCY TREATMENT

PAIN FROM LIFE-THREATENING CAUSE

Often:

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

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

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

→

- Nothing by mouth (NPO)
- IV fluids
- Give oxygen if respiratory distress or SpO_2 <90
- Empirical antibiotics IV/IM (see p. 19)
- Treat pain
- Suspect surgical abdomen – call for help and prepare for possible surgical intervention (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 abruptio placenta or ruptured uterus (see *IMPAC MCPC* guidelines[2]).

- **Severe headache**
  or
- **Stiff neck**

→

If current/recent pregnancy, elevated BP and headache, consider severe pre-eclampsia/ eclampsia; dipstick urine for protein (see *IMPAC MCPC*[2]). Give magnesium sulfate if diastolic ≥110 mmHg with proteinuria (see p. 28).

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 to-keep-open.
- Give morphine for pain (see Section 20).
- Do ECG. Call district clinician for help (see Section 3.3).

- **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.

- **Snakebite**

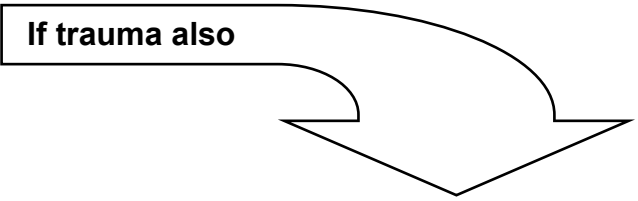
→

- Give oxygen if SpO_2 <90 or respiratory distress.
- Insert IV; give fluids rapidly (see p. 18).
- Treat pain (see Section 20).
- See Section 3.9 for antivenom guidelines.

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.

* For country adaptation

If trauma also



CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS

Do not move neck if cervical spine injury possible

If trauma with abdominal pain:

- Consider possible spleen or liver injury.
- If abdomen is distended and painful:
  - Check Hb.
  - Send type and cross match.
  - Consider diagnostic peritoneal lavage or ultrasound to check for internal bleeding.
- ➢ If penetrating injuries, prepare for laparotomy
- ➢ Prepare for possible surgical intervention and call for urgent surgical help.

If trauma with neck pain or possible cervical spine injury:

DO NOT MOVE NECK —> immobilize the neck (see p. 21).

➢ If severe headache, manage as possible head injury (see p. 21).

If trauma with chest pain:

- Palpate chest for rib fractures.
- Auscultate.

➢ If rib fractures present or reduced or absent breath sounds, consider pneumothorax or haemothorax (see p. 22).

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.[2]
Severe headache	See Section 10.10b.
Suspect acute myocardial infarction	See Section 3.3 for DDx and treatment.
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.
- **If history of exposure or fever, bleeding or other signs during an outbreak suggest viral haemorrhagic fever—** isolate the patient, use standard precautions and PPE, call for help. See Section 11.46 and the VHF pocket guide.

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 suspected venomous snake or 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
- Acute retention of urine

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.17 and Section 3.2.4).
- If violent behaviour or very agitated, protect, calm, and sedate the patient as appropriate (see p. 29). Check glucose and SpO_2 and consider causes (see Section 3.4).

Initiate interim management (and call clinician for definitive care):

- Measure haemoglobin if any bleeding, pale, weak, fainting, abdominal pain.
- If melena or vomiting blood, manage as on p. 23 and admit.
- If large haemoptysis (see p. 230).
- 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. 30 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.

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

If patient is pregnant, give chest 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 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

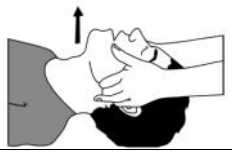
If airway obstructed, open airway and clear obstruction as follows:
If no obstruction, go to STEP 4

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.19).

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

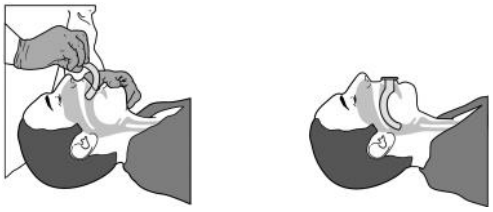
IF AIRWAY OBSTRUCTED BY TONGUE, INSERT AIRWAY DEVICE TO KEEP AIRWAY OPEN, AND THEN GO TO STEP 4.

IF AIRWAY IS NO LONGER OBSTRUCTED, GO TO STEP 4.

INSERT AIRWAY DEVICE

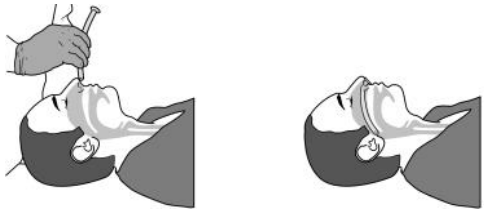
Oropharyngeal airway

- 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).

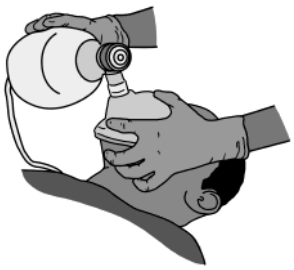
If ventilation is adequate, give oxygen and titrate flow (see p. 15).

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. 31).

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.
- Remove black or green nail polish.
- 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 and dirt (clean nails)

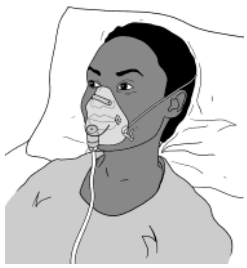
How to give oxygen

➡ 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

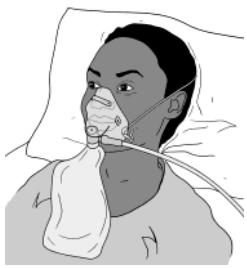
- If increasing respiratory distress or SpO_2 <90



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
- 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. 35) possible
  or
- Transfer to a hospital with available invasive mechanical ventilator possible. See Referral and transfer of severely ill patients, p. 37.

- Call for help from medical officer or anesthetic clinical officer for possible tracheal intubation – see advanced airway management, p. 31
- **Start manual ventilation (bagging) with high flow oxygen** – see p.35

How to give oxygen

▶ Respond to drop in SpO_2 or increasing respiratory rate on oxygen

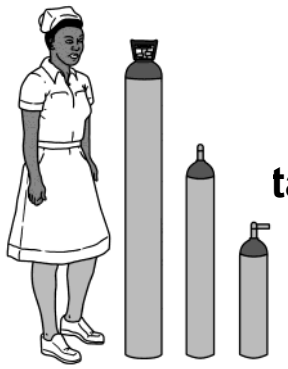
- Deliver increasing oxygen. See previous page.
- Check to make sure oxygen supply and all equipment is working properly:
  - check that the cylinder still has sufficient oxygen
  - check that oxygen is flowing out of the prongs or face mask – hold the end close to your hand and you will feel the airflow
  - 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 compressed gas volume/ tank height/cylinder letter/water volume

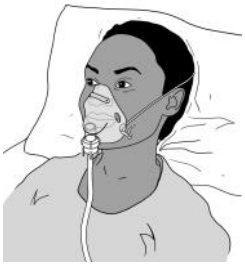
For each rate of oxygen administration:
First row: how long will a tank of this size will last.
Second row: how many tanks required for 24 hours of oxygen administration.O2

Rate of oxygen administration for one patient	O_2 tank D 340 litres	O_2 tank E 680 litres variable	O_2 tank F 1360 litres 1 meter	O_2 tank G 3400 litres 1.5 meter	O2 tank ? 4100 litres 1.5 meter	O_2 tank J 6800 litres 57 inches
Water volume	?	5 litres	10 litres	25 litres	35 litres	46.7 litres
2 litres/min	2 hr 50 min 8 ½ tanks	5 hr 40 min 4 tanks	11 hr 20 min	28 hr 20 min 1 tank	34 hr 10 min 0.7 tank	56 hr Half tank
5 litres/min	1 hr 8 min 21 tanks	2 hr 16 min 10 tanks	4 hr 30 min 5 tanks	11 hr 20 min 2 tanks	13 hr 40 min 1.8 tanks	23 hr 1 tank
8 litres/min	42 min 34 tanks	1 hr 24 min 17 tanks	2 hr 50 min 8 tanks	7 hr 4 tanks	8 hr 32 min 2.8 tanks	14 hr 2 tanks
10 litres/min	34 min 42 tanks	1 hr 8 min 21 tanks	2 hr 16 min 10 tanks	5 hr 40 min 4 tanks	6 hr 50 min 3.5 tanks	11 hr 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.

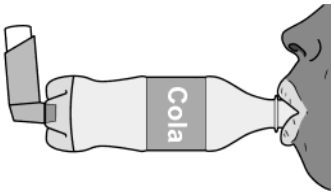
▶ *Give salbutamol for mild wheezing*

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 into the largest vein visible (e.g. antecubital fossa).
- 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 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).
  - Intraosseous infusion
  - 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. 31.
- 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.

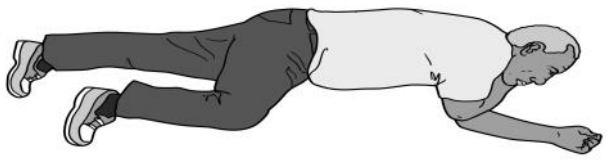
➡ How to give diazepam IV or rectally

- **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. 13).
- **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).

	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 then		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 ml	2 ml	2 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 ml	6 ml	2 ml	1 ml	6.6 ml	3.3 ml	3.3 ml	0.8 ml
60 kg	14.4	7.2 ml	2.4 ml	1.2 ml	8 ml	4 ml	4 ml	1.0 ml
70 kg	16.8	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	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	10.8 ml	3.6 ml	1.8 ml	12 ml	6 ml	6 ml	1.5 ml

Always give glucose with quinine

- 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]

Weight	Oseltamivir	
	Usual dose	Severe disease or severely immunosuppressed
24–40 kg	60 mg twice daily	60 mg twice daily for 10 days
>40 kg (age 13 and older)	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:

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.

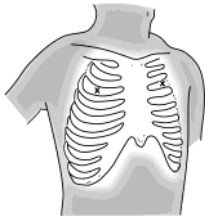
If patient cannot be cleared clinically, patient should remain immobilized until their cervical spine is cleared by X-ray. Three X-ray views are needed to clear the cervical spine (lateral, AP, open mouth odontoid).
The most important view is the lateral X-ray. An adequate lateral X-ray must view to C7/T1.
If patient is unconscious, then they must have their cervical spine immobilized until it is cleared by X-ray.
The thoracic and lumbar spine can be cleared if there is no tenderness with palpation of the spine, and the patient has no neurological deficits.

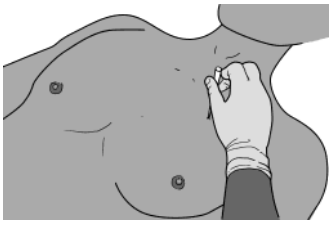
➡ *How to manage serious head injury*

- 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. 37). If not possible, continue supportive care.

➡ *How to manage tension pneumothorax or massive haemothorax*

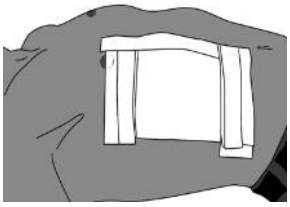
- Treat tension pneumothorax with emergency needle decompression:
  - insert large bore (14 or 16 gauge) cannula along the upper edge of third rib through second inter-costal space in mid-clavicular line
  - if tension pneumothorax, there will be a rush of expelled air.





- Give high flow oxygen.
- Call for help 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

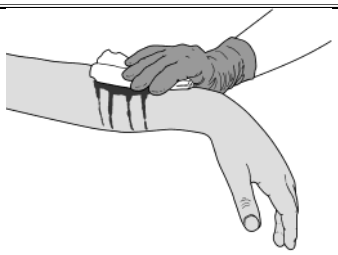
➡ *How to treat sucking chest wound*



Chest wall wound which sucks air in when patient breathes 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.

➡ *How to apply pressure to stop bleeding*



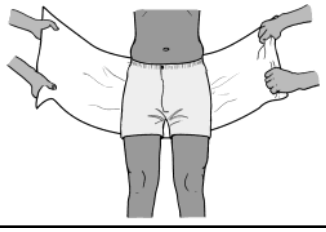
- Apply firm, direct compression.
- Reinforce dressings to apply more pressure if necessary.
- **ONLY IF all other bleeding control measures have failed AND haemorrhage is life-threatening, consider using tourniquet technique until control by surgery or for transport only.**

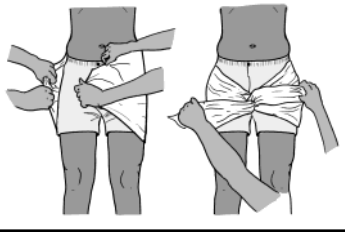
Tourniquet technique:

- 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. Note the time tourniquet is applied.
- 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. 18).
- 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 intravenously (e.g. omeprazole 80 mg).
- Check whole blood clotting time.

➡ How to manage large haemoptysis

- Manage airway.
- Establish IV line.
- Send blood for type and cross match then transfuse as needed.
- Consider antibiotics.
- Monitor Quick Check and haemoglobin (see Section 10.6).

➡ How to manage large nose bleed (epistaxis)

If bleeding continues

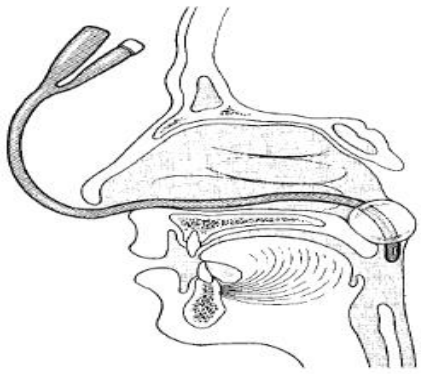
1. **Pressure.** Have the patient gently blow their nose to remove all clots.
   - Ask patient to open mouth, then pinch both nostrils tightly between your fingers and thumb.
   - Hold continuous pressure. Bleeding usually stops within 10 minutes.
2. **Consider cautery** (i.e. silver nitrate) **only 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 sides 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.

If vaginal bleeding in pregnant woman or woman of childbearing age:[2,7]

- **Assess pregnancy status**
- **Assess amount of bleeding**
- **Assess for shock** **(see page 20)**

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)

ANY 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
- Review ultrasound if available.

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[6] (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*.**[2] *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 in theatre (see p. 27) 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. 26).

If placenta is incomplete (or not available for inspection):
- Remove placental fragments (see *IMPAC 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
- 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.

If heavy bleeding

Continue IV fluids with 20 units of oxytocin at 30 drops/minute. Insert second IV line.
- If can visualize cervix, inflate condom over foley catheter[7] to tamponade (see p. 26).
- Apply bimanual uterine or aortic compression
- Give appropriate IM/IV antibiotics .
- Prepare for surgery

Call for district clinician to manage: see *IMPAC MCPC*.[2]

Check if still bleeding

Controlled bleeding

Continue oxytocin infusion with 20 IU/litre of IV fluids at 20 drops/minute for at least one hour after bleeding stops:
- Observe closely (every 30 minutes) for four hours. Keep nearby for 24 hours. If severe pallor, refer back to facility.
- Examine the woman using *IMPAC MCPC*[2] Section: *Assess the mother after delivery.*

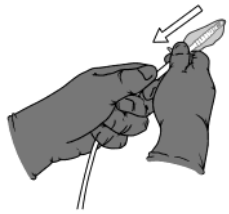
➡ *How to massage uterus and expel clots*

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*

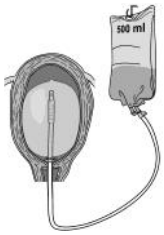
If trained and keeping all equipment sterile:



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.



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.

Clamp the catheter and leave the end inside the vagina.

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:**

Initial dose	**Continuing dose**
IM: 10 IU in buttock (or anterior thigh)	**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

Maximum dose: Not more that 3 litres of IV fluids containing oxytocin

➡ *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:

- Manual removal should be done in theatre.
- 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.28) 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 any placental 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 no response to oxytocin plus ergometrine*

- Give misoprostol 800 mcg sublingually or rectally. (See IMPAC)

➡ 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 buttocks until 24 hours after birth, or after last convulsion (whichever is later).

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
  - give diazepam 0.05–0.1 mg/kg IV (requires longer observation following sedation): OR
  - -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

See page 31 for sedation for intubation.

➡ 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 and spacious area where there is no audience.
- Use space to protect yourself and ensure you have an entry and escape/exit route. Avoid being trapped in a corner.
- 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. Avoid provocation.
  - 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. 19).
  - 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), offer oral treatment before parenteral:

- 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) then every 12 hours.
- **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 thoughts/plans to commit suicide or self harm, about attempts 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, violence, 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, substance ~~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.

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.
   - Check if ETT cuff is intact.
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 help from a 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. 34).
- 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. 33).

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

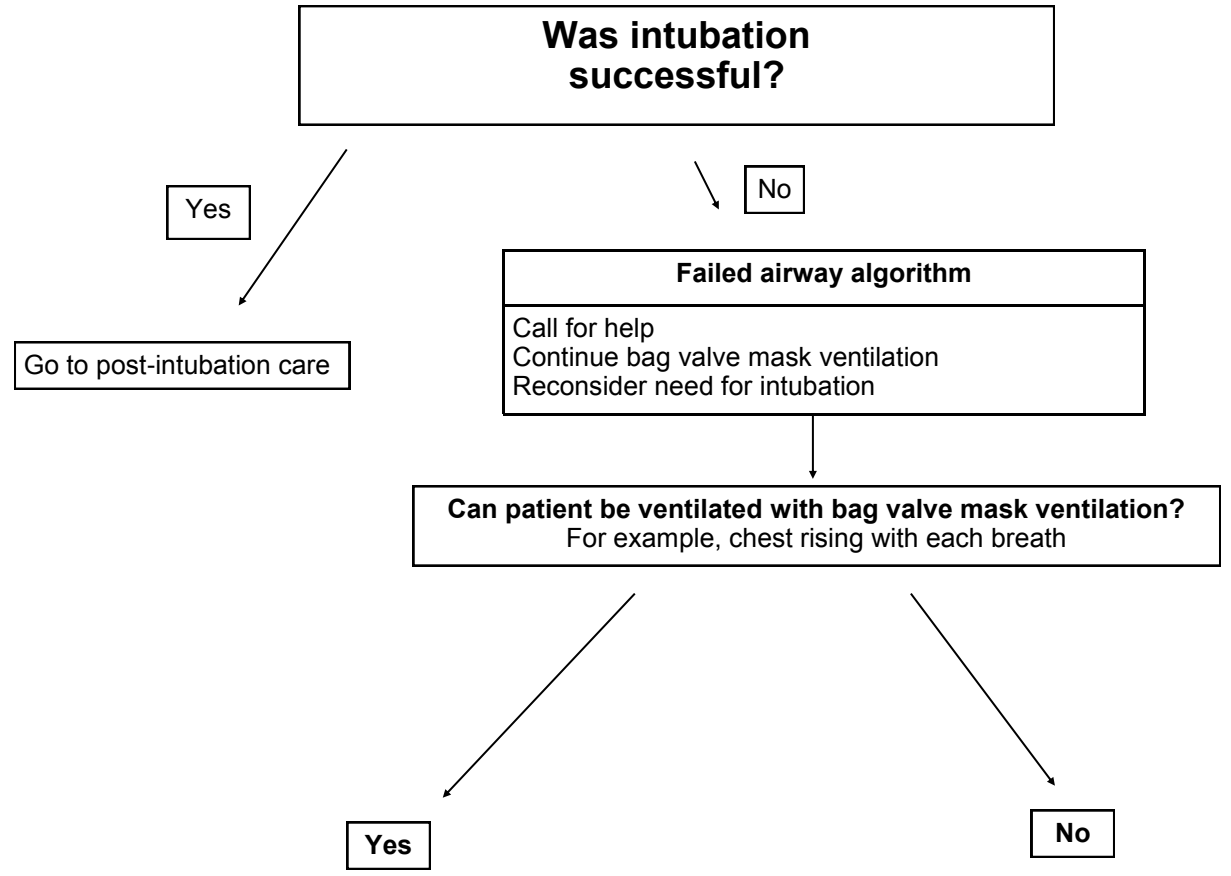
➡ *How to confirm endotracheal tube (ETT) placement*

- 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. 34.

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

Test	Result	Significance	Reliability/action
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

Advanced airway management: for district clinicians with training



Optimize conditions and re-attempt intubation

- Extend neck
- Place pillow under shoulders
- Try different laryngoscope blade
- Manipulate larynx up and to the right to improve view

If still unable to intubate, allow to wake or manage airway with bag valve mask ventilation.

- Insert laryngeal mask airway if available and ventilate through airway.
- Consider surgical cricothyroidotomy (see p. 36):
  - This is a specialized procedure and should only be done in life-threatening circumstances by practitioners who are appropriately trained, and when you cannot ventilate and cannot intubate.

As with intubation, only attempt if:

- The patient cannot be managed with basic airway techniques.
- The equipment is available and in working order.
- There is a post-intubation plan for management of ventilation.

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)*

➡ *If patient becomes blue, cyanotic or hypoxic*

- Confirm placement of ETT (see p. 32)
- 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. 22)
- 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.

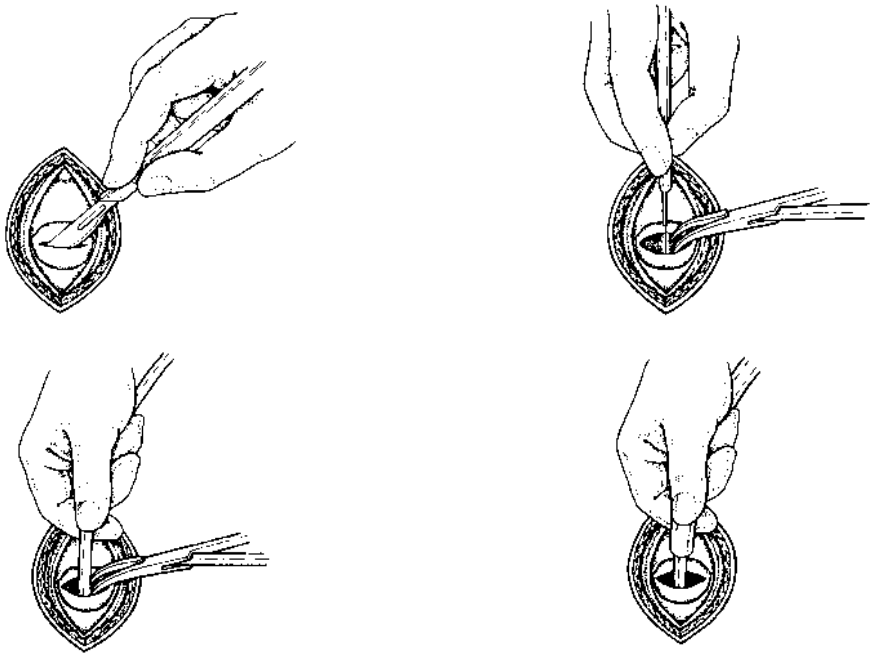
- Call immediately for help if:
  - the patient is turning blue or cyanotic
  - the patient is waking up and biting on the tube, or trying to pull the tube out of his or her mouth
  - it becomes hard to compress the bag or you feel increased resistance
  - the patient is vomiting
  - you hear gurgling 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 saturation falls below 90% (only for patients monitored with a pulse oximeter)
  - you must take a break, and there is no one to relieve you.

➡ *Cricothyroidotomy: 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.
3 Clean the area and infiltrate with local anaesthetic.
4 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 (Figure 1).
5 With a #22 or #23 scalpel blade, stab through the membrane into the hollow trachea.
6 Rotate the blade 90° (Figure 2), 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).
7 Pass a thin introducer or a nasogastric tube into the trachea if very small access.
8 Run a 4–6 endotracheal tube over the introducer and pass it into the trachea (Figure 5).



9 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 during transport 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

- **A**irway and NG tube
- **B**reathing and adequate SpO_2
- **C**irculation, monitoring and IV
- **D**isability/cervical collar/head injury care
- **E**xposed, examined and equipment sorted out and secure
- **F**amily informed
- **F**inal considerations

  Ask for notes and X-rays and other results

  Bed confirmed at receiving hospital

  Continuity of care assured? **C**ommunication equipment

  Drugs and spare? **D**ocumentation, including patient history

  Everything secure? **E**nough drugs? **E**nough oxygen? **E**nough fuel? **E**nough IV fluids?
- **H**ealth worker accompanying patient-prepared?

EMERGENCY TROLLEY should be equipped with:

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 needles
Alcohol wipe or equivalent antiseptic for skin
Tourniquet
Tubes for blood draw
Sterile pads and gauze
Bandage
Suture
Tape
Lubricant
Laryngeal mask airway
Scalpel blades (#22 pr #23)

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
Lidocaine
Midazolam
Ketamine

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

* Lock box

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

➡ *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 during transport 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

- **A**irway and NG tube
- **B**reathing and adequate SpO_2
- **C**irculation, monitoring and IV
- **D**isability/cervical collar/head injury care
- **E**xposed, examined and equipment sorted out and secure
- **F**amily informed
- **F**inal considerations

  Ask for notes and X-rays and other results

  Bed confirmed at receiving hospital

  Continuity of care assured? **C**ommunication equipment

  Drugs and spare? **D**ocumentation, including patient history

  Everything secure? **E**nough drugs? **E**nough oxygen? **E**nough fuel? **E**nough IV fluids?
- **H**ealth worker accompanying patient-prepared?

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

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

3.0 General principles for caring for the severely ill patient

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^{o}–38^{o}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 14−16)

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 15. 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 16. 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 16.

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 12–13).
- 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)?

- acute low blood pressure (shock) – Section 3.1
- airway or difficult breathing (or slow breathing) – Section 3.2
- chest pain – Section 3.3
- unconscious, confused or agitated – Section 3.4
- seizures – Section 3.5
- drug intoxication or withdrawal – Section 3.6
- alcohol intoxication or withdrawal – Section 3.7
- poisoning – Section 3.8
- snake-bite or bee-sting – Section 3.9
- burn – Section 3.10

3.1 Severely ill patient with shock

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 or weak 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 (pulse rate, blood pressure, respiratory rate)
- 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, oedema, crepitations

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, hyperlipidemia)
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
Congenital heart disease	• Known heart disease since birth • Cyanosis • Digital clubbing

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 25	• 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
• Manage airway (see Quick Check pages 12–13). • Give oxygen (see Quick Check pages 14–16). • Give IV fluid rapidly (see Quick Check page 18 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

3.1.1 Manage haemorrhagic shock (see Quick Check page 22 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 12–13)
- Give oxygen for respiratory distress or SpO_2 <90 (see Quick Check pages 14–16)

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 24–25)

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 22).
- Splint long bone or pelvic fracture (see Section 4.5.2 and Quick Check page 22).
- Place chest tube if suspect haemothorax (see Section 7.3.1 and Quick Check page 22).
- If vaginal bleeding,[1] see Quick Check pages 24−26.
- 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 23).

Restore circulating blood volume

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

- During Quick Check (see page 18) 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 18). 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 18). 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.

[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

[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 11) – 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 14–16).
- 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

Key clinical features

- Hypotension (systolic BP <90 mm Hg) plus any of the following:
- Evidence of low perfusion:
  - Reduced cerebral blood flow leading to obtundation (altered mentation) or restlessness.
  - Reduced renal blood flow leading to oliguria.
  - Reduced peripheral blood flow leading to cold and clammy skin.
- Chest pain (if cause by myocardial infarction)
- Pulmonary oedema (bilateral crepitations)
- Lower extremity oedema
- Raised JVP
- History of orthopnea or paroxysmal nocturnal dyspnea

Urgent investigations include:

- Pulse oximetry to measure SpO_2
- ECG – evaluate for ischaemia, ventricular hypertrophy, arrhythmias
- Electrolytes (especially potassium)
- Creatinine
- Haemoglobin
- Chest X-ray
- Ultrasound (general probe) – pericardial effusion and pleural effusion. Cardiac probe can be used to assess for ventricular function and valve pathology.
- Monitor urine output

Treatment

- Give oxygen for respiratory distress or if SpO_2 <90 (see Quick Check pages 14–16)
- Establish IV line
- Sit up the patient.
- Relieve pain with morphine IV – start with 2.5-5 mg every 4hrs, titrate (see Sections 8.1 and 20)
- Correct electrolyte abnormalities

Treat underlying causes

- If ST segment elevation or depression on ECG suggests myocardial infarction, treat or refer for thrombolysis (ST elevation only) or percutaneous cardiac interventions (either ST elevation or depression)- see Section ….
- Cardiogenic shock can occur in myocardial infarction with:
    - Loss of >50% of myocardium (massive or cumulative repeated infarctions)
    - Mechanical complications (VSD, papillary muscle rapture, rupture of ventricle with tamponade)
    - If significant arrhythmias, treat (see Section 3.3).
    - If there is no clinical evidence of fluid overload, give fluids (normal saline) within 1-2hrs cautiously (250–500 ml). Monitor for signs of fluid overload.
    - If signs of pulmonary oedema – see Section 3.2.5 on management pulmonary oedema; consider vasopressors (dopamine) (see Table on next page) and *dobutamine if available* for inotropic support.
    - If there is evidence of pericardial tamponade, arrange urgent drainage (see pericardiocentesis in Section 7.2.12).
    - If pneumonia has precipitated heart failure, treat (see **Sections 3.2.3 and 3.2.5**).
    - If medicine toxicity (calcium channel blocker, ß-blocker, or digoxin intoxication), manage according to Section 3.8.
    - If valvular disease (mitral incompetence, aortic incompetence, aortic stenosis, mitral stenosis), stabilise the patients as above and refer for further evaluation and management

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 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 burrette to limit the volume and control the drip 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 mm Hg 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 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** 10 amps in 1 litre (D5W, NS, LR) or 5 amps in 500 ml (D5W, NS, LR) or 2 amps in 200 ml (D5W, NS, LR)	Use** 5 amps in 1 litre (D5W, NS, LR) or 2.5 amps in 500 ml (D5W, NS, LR) or 1 amp in 200 ml (D5W, NS, LR)

* 1 milligram (mg) is equal to 1000 micrograms (mcg).
** Read ampoule label **3 times** to confirm concentration before mixing.

Use the tables on the next two pages to determine the administration rate for the correct dose of epinephrine or dopamine according to the patient's weight.

The desired dose rate is weight-based. First choose the row in the tables below which matches the patient's weight, then choose the dose rate (start with the lowest).

The infusion rate is commonly presented per hour but is monitored by setting the drip rate. The drip factor of the set determines if there are 10, 20 or 60 drops/ml. Based on the set you are using, choose the drip rate for the desire dose.

For example, in a 40 kg patient with a drip set that provides 10 drops/ml, to start dopamine at the lowest infusion rate of 12 ml/hour, you would provide just 2 drops per minute.

DOPAMINE by peripheral infusion

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	Drip factor (drops/ml) 10	20	60
			Drip rate (drops/min)		
30	5	9	1.5	3	9
	10	18	3	6	18
	15	27	4.5	9	27
	20	36	6	12	36
40	5	12	**2**	4	12
	10		4	8	24
	15	36	6	12	36
	20	48	8	16	48

EPINEPHRINE by peripheral infusion

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hour)	Drip factor (drops/ml)		
			10	20	60
			Drip rate (drops/min)		
30	0.05	9	1.5	3	9
	0.1	18	3	6	18
	0.15	27	4.5	9	27
	0.2	36	6	12	36
40	0.05	12	2	4	12
	0.1	24	4	8	24
	0.15	36	6	12	36
	0.2	48	8	16	48
50	0.05	15	2.5	5	15
	0.1	30	5	10	30
	0.15	45	7.5	15	45
	0.2	60	10	20	60
60	0.05	18	3	6	18
	0.1	36	6	12	36
	0.15	54	9	18	54
	0.2	72	12	24	72
70	0.05	21	3.5	7	21
	0.1	42	7	14	42
	0.15	63	10.5	21	63
	0.2	84	14	28	84
80	0.05	24	4	8	24
	0.1	48	8	16	48
	0.15	72	12	24	72
	0.2	96	16	32	96
90	0.05	27	4.5	9	27
	0.1	54	9	18	54
	0.15	81	13.5	27	81
	0.2	108	18	36	108
100	0.05	30	5	10	30
	0.1	60	10	20	60
	0.15	90	15	30	90
	0.2	120	20	40	120

DOPAMINE by peripheral infusion

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	Drip factor (drops/ml) 10	20	60
			Drip rate (drops/min)		
30	5	9	1.5	3	9
	10	18	3	6	18
	15	27	4.5	9	27
	20	36	6	12	36
40	5	12	2	4	12
	10	24	4	8	24
	15	36	6	12	36
	20	48	8	16	48
50	5	15	2.5	5	15
	10	30	5	10	30
	15	45	7.5	15	45
	20	60	10	20	60
60	5	18	3	6	18
	10	36	6	12	36
	15	54	9	18	54
	20	72	12	24	72
70	5	21	3.5	7	21
	10	42	7	14	42
	15	63	10.5	21	63
	20	84	14	28	84
80	5	24	4	8	24
	10	48	8	16	48
	15	72	12	24	72
	20	96	16	32	96
90	5	27	4.5	9	27
	10	54	9	18	54
	15	81	13.5	27	81
	20	108	18	36	108
100	5	30	5	10	30
	10	60	10	20	60
	15	90	15	30	90
	20	120	20	40	120

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 page 18), 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 19.)

- **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 20 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 20 and Section 11.17.[3] If confirmed Crimean-Congo Haemorrhagic Fever (CCHF), consider IV ribavirin. See Section 11.47 and VHF pocket guide.[4]

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.[5]

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.

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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

[4] MOH Uganda: *Clinical management of patients with viral haemorrhagic fever in Uganda: A pocket guide for the font-line health officer,* Kampala, December 2013.

[5] *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

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.

Table: Modified management of septic shock associated with certain infections

Suspected etiology	Modifications or additions to septic shock guidelines
Dengue[6] 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[7]	• 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*[8]	• 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.
Postpartum sepsis or septic abortion see Section 10.15 and *IMPAC MCPC*[8]	• 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.

[6] *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

[7] *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

[8] *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

PID[9]**, pelvic or tubo-ovarian abscess** see Section 10.15 and *IMPAC MCPC*[8]	• 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 11.47	• IV ribavirin may be effective against Crimean-Congo haemorrhagic fever (and Lassa fever in West Africa)- see VHF pocket guide and consult with national programme and experts on its use. • See 6.14 for infection control. • Fluids, other supportive care are the same. Follow flowchart on following pages.

[9] *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

First 2 hours

Recognize

Septic shock

Clinical diagnosis of severe sepsis or septic shock
- Suspected infection
- Hypotension (systolic blood pressure <90 mmHg) **and 1 or more of the following**
- Pulse >100 bpm
- Respiratory rate >24
- Abnormal temperature (<36°C or >38°C)

Severe respiratory distress without shock

Clinical diagnosis of severe respiratory distress without shock
- If respiratory rate >30 or SpO_2 <90, and
- SBP >90 mmHg, and
- No heart failure, and
- Suspected pneumonia or acute lung injury

Fix the physiology

Oxygen: titrate to SpO_2 90

Fluids:
After initial bolus of 1000 ml, continue rapid fluids LR or NS at 20 ml/kg/hour, up to 60 ml/kg within the first 2 hours

Oxygen: Titrate to SpO_2 90

Fluids:
Give fluids at 1 ml/kg/hour or orally

If wheezing, give salbutamol

Treat infection

Urgent empirical antimicrobials
- Antibiotics
- Antimalarials
- Influenza -specific antiviral if suspect influenza
- Consider IV ribavirin if confirmed CCHF

Identify source of infection
- Use signs or symptoms to consider source.
- Malaria test
- Where available, molecular testing for TB or AFB smear of sputums, if cough
- Chest X-ray, Gram-stain sputum
- Send blood cultures.

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)

Check results of emergency laboratory
- If haemoglobin <7 mg/dl (Hct <20), consider transfusion.
- If glucose <3 mmol/l (54 mg/dl), then give D50 25–50 ml (see Quick Check page 19).

Respond

If respiratory function declining (increasing RR, falling SpO_2)
- Check oxygen supply.
- If JVP elevated, increasing crackles,

Consider fluid overload.

SBP <90

If SBP <90, switch to manage as septic shock
- If wheezing, give salbutamol.
- If suspect fluid overload, slow rate of fluid administration and start vasopressors if still in 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 elevated JVP and increasing crackles, Consider fluid overload.	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.

		Septic shock	Severe respiratory distress without shock
6–24 hours	**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) • Influenza -specific antiviral if suspect influenza • Consider IV ribavirin if confirmed CCHF	
	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 value 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) • Influenza -specific antiviral if suspect influenza • Consider IV ribavirin if confirmed CCHF	
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 **Respond**	**Every 8 hours (check SBP hourly if weaning off vasopressors); then daily** • SBP, pulse • Respiratory rate • SpO_2 • Mental status (AVPU) Respond to changes as indicated earlier.	

3.2 Severely ill patient with difficulty breathing

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
- severe bronchospasm (asthma, COPD).
- anaphylaxis
- pneumothorax
- cor-pulmonale
- pulmonary embolism
- organophosphate poisoning

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 12–17.

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)
- noisy breathing (wheeze, stridor)
- inability to speak complete sentences
- cyanosis
- depressed level of consciousness

For clinical purposes there are four categories of severe respiratory distress

Severe respiratory distress – consider DDx in these categories

	Respiratory	Cardiac	Blood	Drug toxicity
Common	**Pneumonia** o **bacterial** o **influenza** o **PCP** **Pleural effusion** **COPD** **Asthma**	**Pulmonary oedema (acute heart failure)** **Myocardial infarction**	**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
  - o lung problems (COPD, severe asthma, previous severe pneumonia)
  - o heart problems (myocardial infarction, hypertension, cardiomyopathy, heart failure, chest pain)
  - o systemic illnesses (diabetes, HIV, TB, cancer)
  - o medications (ART)
  - o recent opioid drug use
  - o tobacco use
- previous surgical or trauma history
  - o recent trauma or bite
  - o recent period of immobility.

Examination

Do a focused examination to identify likely causes.

Respiratory

- stridor, swollen tongue, airway oedema (suspect upper airway obstruction)
- trachea pushed or pulled to one side (suspect tension pneumothorax)
- pattern of breathing
  - o prolonged expiration time (suspect asthma or COPD)
  - o deep, laboured breathing (suspect systemic acidosis)
  - o small, rapid breaths (suspect severe pneumonia, acute lung injury, muscle weakness)
- quality and distribution of breath sounds

- decreased air entry/breath sounds on auscultation
- bibasilar crackles (suspect pulmonary oedema)
- bronchial breath sounds (suspect consolidation from pneumonia)
- wheeze (if wheezing, classify severity – see Section 3.2.4). If unilateral consider bronchial obstruction (foreign body, tumor,etc)

- percussion
  - dullness (suspect pleural effusion)
  - hyper-resonance (suspect bullae, pneumothorax, or asthma exacerbation)

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).

Neurological

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

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, send sputum for AFB smear and culture and other diagnostic assessment if suspect extrapulmonary TB. If sputum AFB smear is negative or the patient is a Multi drug-resistant TB (MDR-TB) suspect do molecular testing with a nationally or WHO-approved technology, e.g. Xpert MTB/RIF, if available. Otherwise, send for culture and drug susceptibility testing (DST).
- If wheezing, check peak flow (see Section 7.2.22).
- 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 11	• Very sudden onset • Cyanosed • Grasping at neck, eating just prior to attack
Anaphylaxis see Quick Check page 11	• 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 22	• 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 see Section 3.2.3	• 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
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 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 see 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 11.20 	• 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 12–13
Give oxygen	Quick Check pages 14–16
If wheezing, give salbutamol	Quick Check page 17
Position patient in most comfortable position for breathing	
Identify and treat cause	
Monitor – record – respond	Section 3.0

Manage airway (see Quick Check pages 12–13)

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 31). 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 16–18) 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 bag-valve-mask (BVM) ventilation using high flow oxygen (see Quick Check pages 13). 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 12−13).
Anaphylaxis	• Give epinephrine (see Quick Check page 11 and Section 3.1.3).
Pneumothorax	• If tension, insert needle or chest tube (see Quick Check page 22).
Pericardial tamponade	• Drain pericardial fluid (see Sections 3.2.6.2 and 7.4.5).
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 17 and Section 3.2.4). If suspect asthma or COPD, give hydrocortisone 100 mg IV or equivalent oral dose (see Section 18.4).
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 18).
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 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 • SpO2 <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 12–13 and Section 3.2.1
• Give oxygen	Quick Check pages 14–16 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.

[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

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 28) and hydralazine IV (see Section 3.2.5).
- For tocolytic-associated acute lung injury, stop medication.

[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

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.
- 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 pages12–13). • Check oxygen supply and increase flow rate (see Quick Check pages 17–18). • 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 mmols (54 mg/dl), give D50 25–50 ml** (see Quick Check page 19). **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 31 and 37). 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 empyema, 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 empyema.
- 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.

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).

[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

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 17 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 Sections 10.6, 18.4	• 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 Sections 10.6, 18.4	• 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 12–13). • Give oxygen therapy (see Quick Check pages 14–16). • Give inhaled salbutamol immediately (see Quick Check page 17 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 12–13). • Give oxygen (see Quick Check pages 14–16). • Give salbutamol by continuous nebulizer (see Quick Check page 17 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 14–16). • Give salbutamol by nebulizer (continuous or every 20 minutes) (see Quick Check page 17 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.
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 17)

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 19)**.** 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 14–16).
- 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 13, 31−36). 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	• 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 12–13). • Give oxygen therapy (see Quick Check pages 14–16). • 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 28, 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.

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.

[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

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 17).
- 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**

Furosemide: **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

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

Furosemide: 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 hypertensive: 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.

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 if 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 enalapril 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

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 **Respond**	**Every 8 hours (check SBP hourly if weaning off pressors); then daily** • SBP • Respiratory rate • SpO_2 • Mental status (AVPU) 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 and valvular heart disease emergencies, refer to national guidelines.

3.2.6.1 Management of emergency cardiac arrhythmias

If you suspect cardiac arrhythmias based on clinical features such as palpitations, syncope or abnormal pulse, do an ECG to confirm the arrhythmia. If confirmed, then use the flowchart below.

Basic approach for all arrhythmias:

- Identify arrhythmia – pulse (too slow <60/minute, too fast >100/minute, regular/irregular), use ECG and/or cardiac monitor if available.
- Ensure adequate oxygenation (see Quick Check)
- Establish IV access
- Monitor SBP. If hypotensive (SBP<90), give fluid bolus and consider referral for cardioversion

Follow the flowchart on the next page while considering the possible causes:

Search for and Treat Reversible Causes

6 H's: **H**ypoxia **H**ypovolaemia **H**ypo/hyperthermia **H**ypo/hyperglycaemia **H**ypo/hyperkalaemia **H**ead injury

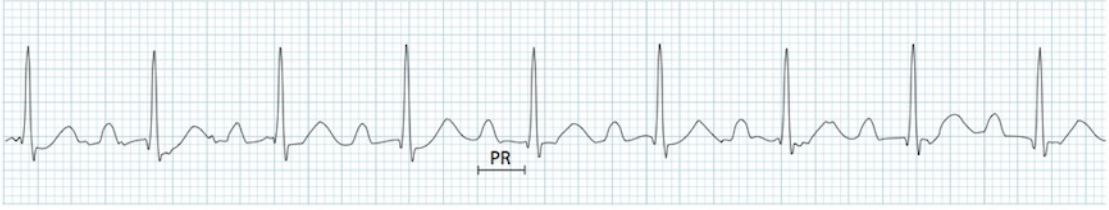
6 T's: **T**oxins **T**rauma **T**ension pneumothorax **T**amponade **T**hrombosis (coronary) **T**hrombosis (pulmonary)

Bradycardia = heart rate less than 60 beats/minute

Bradycardia often starts in the sinus node. A slow heart rate may occur because the sinus node discharges electrical impulses at a slower than normal rate, has abnormal pauses, or discharges an impulse that is blocked before it causes the atria to contract.

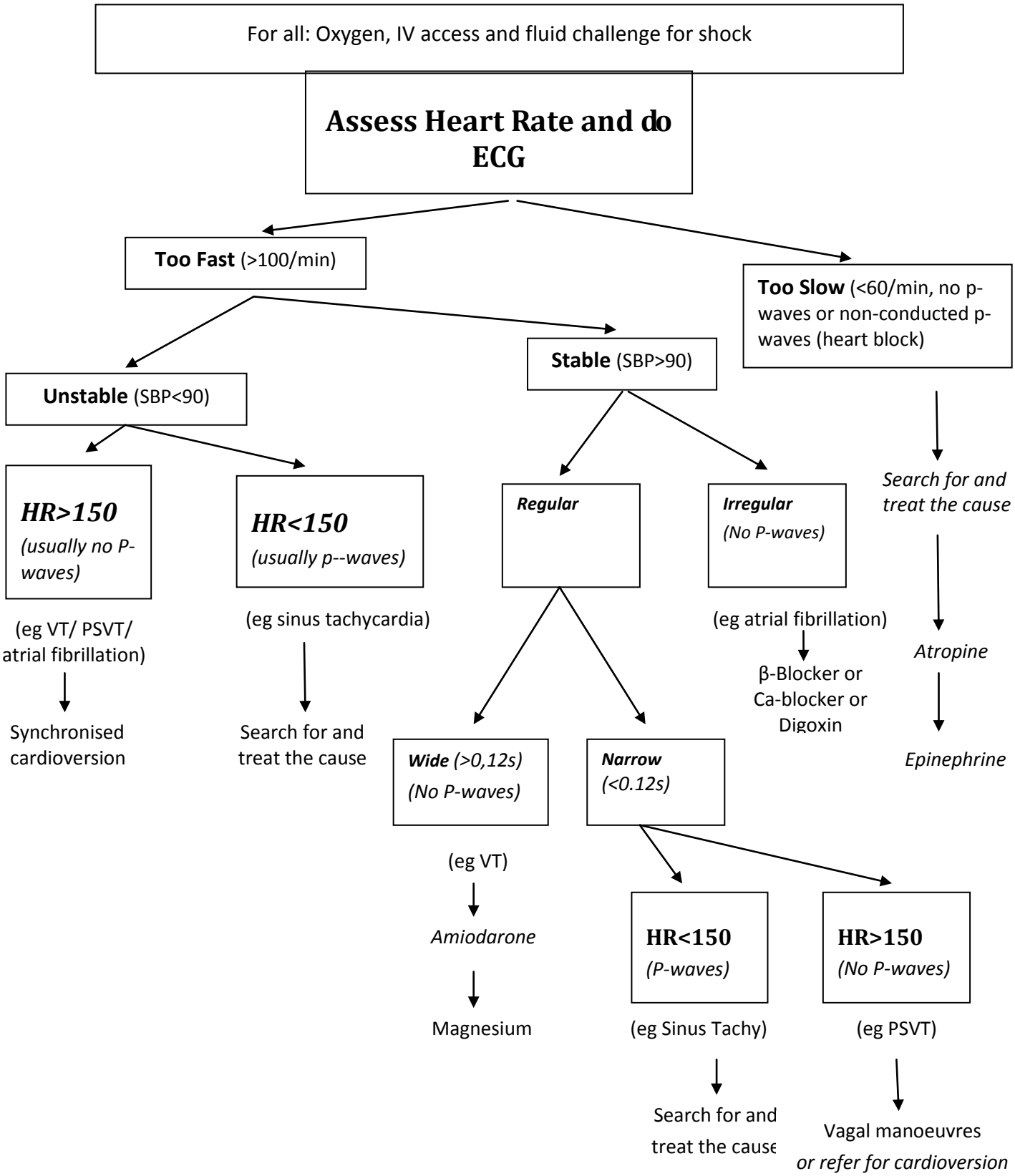
Bradycardia may also occur because electrical signals transmitted through the atria aren't transmitted to the ventricles (heart block, or atrioventricular block). Heart blocks are classified based on the degree to which signals from the atria reach the ventricles:

- **First-degree heart block**- **all reach the ventricles but slowed; usually asyptomatic;**
  - **PR interval > 200ms (five small squares)**



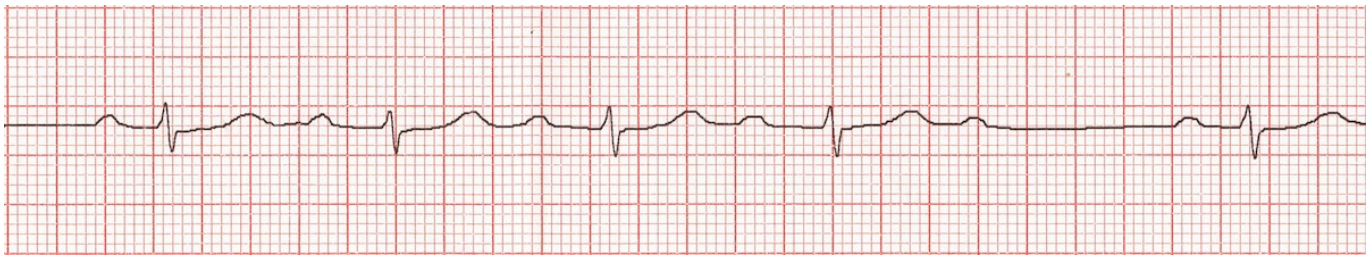
ADULT ACUTE ARRHYTHMIA FLOWCHART[6]

(if ECG/monitor and referral for cardioversion available)

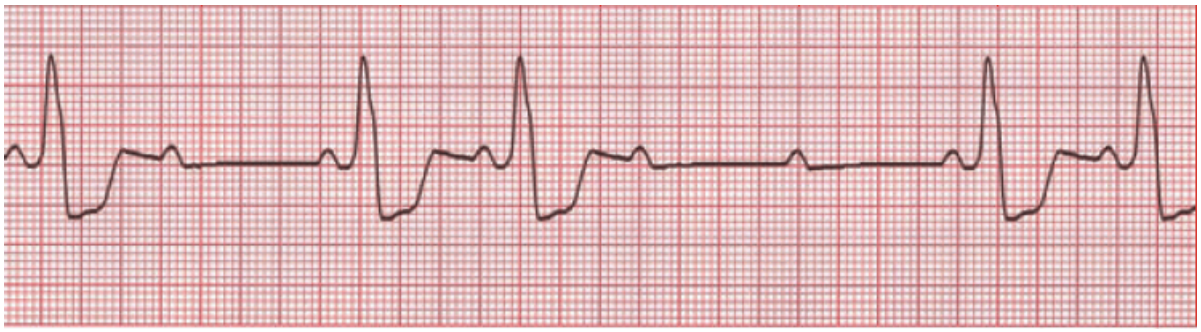


[6] W.G.J. Kloeck editor: A Guide to the Management of Common Medical Emergencies in Adults (9th Edition), 2012, Division of Emergency Medicine, University of the Witwatersrand, RSA.

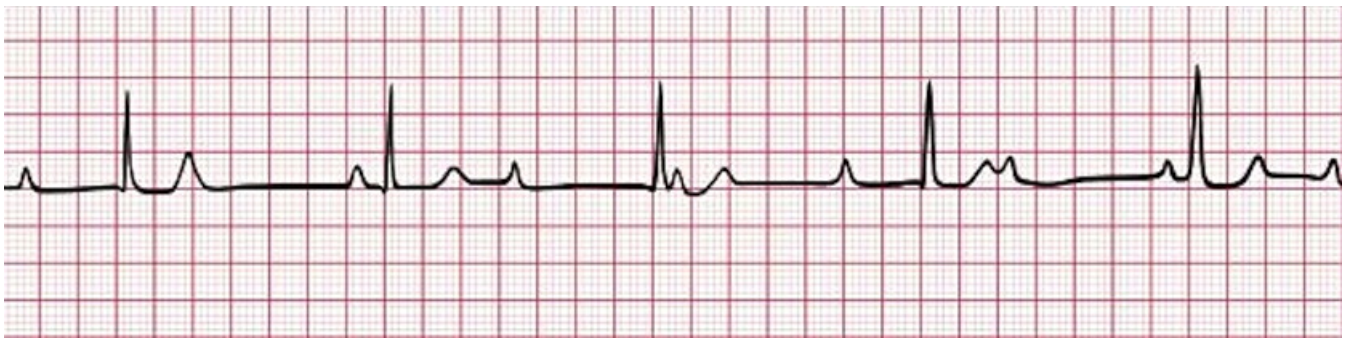
- **Second-degree heart block**- **some beats are dropped,** resulting in a slower and sometimes irregular rhythm;
    - **Mobitz 1** (Wenckebach phenomenon)**:** progressive prolongation of the PR interval culminating in a non-conducted P wave; PR interval is longest immediately before the dropped beat; PR interval is shortest immediately after the dropped beat



    - **Mobitz 2:** Intermittent non-conducted P waves without progressive prolongation of the PR interval (compare this to Mobitz I); the PR interval in the conducted beats remains constant; the P waves 'march through' at a constant rate.



- **Third-degree (complete) heart block**- none of the electrical impulses from the atria reaches the ventricles. When this happens, the bundle of His or other tissues of the ventricles function as a substitute pacemaker for the ventricles. The patient will have severe bradycardia with independent atrial and ventricular rates, i.e. AV dissociation.



Key clinical features of bradycardia:

- Asymptomatic coincidental finding, especially if nocturnal
- Fatigue
- Exertional dyspnoea
- Less commonly, pre-syncope or syncope
- May be intermittent or persistent.

ECG in bradycardia: Look for p waves or non-conducted p-waves (heart block). Look for ST or T wave changes of ischaemia/AMI.

Causes:

- Physiological sinus bradycardia (fit, young patients at rest) in which case it is asymptomatic (and requires no treatment)
- Drug induced (e.g. beta-blockers, calcium channel blockers, some overdoses)
- Systemic illness (e.g hypothyroidism, hypothermia)
- Electrolyte abnormalities, especially hyperkalemia
- Sinus node disease
- Myocardial ischemia/infarction

Assessment and Treatment:

- Assess hemodynamic status (BP, level of consciousness, urine output, signs of heart failure)
- Identify and treat causative factors (drug history, thyroid status, electrolytes)
    - Identify and treat electrolyte abnormalities (especially hyperkalemia)
    - Cease medicines that slow heart rate (calcium channel blocker, ß-blocker, digoxin). If SBP>90 mmHg, this may be all that is required. Monitor heart rate and BP.
    - For myocardial ischemia/AMI, see Section 3.3.2.
    - Send thyroid function tests if no obvious medication causing bradycardia.
- For profound bradycardia (<40 bpm) with hypotension (rare), give atropine 0.5 mg (maximum of 3 doses) and assess response. If no improvement, give epinephrine in increments of 100-200 mcg (higher increments if profoundly hypotensive); watch for side effect of severe hypertension). Dopamine or epinephrine infusion can also be used (See vasopressor table which follows). Refer to facility with pacemaker service.
- Patients with second degree, Mobitz II or third degree heart block also need to be referred for pacemaker implantation.

Most bradycardias have a good prognosis.

Atrial fibrillation (AF)

Atrial fibrillation is the commonest clinical arrhythmia, affecting 1% of the population.

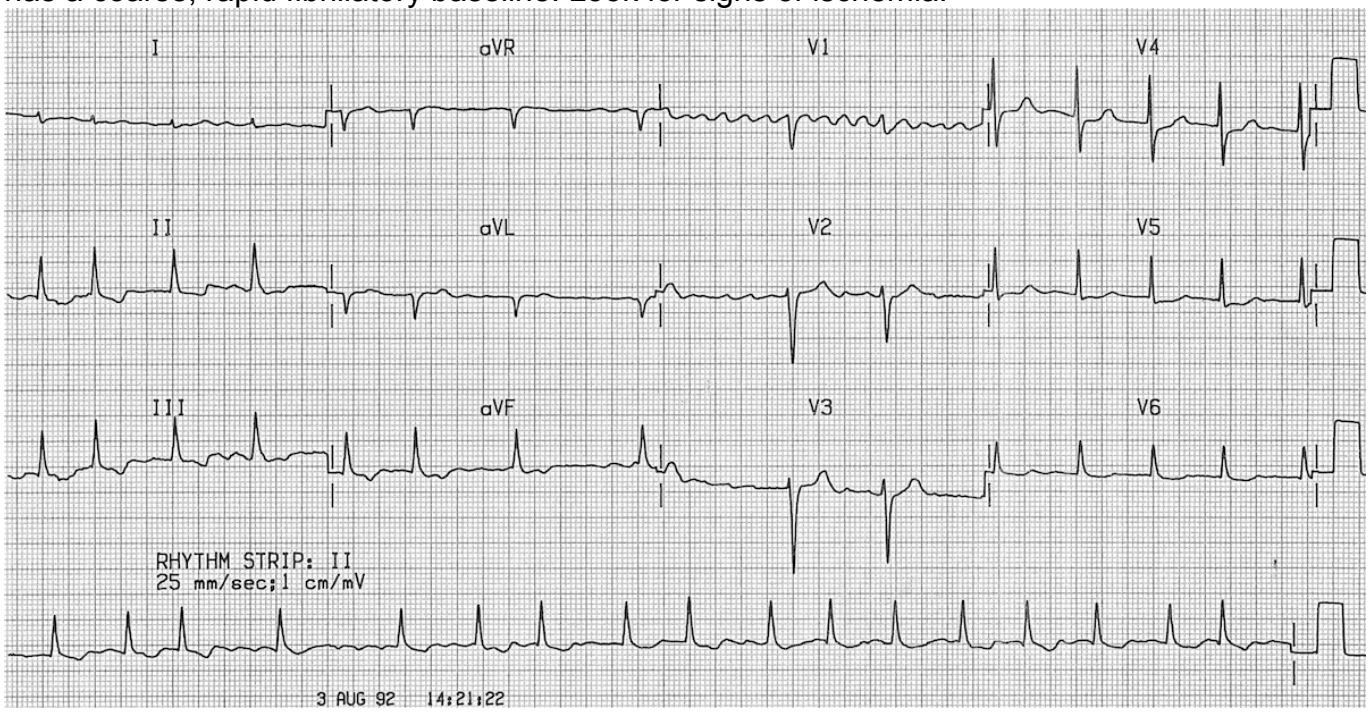
Key clinical features:

- Symptoms result from a rapid, irregular ventricular rate and loss of atrial contribution to ventricular filling and cardiac output
- Patients may be asymptomatic, or have palpitations, light headedness, weakness, chest pain, dyspnoea, pre-syncope, syncope, angina, hypotension, or frank pulmonary oedema.
- Some patients present with an embolic event (particularly stroke; emboli to bowel and legs also possible).
- AF may be *paroxysmal* (spontaneously reverts to sinus rhythm), *persistent* (requires pharmacologic or electric cardioversion to restore sinus rhythm, or a decision to manage with rate control) or *permanent* (sinus rhythm cannot be restored; manage with rate control).

Causes:

- Idiopathic
- Hypertension
- Mitral valve disease
- Cardiomyopathy (ischemic, dilated or hypertrophic)
- Acute infection
- Thyrotoxicosis
- Post-surgery.

ECG: Look for irregular ventricular rhythm and no discrete atrial activity (although lead V1 often has a coarse, rapid fibrillatory baseline. Look for signs of ischemia.



Treatment –

- For stable patients two principal strategies are: restoration of sinus rhythm (amiodarone) or ventricular rate control (calcium channel blocker, ß-blocker, or digoxin). Some drugs (amiodarone) may address both. If not responding, refer. .

AF with severe hemodynamic compromise

Ventricular rate typically >150 bpm, with hypotension and hypoperfusion (reduced conscious level, pulmonary oedema, or cardiac ischemia).

- Give oxygen
- If no DC cardioversion available, on site, give IV amiodarone 150mg and *refer urgently for synchronized DC cardioversion under conscious sedation preferably with midazolam using 200 – 360J monophasic or 150 – 200J biphasic energy*

Ventricular tachycardia (VT)

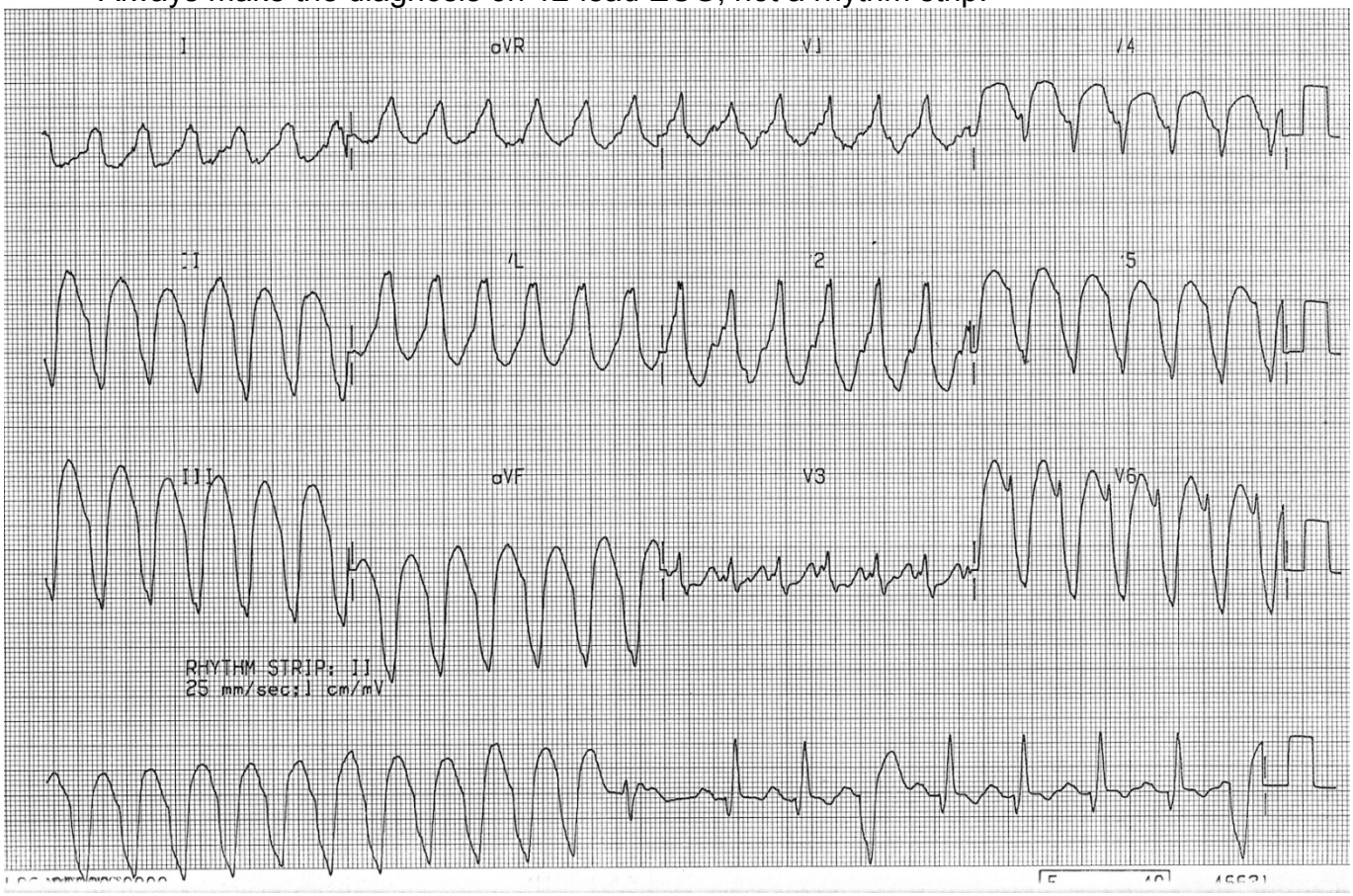
A broad complex tachycardia should be assumed to be VT until proven otherwise.

Key clinical features

- The ventricular rate may be anywhere between 100 and 300 bpm
- Symptoms range from none to palpitations, chest pain and dyspnoea, and hemodynamic collapse with cardiac arrest
- Tachycardia may be sustained or non-sustained

ECG:

- Broad complex tachycardia
- Always make the diagnosis on 12-lead ECG, not a rhythm strip.



Causes:

- Ischemic heart disease (acute or chronic)
- Non-ischemic cardiomyopathies (hypertrophic, dilated, arrhythmogenic right ventricular)
- Idiopathic

Treatment

- For unstable patients with VT, start IV amiodarone 150mg and refer urgently to facility with DC cardioversion.
    - Even VT that appears to be well tolerated has the potential to deteriorate rapidly so referral for treatment needs to be done promptly, particularly in patients with known or suspected impaired LV function
    - For stable patients with VT, give oral amiodarone 200 mg stat and refer.

3.2.6.2 Management of pericardial effusion and tamponade

Key clinical features:

- Chest discomfort
- Breathlessness
- Faintness and syncope
- Cough and dysphagia
- Tachycardia (> 100 beats/min), may be lower in hypothyroidism and uremia.
- Reduced pulse pressure
- Hypotension
- Jugular venous distension (rises on inspiration – Kussmaul's sign)

- Pulsus paradoxus (the normal systolic pressure difference between inspiration and expiration is increased to over 10 mmHg. Clinically, the pulse fades on inspiration)
- Muffled heart sounds, non-palpable apex beat
- Dyspnoea or tachypnoea with clear lungs

Investigations:
- ECG – reduced voltages, electrical alterans (as the heart swings in the fluid)
- CXR – globular heart, convex or straight left heart border
- Ultrasound – common findings include:
    - General probe: Pericardial effusion
    - Cardiac probe:
        - Diastolic collapse of right ventricular free wall and right atrium
        - Dilated IVC with no inspiratory collapse and reversed flow with atrial contraction
        - Tricuspid flow increased during inspiration
        - Mitral flow decreased during inspiration

Causes:
- Often idiopathic
- Viral (e.g. coxsakie, epstein-barr virus)
- Bacterial/mycobacterial – TB, acute rheumatic fever, pneumonia (can be associated with pleural effusion)
- Malignancy
- Uraemia
- Autoimmune (SLE, rheumatoid arthritis)
- Post MI (Dressler's syndrome)
- Post-cardiac surgery
- Hypothyroidism
- Chest radiotherapy
- Trauma (e.g. blunt chest injury)

Treatment:
- Pericardiocentesis should be performed urgently. See Section 7.4.5.
  NOTE: removing only a small amount of fluid can improve haemodynamics considerably.
- IV fluid resuscitation can temporise until pericardiocentesis done.

3.2.6.3 Hypertensive crisis and malignant hypertension

Definitions/key clinical features
Hypertensive urgency: Severe hypertension SBP>180/DBP>120 mmHg with no end/target organ damage

Hypertensive emergency: severe hypertension SBP>180/DBP>120 mmHg with evidence of end/target organ damage. Look for these clinical features of end organ damage:

- Hypertensive encephalopathy: altered mentation, papilloedema, retinal haemorrhage
- Acute renal failure: oliguria, urine dip stick (haematuria)
- Acute left ventricular failure: pulmonary oedema with crepitations
- Acute aortic dissection: blood pressure/ pulse differential between the arms, chest pain radiating to the back
- Pre-eclampsia/ eclampsia: hypertension in pregnant or post-partum patients
- Stroke/intracranial hemorrhage: altered mental status and focal neurologic deficit

Look out for precipitating factors like poor treatment adherence, thyrotoxicosis, pheochromocytoma, etc.

In a hyptertensive urgency (no signs of acute end organ damage) the goal of management is to reduce the BP below 160/100 mmHg over several hours to days.

The initial aim of treatment in hypertensive emergency is to bring the diastolic blood pressure between 100-105 mmHg within 2-6 hours; the maximum initial fall in BP should not exceed 25% of the initial presenting BP.

NOTE: Rapid BP reduction may lead to death or permanent neurological damage as a result of ischaemia.

Treatment of hypertensive urgency
The principal is to use oral anti hypertensive drugs. Start with a logical combination of two different drugs (A+C, A+D, C+D, A+B, C+B)
A: ACEI's/ARB's like captopril 25 mg 8 hourly
B: beta blockers like atenolol 50 mg once daily
C: calcium channel blockers like nifedipine 20 mg 12 hourly **(**Note that sublingual nifidipine is contraindicated because it lowers BP too quickly, which can cause stroke.)
D: HCTZ 25 mg or bendroflumethazide (bendrofuazide) 5mg once daily, or.

Treatment of hypertensive emergency:

Treatment principle is to use intravenous medications:

- Give hydralazine 10mg IV diluted in normal saline every 30 minutes until BP controlled.
    - Take blood pressure before each dose.
    - Stop hydralazine if diastolic BP is < 100 mmHg.

OR

- If available, IV labetalol is the medicine of choice:
    - Give 20 mg push over 2 minutes
    - May administer 40-80 mg at 10 minute intervals; total cumulative dose should not exceed 300 mg.

- Once the crisis situation has been managed, add 2 or more oral agents (diuretic, ß blocker, vasodilator, ACE inhibitor, calcium antagonist) to maintain BP below 140/90 mm Hg.
- If suspected phaeochrocytoma, refer (patient may need α-blocker phentolamine for BP control (before ß-blocker)

Note: In the absence of IV medications, give oral antihypertensives and refer urgently.

3.3 Approach to the patient with chest pain

3.3.1 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 neck, jaw, or left arm, shoulder and back, and abdomen) • Associated with nausea and shortness of breath • Duration is short, 2-10 minutes • Easily relieved or abates on cessation of exertion, with rest • Can also easily be relieved by use of nitroglycerin • History of ischaemic heart disease • Risk factors − hypertension, diabetes, cigarette smoking, obesity, hyperlipidaemia/dyslipidemia, tobacco, family history • Resting ECG – normal in half of patients or with non-specific ST-T changes
Acute coronary syndrome (unstable angina, non-ST elevation or ST elevation myocardial infarction) see Section 3.3.2	• Severe "crushing" central chest pain ± radiation to jaw, neck or arms (pressure, tightness) at rest • Sweating, clammy • Nausea and vomiting • Breathlessness, shortness of breath • Atypical presentation may include pain in the back or abdomen, and confusion • History of coronary artery disease • History of cardiac disease • Risk factors − hypertension, diabetes, sickle-cell anaemia, smoking, hyperlipidaemia/dyslipidemia, tobacco, family history • ECG normal or with changes – ST elevation changes, left bundle branch block in STEMI; in cases of unstable angina and non-STEMI- 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 embolism see Section 3.3.3	• Presence of major risk factors which include: o Recent abdominal/pelvic surgery o Recent hip/knee replacement recent immobilization, travel, pregnancy, cancer, recent surgery, long bone or pelvic fracture o Lower limb fracture o Heart disease in failure o Varicose veins o Recent caesarean section o Post-partum period o Abdominal/pelvic malignancy o Advanced metastatic malignancy o Prolonged immobilisation during hospitalisation, air travel o History of venous thromboembolism (DVT)

	○ Pregnancy or contraceptive pills • Evidence of DVT – swollen leg • May have fever (usually mild) • Cough • Difficulty breathing, breathlessness • Fast breathing • Cyanosis • Haemoptysis • Tachycardia • Syncope • SPO2 at ≤ 85% • Elevated JVP • Hypotension • Engorged neck veins • Right ventricular hypertrophy • ECG changes: sinus tachycardia, right bundle branch block, 1^0 AVB; premature ventricular beats, ST-T wave abnormalities.
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
Less common causes	
Oesophageal rupture	• Sudden onset central chest and abdominal pain • During or following excessive vomiting • Vomiting blood • Shock
Aortic dissection	• Instantaneous pain of cataclysmic severity • Pain pulsatile or tearing • Pain is in anterior thorax or inter-scapular region and migrates as dissection progresses. • Tearing pain radiating to the back, abdomen or between shoulder blades • Asymmetrical pulses or BP • New stroke • Causes and associations: ○ Hypertension ○ Bicuspid aortic valve ○ Marfan's syndrome ○ Aortic coactions ○ Iatrogenic (angiography) • ECG: non-specific ST-T wave changes; left ventricular hypertrophy
Tension pneumothorax see Quick Check page 22	• Difficulty breathing • Elevated JVP • Displaced trachea to opposite side • Decreased breath sounds on affected side • Hyper-resonance 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	• Chest pain, typically retrosternal, sharp • Sharp, posterior pain • ± radiation to the back/scapula • Relief when leaning forward • Sometimes pain is postural (worsens on lying flat, better when sitting up. • Can be worse with deep inspiration • ± shortness of breath • Onset over hours, occasionally minutes, sudden • History of coryzal illness in preceding 1-3 weeks • Acute rheumatic fever, TB pericarditis, chest trauma • ECG: 10% normal; if abnormal- diffuse, "saddle-shaped" ST elevation, non-specific T-wave inversions

3.3.2 Management of acute coronary syndrome

Key clinical features:

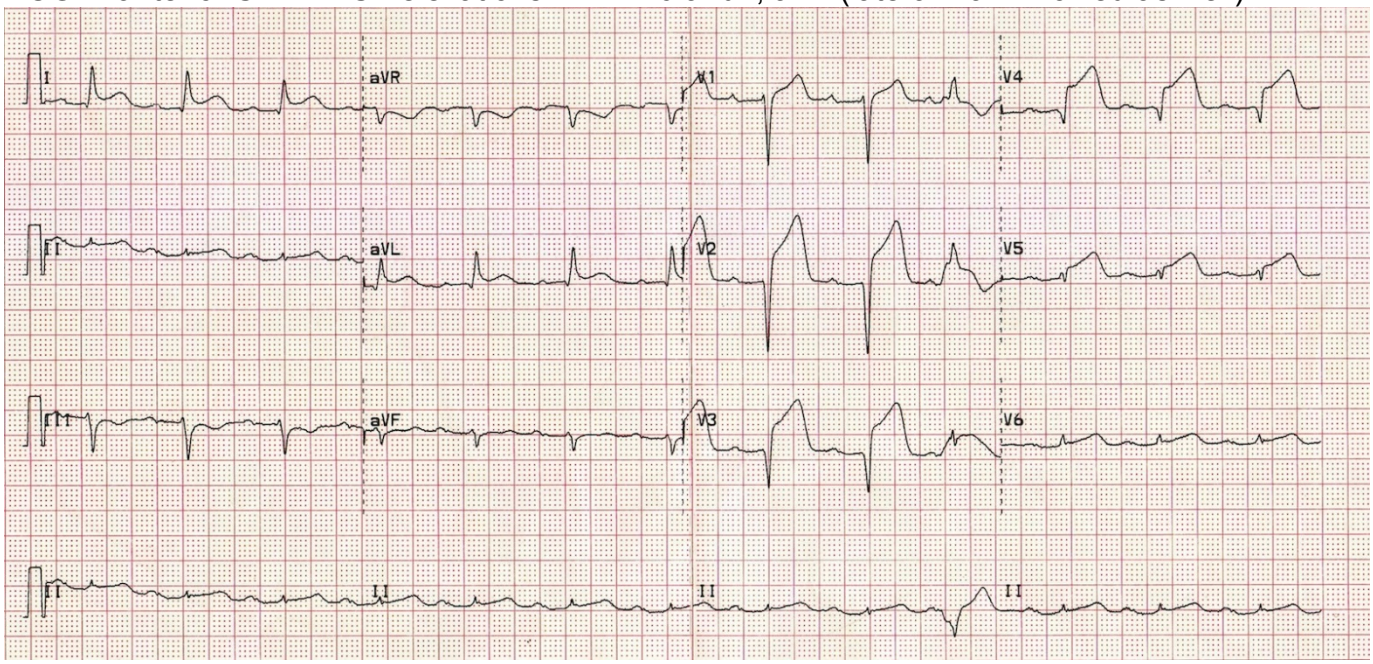
- Severe "crushing" central chest pain ± radiation to jaw, neck or arms(pressure, tightness, heaviness) at rest
- Sweating, cold and clammy skin/peripheries
- Nausea and vomiting
- shortness of breath
- Atypical presentation may include pain in the back or abdomen, confusion or collapse
- History of coronary artery disease
- History of cardiac disease
- Risk factors − hypertension, diabetes, sickle-cell anaemia, tobacco smoking, hyperlipidaemia/dyslipidemia, family history, sedentary life style, central obesity.

Urgent investigations include:

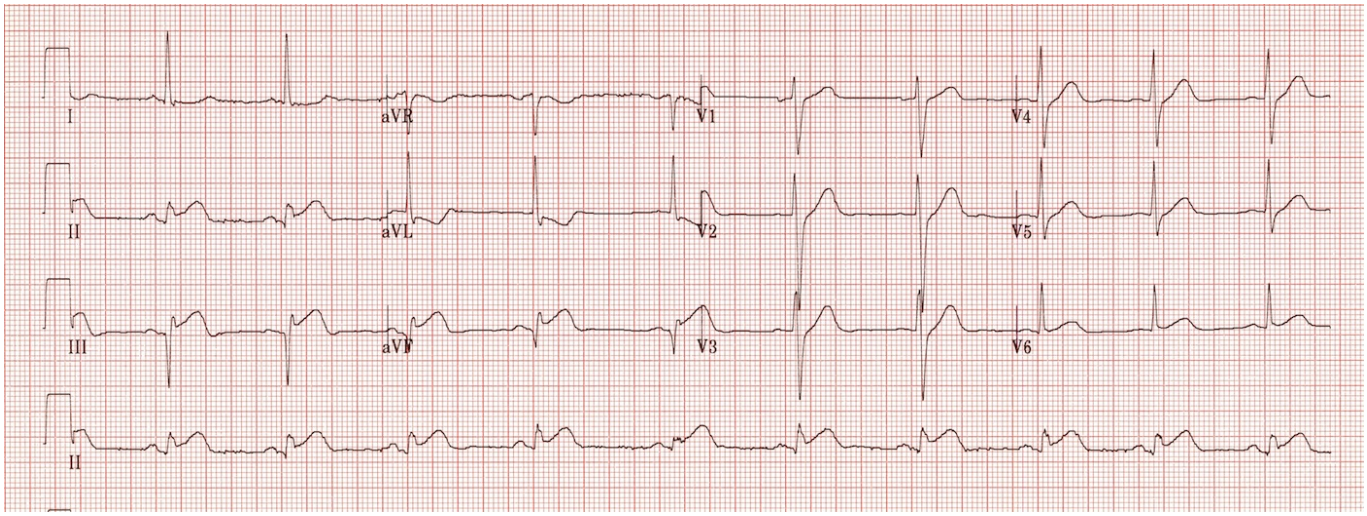
ECG: STEMI: ST elevation or new onset left bundle branch block; non-STEMI: ST depression or T wave inversion

Pulse oximetry to measure SpO_2

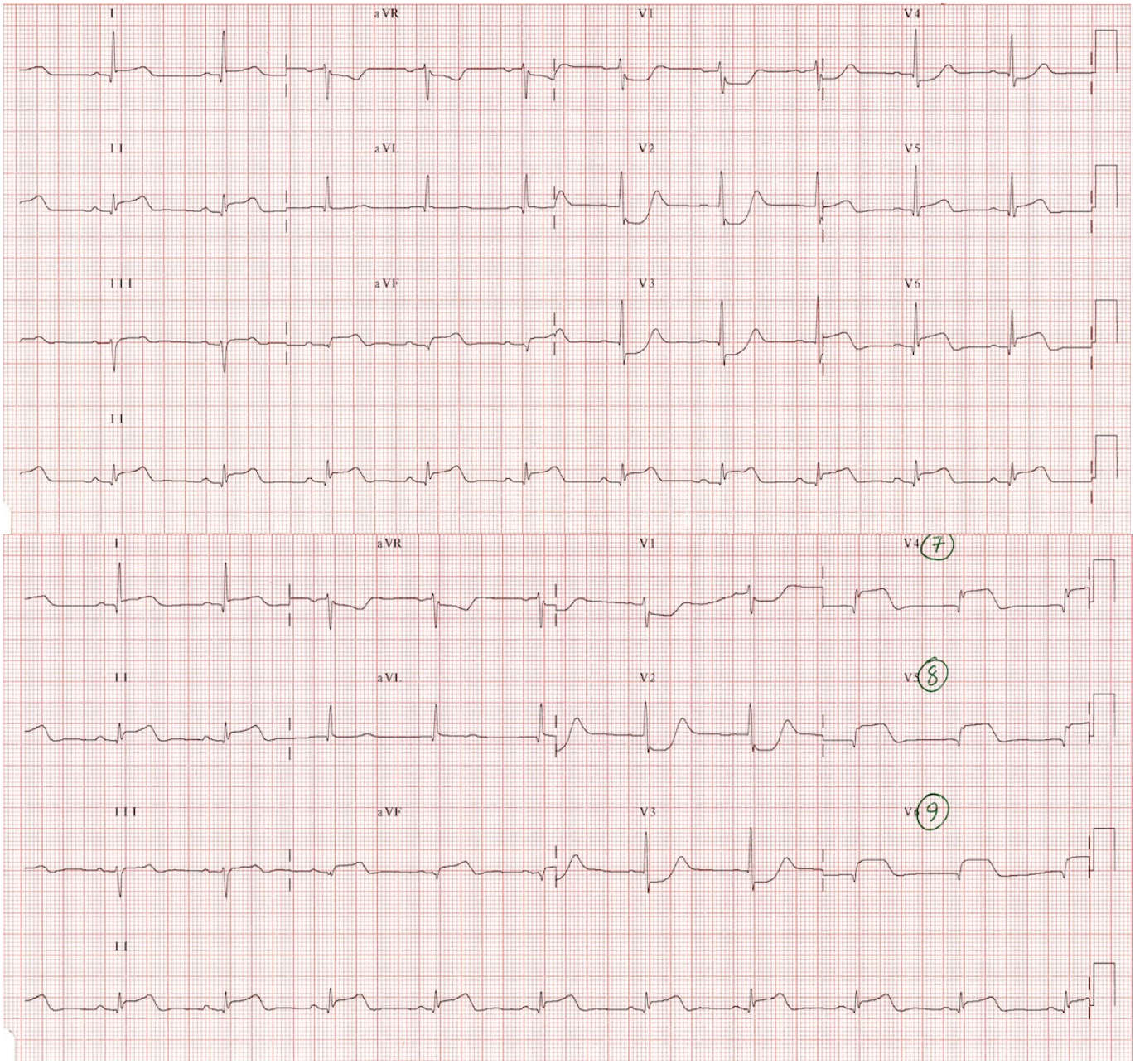
ECG in anterior STEMI: ST elevations in V1-V6 and I, aVL (lateral wall involved as well)



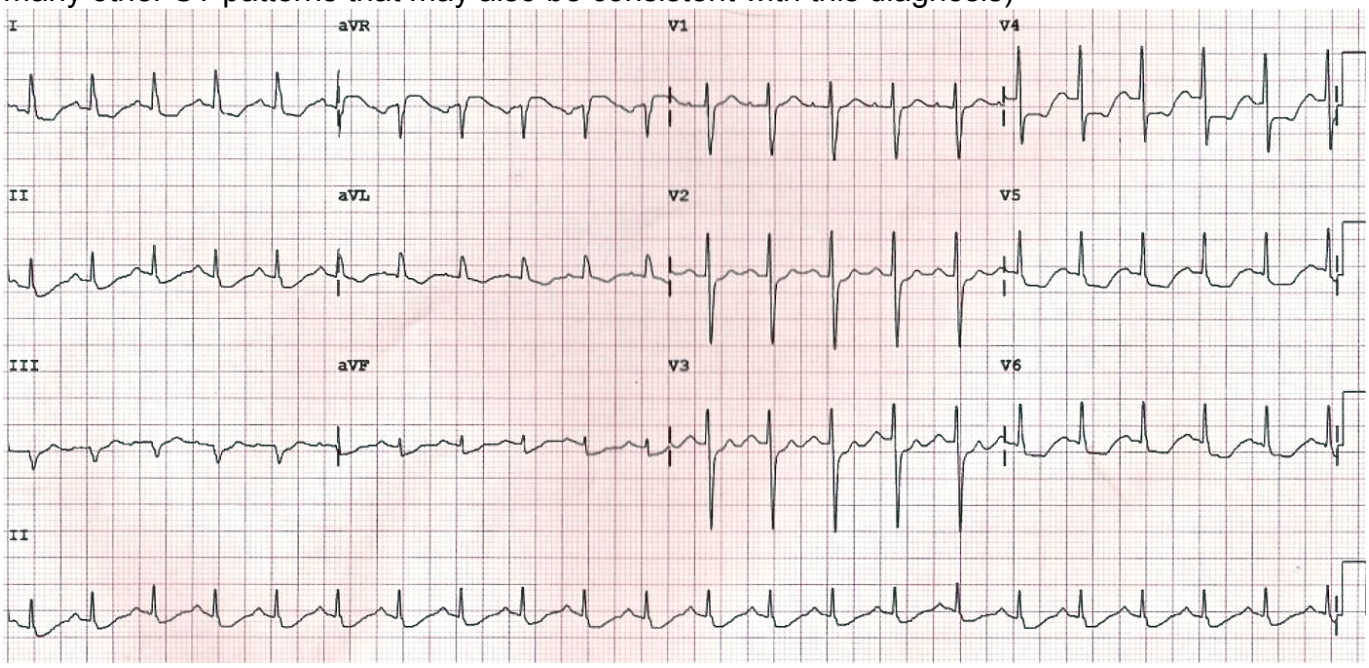
ECG in inferior STEMI: ST elevations in II, III, and aVF



ECG in posterior STEMI: ST depressions in V1-V3 should raise suspicion of posterior infarction (a15-lead ECG including leads V7-V9 should be performed; it will show ST elevation in the posterior leads)



ECG example of diffuse ST-segment depression that may be seen in non-STEMI (there are many other ST patterns that may also be consistent with this diagnosis)



Emergency management:
Remember that "time is myocardium"

- Oxygen (irrespective of SpO_2)
- Aspirin 300 mg chewed for rapid buccal absorption + clopidogrel 300mg (if available).
- Establish an IV line
- Morphine – titrate (start with 2.5-5 mg 4 hourly IV- see Sections 8 and 20))
- Sublingual GTN 0.2-0.5 mg every 5 minutes for maximum of 3 doses in 15 minutes.
- Oral β-blocker e.g carvedilol 3.125 -12.5 mg 12 hourly or metoprolol 25 – 50 mg tds (in absence of low blood pressure)
- Subcutaneous low molecular weight heparin (LMWH) like enoxaparin, tinzaparin (1mg/kg/24hours) in STEMI or non-STEMI
- ACEI's/ARB's within the first 24 hours (in absence of low blood pressure)
- Statin like atorvastatin 40-80 mg once daily
  NOTE: monitor blood pressure every 15-30bminutes when patient is on GTN, ACEI's/ARB's and B blockers

Refer immediately to referral centre for thrombolysis or primary percutaneous coronary intervention.

3.3.3 Management of acute pulmonary embolism

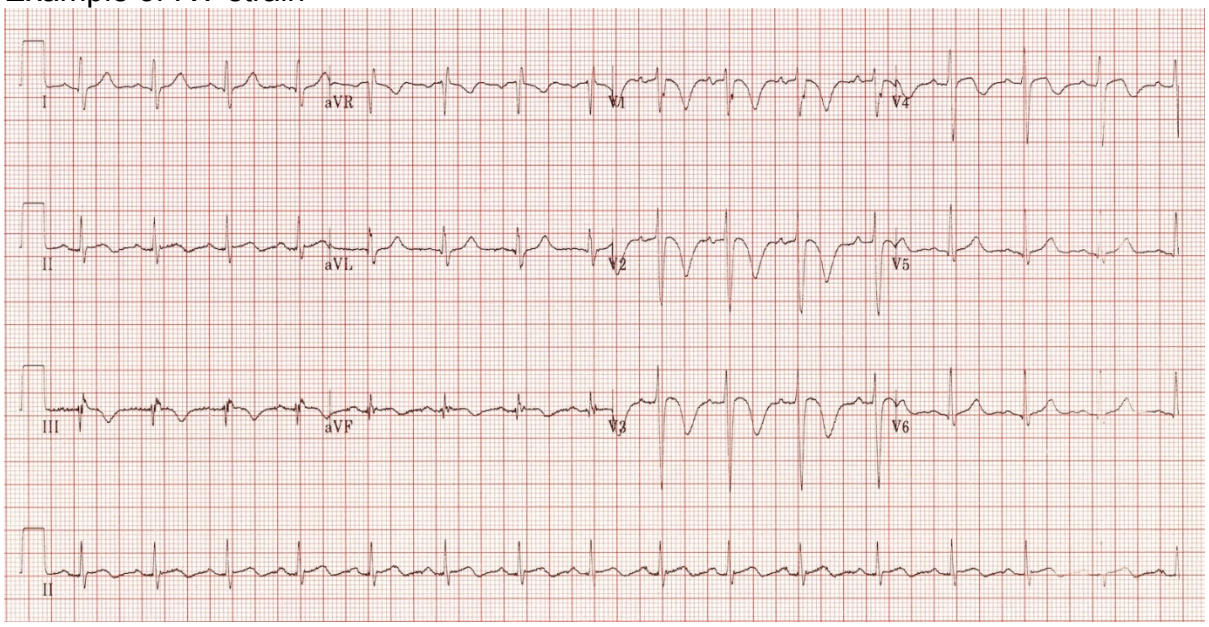
Key clinical features

- breathlessness
- tachypnoea (rapid respiratory rate)
- chest pain
- cough
- collapse
- haemoptysis
- tachycardia
- fever
- elevated JVP
- hypotension
- cyanosis.

Risk factors
Immobility, history of surgery, long haul travel, HIV, Oral contraceptives, pregnancy, smoking, obesity, malignancy, chronic heart failure.

Investigations:
- Pulse oximetry to measure SpO_2
- ECG- sinus tachycardia, other non-specific changes (including RV strain pattern)

Example of RV strain



- Chest X-ray: Normal in most cases but may show wedge-shaped peripheral infarcts or pulmonary effusions.
- Ultrasound:
    - Cardiac echo may shows dilated hypocontractile right ventricle with increased pressure and tricuspid regurgitation.
    - Compression ultrasound of the legs may show deep vein thrombus

Emergency management:
If you suspect PE, start emergency treatment and refer urgently.

Emergency treatment
- Institute resuscitation measures depending on the haemodyamic status of the patient:
- Oxygen
- Analgesia (morphine or NSAIDs if pleuritic pain)
- Cautious use of intravenous fluids if patient is hypotensive
- Dopamine or epinephrine (see Section 3.1.4) can be used for shock.
- Anticoagulation:
    - start low molecular weight heparin 1 mg/kg every 12 hours, **if** no history trauma or other bleeding problem.

Refer urgently all patients with suspected massive PEs

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

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
- P – responds to pain
- V – responds to voice
- 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 19 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 21 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 21).
- Exclude additional serious causes – shock (low blood pressure), respiratory failure (cyanosis, difficulty breathing).
- Abnormal temperature (>38^{o}C or <36^{o}C)
- 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 11.43	• Endemic areas in Africa • Intermittent fever, headache • Generalized lymphadenopathy, particularly in posterior cervical triangle • Slow onset • Poor concentration and personality changes
Encephalitis	• Fever • Altered conscious state, personality change, coma • Seizures
Rabies see Section 11.31	• 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)
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: o confusion o poor attention o poor short-term memory o cognitive deficits below baseline functioning
Eclampsia see Quick Check page 28	• 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, papılloedema)
Hypertensive encephalopathy see Section 3.2.6.3	• 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 hepatıcus* (musky breath) • Jaundice, hypoglycaemia
Uraemia see Section 11.32	• Asterixis – uraemic flap • Peripheral oedema, ascites, uraemıc 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 • Abdominal complaints e.g diarrhoea
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 19).
- 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 delirium that presents with agitation or psychotic symptoms, give the patient low doses of antipsychotic medications (haloperidol) (see Quick Check page 29 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 and monitor vital signs regularly.
- 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 29). 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. DKA is a major source of morbidity and mortality; therefore, preventing it should be the primary goal.

Risk factors for DKA:

- Lack of insulin in the body
  - omission of insulin dose or
  - new diagnosis of diabetes mellitus
- Stress
  - infections
  - psychological
  - trauma
  - surgery
  - myocardial infarction
  - stroke
- Certain medicines
  - steroids
  - beta-blockers
  - thiazide diuretics

DKA causes

- 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.

Key clinical features

- 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 slide or RDT for malaria parasites
  - 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 12–16 to assess airway and breathing, to protect the airway, and to give oxygen as needed. Use Quick Check page 4 to assess the circulation.

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.
- Avoid potassium containing fluids like Ringers Lactate at this point.

Manage potassium (see Section 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.
- Do not begin replacement until the level is <5.3 and there is adequate urine output (more than 50 ml/h).
- 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.
- Potassium chloride supplementation – maintain the K level between 4–5 mEq/l.
- 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.
- 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 on next page.

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.

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.**
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.

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 (Section 18.1).

Assess for signs of infection and initiate antibiotics as indicated.

3.4.4 Manage hyperosmolar hyperglycemic non-ketotic syndrome (HONK)

Definition

It is characterized by extreme hyperglycemia (> 600 mg/dl) and serum hyperosmolarity (> 320 mOsm/L) but with little or no ketosis.

Those at risk

- Elderly
- Those with reduced intake e.g. vomiting.

Causes

- infection
- new onset diabetes
- medicines particularly steroids
- insulin under-dosing

Key clinical features

- confusion
- coma
- focal or generalized seizures
- extreme dehydration (extemely dry skin and mucous membranes)
- hypotension
- features of thrombotic events in various organs e.g. stroke, myocardial infarction

Investigations

- hyperglycemia RBG > 600mg/dl in absence of severe ketonemia
- gross elevation of haematocrit,
- high urea nitrogen, creatinine, and albumin.
- lactic acidosis is common
- serum bicarbonate level - low and the anion gap increased.
- serum osmolarity > 320mOsm/L
- serum sodium level is usually elevated

Treatment

Fluid

- Fluid replacement is the most important component of therapy.
- Administer IV normal saline initially. If the patient is in shock, give 1 to 2 L/hour initially to correct shock; otherwise, give 500 ml/hour for 4 hours, then 250 ml/hour for 4 hours.
- Once plasma glucose reaches 14.0 mmol/L, add glucose to maintain plasma glucose at 12.0 to 14.0 mmol/L.

Insulin

- Insulin treatment, as for DKA in (section 3.4.3), is started after at least 1 or 2 litres of 0.9% saline has been administered.

Electrolytes

- Add potassium immediately if patient is normo- or hypokalemic. Otherwise, if initially hyperkalemic, only add potassium once serum potassium falls to <5 to 5.5 mmol/L and patient is urinating.

Comorbidities

- If infection is suspected, use broad spectrum antibiotics.
- Patients with histories of arterial and venous thrombosis can benefit from low-dose prophylactic heparin administration

Prevention

- Ensure proper education and treatment of diabetes of patients
- Appropriate and timely management of co-morbid conditions in diabetes.

3.4.5 Manage hypoglycaemia

Hypoglycaemia can be defined as a blood glucose level of <3.1 mmol/litre (<50 mg/dl); (≤3.9mmol/l in diabetics). 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 administered) as confirmation of hypoglycaemia.

Key clinical features

- 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.

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)

Investigation

If hypoglycaemia is suspected, perform a finger-prick test or carry out laboratory testing immediately to either confirm or rule it out.

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 (patient is alert with symptoms of hypoglycaemia) is usually treated with food, oral glucose powder or tablets, or sucrose solutions. The guide is to administer 15–20 g glucose, 15–20 g glucose (e.g 3 teaspoons sugar, 175 mL (3/4 glass) of juice or soda, 1 tablespoon of honey, a banana) to raise blood glucose . If the patient is conscious, give sweet drinks (not diabetic or sugar-free).

- 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 19). 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.
- Glucagon injection 0.5 mg for age < 12 years, 1 mg for age > 12 years for hypoglycaemia not responsive to IV dextrose.
- 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.

3.4.6 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:
Infectious adrenalitis

- 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 sudden withdrawal of steroids that had been used for a long time (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.

Key clinical features

Symptoms	Signs
• fatigue, lack of energy, reduced strength • Anorexia, gastric pain, nausea • Myalgia, joint pain • Dizziness • Salt craving (usually in primary adrenal insufficiency) • Dry and itchy skin • Loss or impairment of libido	• Skin hyperpigmentation (primary adrenal insufficiency) • Fever • Hypotension (SBP<100mmHg) • Postural hypotension (pronounced in primary adrenal insufficiency)

Investigations

- Electrolytes (may show hyperkalemia, hyponaetremia, hypercalcemia- usually in primary adrenal insufficiency)
- CBC (may show anaemia, eosinophilia, lymphocytosis)
- glucose (finger-prick or laboratory) (may show hypoglycaemia)
- early morning cortisol and ACTH (take sample between 7-9 am
- 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 19).
Commence urgent steroids. Give 100 mg hydrocortisone IV or 8 mg dexamethasone IV immediately then repeat every 8 hours. Half to two thirds of the daily dose should be given in the morning to mimic the natural production of cortisol in the body.
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.
In suspected primary adrenal insufficiency, give fludrocortisone 0.05-0.2 mg daily as one dose in the morning.

- 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.

3.4.7 Syncope[1]

Definition: A transient, self-limited sudden loss of consciousness, usually leading to falling.
Syncope can be caused by a wide spectrum of conditions, ranging from the benign faint to potentially life threatening cardiac arrhythmias. The challenge is to establish the right cause for appropriate treatment and referral.

Diagnosing syncope

- History and examination are the most important steps in differentiating between syncopal and non-syncopal causes
- Conditions that mimic syncope include epilepsy, hypoglycemia and intoxication
- Remember that many elderly patients with syncope describe the episodes as falls, often failing to recognize loss of consciousness.
- Some conditions without a real loss of consciousness may mimic syncope (falls, cataplexy, psychogenic syncope, transient ischemic attacks)

Questions to ask

- Inquire about the 3 P's
  - Provocative factors (fatigue, dehydration, warm atmospheres, emotional circumstances, fear, pain)
  - Prodromes (nausea, sweating, giddiness, abdominal discomfort)
  - Postural components (standing, sitting or lying)
- Try to obtain a witness account of the episode.
- How long did the episode last? Arrhythmic syncope can be very brief with almost immediate recovery such as intermittent AV blocks in Stokes- Adams attacks.
- How long did the patient take to recover and how did they feel? Was there confusion?

Causes

Neutrally mediated syncope and orthostatic hypotension cause of over 50% of syncope cases. Cardiac causes represent 15% of cases. Neurological and psychiatric causes are found in 10%

Neurally-mediated (reflex) syncope	Orthostatic Hypotension	Cardiac arrhythmias and other cardiovascular causes
• Vasovagal syncope • Classical (simple faints) • Non Classical (unprovoked) • Situational syncope • Swallow, cough, micturition • Carotid sinus hypersensitivity	• Autonomic failure o Primary (e.g. pure autonomic failure, multi system atrophy and Parkinson plus syndromes) o Secondary like diabetes mellitus • Drug induced (vasodilator therapy) • Volume depletion (diuretics, fluid loss and Addison's disease)	• Sinus node dysfunction • Atrioventricular block • Paroxysmal arrhythmias • Inherited syndromes e.g. Long QT, Brugada syndrome • Drug induced bradycardia or prolonged QT interval Other cardiovascular • Obstructive vulvular disease (e.g. aortic stenosis) • Aortic dissection • Pericardial tamponade • Pulmonary embolism • Atrial myxoma

Investigations

- Carotid sinus massage to diagnose carotid sinus hypersensitivity
- 12 lead ECG
- CXR: cardiac enlargement on aortic dissection
- Echocardiography
- Electroencephalogram (EEG) where applicable
- *Some patients my require referral for brain CT scan.*

Treatment

- Non pharmacological measures in patients with vasovagal syncope like education, reassurance, leg crossing or hand grips during prodromes to delay or avoid loss of consciousness.
- Address the specific cause. (Refer to *Uganda Clinical Guidelines* or other Sections of this manual for management of specific causes)
- In case of cardiac syncope, refer for further management.

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
Cerebral lymphoma or other Intracranial mass 	• Headache • Nausea, vomiting • Other focal neurological signs and symptoms (unequal pupils, cranial nerve findings, limb weakness, papılloedema)

Management of acute seizures

- Check the patient's airway, breathing. Place in recovery position (see Quick Check page 19). Give oxygen using nasal prongs.
- Give IV glucose D50 25–50 ml slowly (see Quick Check page 19).
- 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 28); 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.

- Use the Quick Check to check airway, breathing, circulation.
- Administer oxygen.
- Put the person on their side to prevent aspiration
- **DO NOT** put anything into the mouth during a convulsion
- 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. It is critical to have a very good IV line as the drug is very caustic and will cause significant local damage if it extravasates
- 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 – 15 mg / kg IV (at a rate of 100 mg/minute) 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 12), 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), toxoplasmosis (see Section 11.41) and lymphoma (see Section 11.26).

3.6 Manage intoxication or overdose, or withdrawal from injecting or other use of opioids, amphetamine-type stimulants, or cocaine[1,2]

3.6.1 Opioid intoxication or overdose – Treatment of opioid intoxication or overdose 3.6.2 Manage opioid withdrawal – The effects of acute opioid withdrawal – Manage acute opioid withdrawal	3.6.3 Manage stimulant intoxication and overdose – – Standard stimulant intoxication – Complicated stimulant intoxication – Amphetamine and cocaine acute intoxication – initial management – Special features of cocaine intoxication or overdose 3.6.4 Manage stimulant withdrawal – Symptomatic management of withdrawal – Non-pharmacological management of withdrawal

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.

Treatment of opioid intoxication or overdose

See Quick Check (page 18) 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.

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

[2] *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.

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-actin; most effect is gone within 40 minutes and it wears off completely 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.
- Consider that they may have co-existing mental health problems/disorders (See Section 10.11)
- 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 reliableManage 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. Methadone (a full agonist)[3] is effective for relieving symptoms and ensuring that patients can complete a detoxification schedule.

- 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.

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.

[3] 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.

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 short term antipsychotics (haloperidol or chlorpromazine). **DO NOT** commence long-term antipsychotics
- Periodically monitor the patient's ECG, pulse rate, respiratory rate, BP and body temperature every 2-4 hours.

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.
- Give diazepam in titrated doses if person becomes agitated until the person is calm and lightly sedated.

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). Manage withdrawal symptoms as they emerge:

- Treat nausea with anti-emetics
- Treat pain with simple analgesics
- Treat insomnia with light sedatives
- Maintain hydration.
- Avoid restraining the person.

The person usually becomes symptom-free 1–3 months after stopping amphetamine use, although the cravings may persist for years. Allow the person to leave the treatment facility if they wish to do so.

Depressive symptoms may occur after withdrawal or during the withdrawal period and the person may have pre-existing depression. Be alert to the risk of suicide

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 e.g suicidal behaviour, absence of social supports or a previous complicated withdrawal.

3.7 Acute alcohol withdrawal and intoxication[1]

3.7.1 Acute alcohol withdrawal

The alcohol withdrawal state refers to a group of symptoms that may occur upon cessation of or reduction in alcohol after its prolonged daily use. It 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. And also to correctly identify and manage a patient who has alcohol withdrawal state with delirium and/or seizures

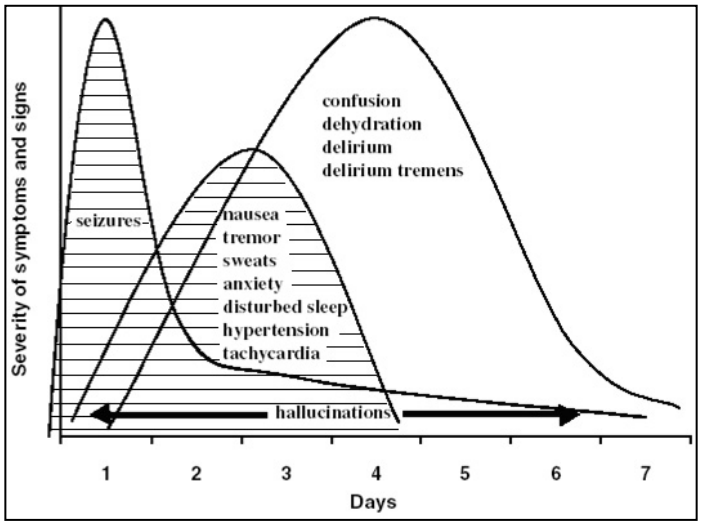
Alcohol withdrawal usually develops within 24 hours of the last drink, peaks at 2–3 days, and usually resolves within 5 days. When withdrawal seizures occur, this is usually in the first 48 hours. Confusion, delirium, and hallucinations occur in severe withdrawal, and can persist for days or (rarely)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

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

[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://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.

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. The dose and duration of diazepam treatment should be determined individually, according to the severity of withdrawal and the presence of other medical disorders.

If the patient presents in an alcohol withdrawal state or before withdrawal symptoms develop in the case of planned withdrawal, give diazepam 10–20 mg orally every 6 hours at an initial dose of up to 40 mg daily (i.e., 10 mg four times daily or 20 mg twice daily) for 3 – 7 days 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 19) 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 room which is well lit in the day time and lit enough at
night to prevent falls if the person gets up in the night., 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 5-10 mg diazepam slow IV administration, repeated if necessary every 15-30 minutes until the patient is in a state of light sedation or can take oral diazepam.
- Use antipsychotic medication only if necessary, for the duration of psychotic symptoms if present (e.g. haloperidol 2.5 – 5 mg orally 3 times a day)
- Exclude other causes of confusion or delirium, e.g. head injury, hypoglycaemia, hypoxia, infections commonly pneumonia, 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, 3 times daily for 5 days.
- Give adequate fluids IV.
- Avoid restraining the patient

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 12) 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.**[2] 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.

Is the patient at low risk of alcohol withdrawal?
- drinking <6 drinks per day, and
- no previous history of alcohol withdrawal.
- Not in withdrawal at the moment

→ No diazepam recommendation check daily, treat signs & symptoms/ other conditions.

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 symptom. 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).

[2] 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.

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.

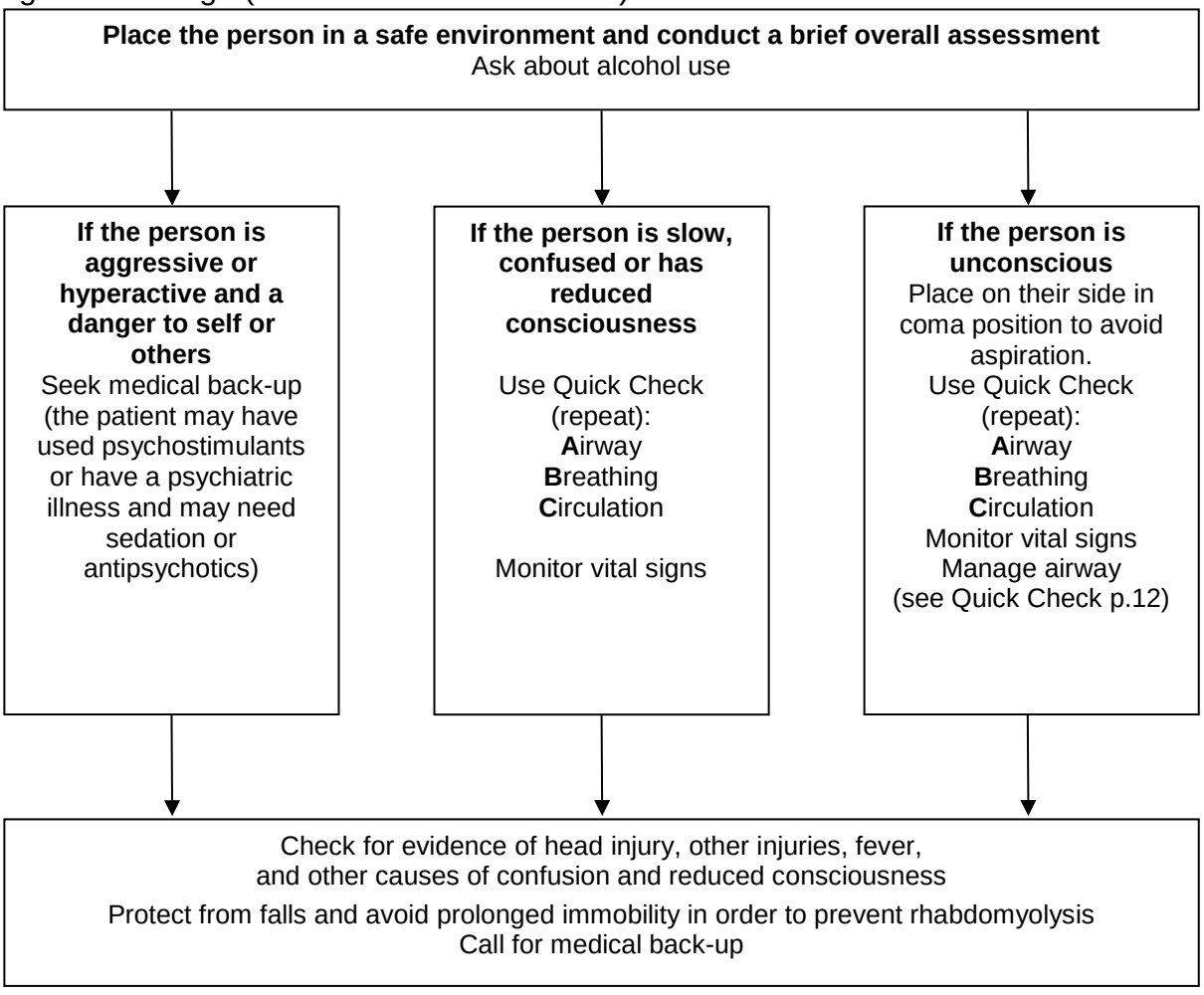
Ensure the patient is in a safe environment. Use Quick Check and monitor vital signs. Repeat Quick Check regularly. Conduct a brief overall assessment:

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).



3.8 Poisoning

3.8.1 Ingested poisons or overdose of medicines – Prevent aspiration of gastric contents – Assess airway and breathing – Assess circulation – Assess neurological impairment – Assess the need for antidotes – Risk assessment – Common agents ---Use clinical signs to know which poisons to suspect – Management principles for ingested poisons – Important considerations in resuscitation and stabilization that may differ from management of non-poisoned patients – Differences with standard guidelines for management of arrhythmias and advanced cardiac life support – Criteria for inpatient hospital admission – Removal of the poison from the gastrointestinal tract (gut decontamination) – Induction of vomiting (emesis) to treat poisoning should usually not be used – Very limited role for gastric lavage – Activated charcoal may be useful in the first 1–2 hours after ingestion for some poisons – Very limited role for whole bowel irrigation (WBI) for gut decontamination – Management of specific poisons – Table: Poisons or toxins, symptoms of toxicity in overdose, and brief guidance on specific management	3.8.2 Inhaled poisons – Table: Inhaled poisons or toxins, symptoms of toxicity, and brief guidance on specific management 3.8.3 Chemicals on the skin or in the eye – Health worker protection – Manage chemicals in the eye – Manage chemicals on the skin – Manage organophosphates or carbamate on skin – Manage exposure to tear gas (e.g. CN or CS gas)

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 19) 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 13) 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 18 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 31−34 for further details on advanced airway management. Patients who are drowsy should be managed in the recovery position (see Quick Check page 19) 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 30 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).

[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.

- **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 18 and Section 3.6).

Use clinical signs to know which poisons to suspect

Tachycardia	Bradycardia	Dysrhythmias
• Anticholinergic agents e.g. atropine, *Datura*, tricyclic antidepressants, carbamazepine, antihistamines • Salicylates (aspirin) • Theophylline/aminophylline • Sympathomimetics e.g. amphetamine, cocaine, ephedrine • Selective serotonin reuptake inhibitors (SSRIs) e.g. fluoxetine, paroxetine • Hypoxia caused by e.g. carbon monoxide, cyanide, methaemoglobinaemia (e.g. from propanil) • Chlorphenoxy pesticides e.g. 2,4-D, MCPA	• Digoxin • Beta blockers • Calcium channel blockers • Cholinesterase inhibitors e.g. organophosphorus pesticides, carbamates	• Chloroquine / quinine • Digoxin • Anticholinergic agents (e.g. tricyclic antidepressants, carbamazepine) • Theophylline/aminophylline • Dextropropoxyphene • Phenothiazines e.g. chlorpromazine • Sympathomimetics (e.g. amphetamine, cocaine, ephedrine) • Aluminium or zinc phosphide

Drugs / poisons causing pulmonary oedema
• Irritant gases • Petroleum distillates e.g. kerosene (after aspiration) • Salicylates (aspirin) • Opioids (e.g. pethidine, morphine) • Beta blockers • Organophosphates & carbamates • Aluminium or zinc phosphide • Ethylene glycol • Fluid overload (iatrogenic) in severe poisoning

Pupil changes	
Constricted	**Dilated**
• Opioids (e.g. pethidine, morphine) • Organophosphates & carbamates • Phenothiazines e.g. chlorpromazine	• Anticholinergic agents e.g. tricyclic antidepressants, carbamazepine, antihistamine • Sympathomimetics e.g. cocaine, amphetamines • Any cause of hypoxia or hypothermia

Poisons causing convulsions
• Anticholinergic agents (e.g. tricyclic antidepressants, carbamazepine) • Chloroquine / quinine • Phenothiazines • Opioids • Aspirin (severe poisoning) • Amphetamines • Monoamine oxidase inhibitors • Theophylline / aminophylline • Isoniazid • Hypoglycaemic agents • Serotonin syndrome • Drug withdrawal states • Ethylene glycol • Organophosphates & carbamates • Lead (encephalopathy in severe acute or chronic poisoning) • Hypoxia caused by e.g. carbon monoxide, cyanide or any severe poisoning

In addition to these "single" signs there are certain combinations that may give further help. One of the commonest patterns is a coma with flaccidity of muscles and hypotension:

Coma with flaccid muscles and hypotension
• Alcohol (severe intoxication) • Benzodiazepines (e.g.flunitrazepam) • Sedative hypnotics e.g. barbiturates • Opioids

Coma with brisk tendon reflexes, tachycardia and dilated pupils
• Anticholinergic agents e.g. tricyclic antidepressants

Restlessness with brisk tendon reflexes, hypertonia and fever
• Anticholinergic agents • Amphetamines • Monoamine oxidase inhibitors

Restlessness with malaise, nausea and weakness
• Organophosphates and other insecticides • Drug and alcohol withdrawal states • Carbon monoxide

Burns in the mouth with dysphagia and abdominal pain
• Corrosives / caustic agents e.g. alkalis and acids • Paraquat (weedkiller) • Glyphosate (weedkiller))

Changes in behaviour
Alcohol Drug and alcohol withdrawal states (see Sections 3.6-3.7) Steroids (e.g. chronic abuse) Solvents Any psychotropic agent Anticholinergic drugs and plants (e.g. *Datura*)

Some other syndromes:

Coma, miosis & respiratory depression = opioids

Coma, respiratory depression & bradyarrhythmias = gamma hydroxyl butyrate (GHB)

Coma, seizures & arrhythmias = tricyclic antidepressants

Coma, pink skin (& seizures) = cyanide or carbon monoxide

Chocolate cyanosis (=methemoglobinemia) = nitrites, propanil

Hyperventilation (because of metabolic acidosis): Toxic alcohols e.g. methanol, ethylene glycol

Hyperventilation (respiratory alkalosis) & agitation/tinnitus: Salicylates (early stage)

Hypersalivation, lachrymation, bronchorrhoea, bronchoconstriction, muscle fasciculation, miosis = cholinergic poisoning e.g. organophosphates, carbamates

It must be emphasised again that these features are not diagnostic but they do help to shorten list of likely poisons. A precise diagnosis can be made if blood and/or urine assay is available but this is unlikely. These lists are not meant to include all drugs but rather those that you are might come across.

The rule in the management of all patients who have been (or might have been) poisoned is to give supportive measures and not to jump to conclusions: we must not do more harm than good.

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.

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 12−13).
- If inadequate ventilation, assist ventilation with BVM (see Quick Check pages 12−13).
- If signs of severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14−16).
- If wheezing, give salbutamol (see Quick Check page 17).
- Is there an indication for advanced airway management with tracheal intubation (see Quick Check pages 31−36)?
  - 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 31 to 35 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 18 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 19).
- If consciousness is reduced, place in the recovery position.
- Manage seizures with diazepam *or lorazepam* (see Quick Check page 19 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 29 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).
- Always assess for suicide/self harm when patient is conscious (refer to Quick Check page 30 and Section 10.11 Mental Health problems).

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 36) 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 page 37), 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. Although Uganda does not currently have a functional service, a poison centre warm or hot line can be reached in Kenya: National Poison Information and Management Centre, Kenya +254-2726300 ext 44365 or +254-2725272.

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 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 an 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).

Medicines which are not on Uganda essential medicines list and lab not usually available are in italics.

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 18 and Section 3.1). Target adequate urine output. • Gastric lavage: Worthwhile up to 1 hour after poisoning as stomach emptying is delayed. • Give activated charcoal, 50 g repeated as needed every 4 hours or 25 g repeated prn every 2 hours • *Monitor electrolytes and bicarbonate 2 hourly*. • Correct hypokalaemia. Monitor and maintain serum K between 4 and 4.5 mmol/l. • Look out for and treat hypoglycaemia - give 25–50 ml D50 IV (see Quick Check page 19). • If available, 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. Note: sodium bicarbonate may only be available at regional referral hospitals, requiring referral. • 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.
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 18 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 (50 g repeated as needed every 4 hours or 25 g repeated prn every 2 hours) *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 (adrenaline) infusion (see Section 3.1.4). As a temporary measure which preparing an infusion, epinephrine injection 1 in 1000 (1 mg/ml) at dose IM 0.5 mg or IV 0.1 to 0.2 mg can be given and repeated (several times if necessary) every 10 minutes according to BP, pulse rate, and respiratory function, until improvement occurs 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 19 and Section 3.5). Avoid the use of phenytoin in propranolol overdose.
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 18 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease. • Give activated charcoal 50 g- 100 g if patient presents within 2 hours and is stable. • For sustained-release preparations, give multiple doses of activated charcoal (50 g repeated as needed every 4 hours or 25 g repeated prn every 2 hours) *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.

[3] Calcium chloride 10% – 0.2 ml/kg to a maximum of 10 ml over 5 minutes.

		• 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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease. • Give repeat dose of activated charcoal (50 g repeated as needed every 4 hours or 25 g repeated prn every 2 hours) 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 starting with dopamine followed by epinephrine (see Section 3.1.4). As a temporary measure which preparing an infusion, epinephrine injection 1 in 1000 (1 mg/ml) at dose IM 0.5 mg or IV 0.1 to 0.2 mg can be given and repeated (several times if necessary) every 10 minutes according to BP, pulse rate, and respiratory function, until improvement occurs and titrate up as needed. • • 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 19 and Section 3.5). Do not give phenytoin.
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 and Section 3.1). • Give activated charcoal 50-100 grams single dose 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,	• Manage airway and assist ventilation, as needed (see Quick Check pages 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16).

	coma, hypotension, arrhythmias, sudden cardiac arrest	• If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 and Section 3.1). • If shock persists, give vasopressors (see Section 3.1.4) – epinephrine is preferred. • Give activated charcoal 50-100 g as single dose 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 19 and Section 3.5). Avoid barbiturates as these may precipitate cardiac arrest. Avoid phenytoin.
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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 7.45–7.5*5. • Treat torsade de pointes with magnesium sulfate 1–2 grams IV. • Seizures should be treated with diazepam (see Quick Check page 19 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:
		  o serum potassium >6 mmol/l
		  o bradycardia or heart block with hypotension
		  o 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.
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If unconscious, give 25–50 ml D50 (see Quick Check page 19). 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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • Give naloxone (see Quick Check page 18 and Section 3.6). • Give activated charcoal if within 2 hours of ingestion and airway is protected. • *Cardiac monitoring a*nd 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.

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:
		  o 75 mg/kg if high risk (nutritionally deficient, acute starvation, AIDS, alcoholic, on enzyme-inducing drugs);
		  o 150 mg/kg if not high risk.
		• Give acetylcysteine IV or orally:
		  o 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.
		  o 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. o 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: o Monitor urea, electrolytes, CK, and renal function. o *Cardiac monitoring* and perform 12-lead ECG. o Give IV fluids to maintain good urine output. If in shock, give rapidly (see Quick Check page 18). o If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). o Sedate with diazepam if agitated or if having seizures (see Quick Check page 29). o Hyperthermia (>40.5°C) should be treated with rapid cooling (see Section 10.1). o *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.* o 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..
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 29 and 19). • 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 19 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	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	• If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 and Section 3.1). • If more than 40 mg/kg body weight of elemental iron ingested then: o 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

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.	symptomatic patients should be observed for minimum of 12 hours.	• 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: o taken 60 mg/kg elemental iron (see table of elemental iron content or check label), or o 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.
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 18 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 19 and Section 3.5). • *Arrange referral for 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 12–13 and 31). • If severe respiratory distress or SpO2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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. • *Arrange referral for 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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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, atenolol or propranolol 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 page 19). 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 referral for haemodialysis, if available, for life-threatening toxicity.*
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 and Section 3.1). • If shock persists after fluid resuscitation, start vasopressors (see Section 3.1). • *Cardiac monitoring a*nd 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.
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	• Manage airway and assist ventilation as needed (see Quick Check pages 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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

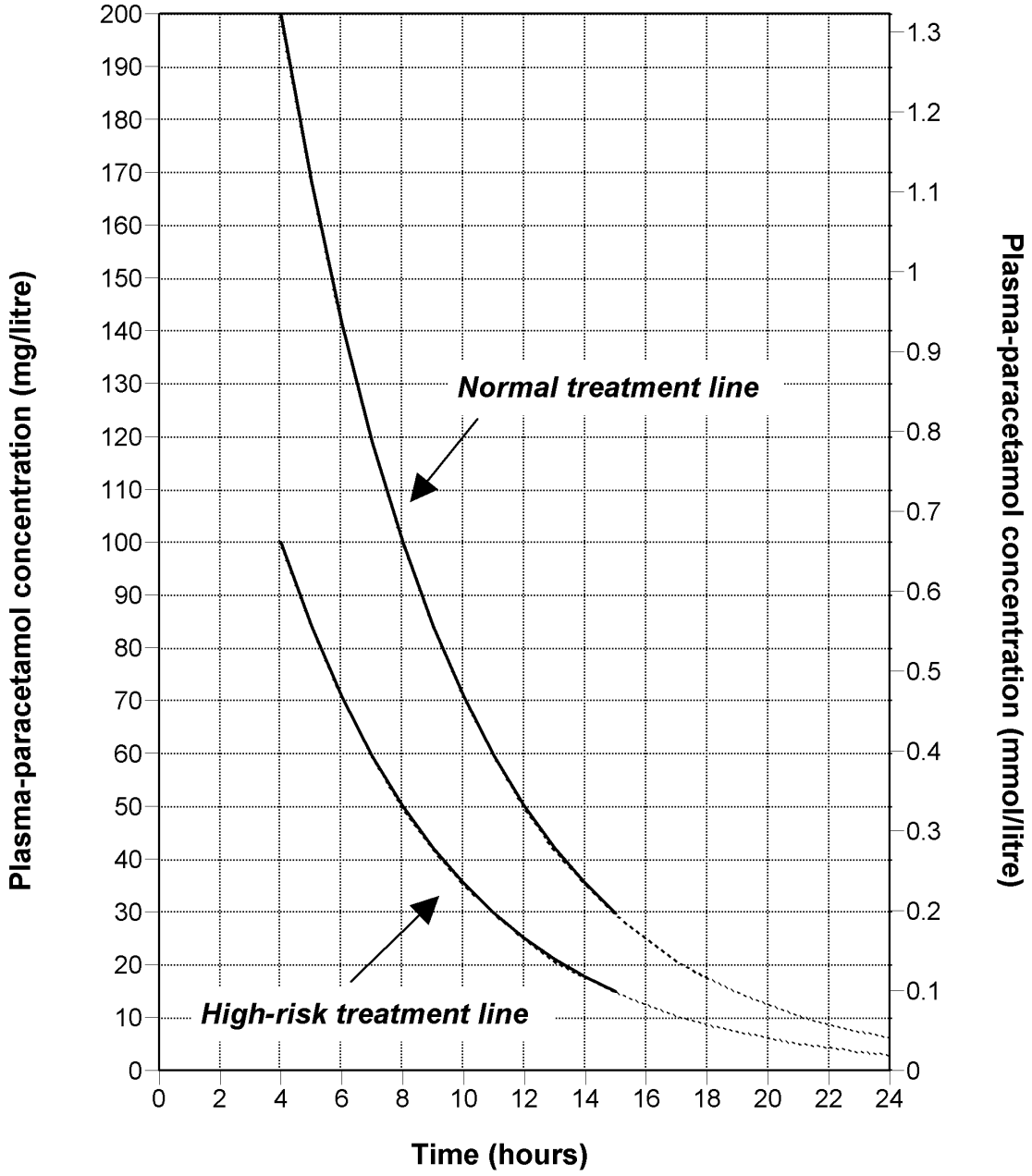
	abnormalities, prolonged coma	sodium bicarbonate. Suggested regimen: sodium bicarbonate 225 mmol (225 ml of an 8.4% solution) intravenously over 1 hour. Give additional boluses of intravenous sodium bicarbonate to maintain urine pH in the range 7.5–8.5. Urinary alkalinisation should only be done if there 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 arrange referral for haemodialysis, if available.*
Organophos-phates and carbamates	Muscarinic effects: DUMBBELS (**d**efecation, **u**rination, **m**iosis, **b**ronchospasm, **b**ronchorrhea, **e**mesis, **l**acrimation, **s**alivation) Nicotinic effects: weakness, fasciculation, paralysis, mydriasis Other: agitation, confusion, lethargy, convulsions, coma	• Manage airway and assist ventilation as needed (see Quick Check pages 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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 page 19 and Section 3.5). Repeat dose as necessary. • For organophosphates ONLY, give pralidoxime, if available. Give pralidoxime mesylate 30mg/kg IM - Follow by 1-2 more doses at 4-6 hour intervals depending on the severity of the poisoning and response to treatment In very severe poisoning, the initial dose of pralidoxime may be doubled - Usual maximum dose: 12g in 24 hours - The dose can also be given by slow IV (over a 5 minute period) by diluting 1g in 10-15 ml of water for injection or by IV infusion (up to 500 mg/hour may be required) Most useful within 24–48 hours.
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	• If shock, give rapid IV fluids (see Quick Check page 18 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*

	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.	*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.
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18). • 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).* o 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. o 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%.* o May need methylthioninium chloride for 2–3 days. o If patient is deteriorating on this therapy, consider possibility of G6PD deficiency or haemolysis. o If methylthioninium chloride is not available or patient has G6PDD, give IV or oral ascorbic acid 500 mg every 12 hours. o If patient continues to deteriorate consider exchange

		transfusion.
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. **Acids** 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 12–13 and 31). • If stridor, consider advanced airway management (see Quick Check pages 31 to 34) and surgical airway (see Quick Check page 36 and Section 3.2.2). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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.
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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: o 0.2 ml/kg/hour (non-drinker) o 0.46 ml/kg/hour (heavy alcohol user). • Maintenance dose during dialysis: o 0.5 ml/kg/hour (non-drinker) o 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 $mOsm/kgH_2O$ may be indicative of ethylene glycol poisoning if serum ethanol is 0 (if not, subtract 24 $mOsm/kgH_2O$ 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.
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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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: o 0.2 ml/kg/hour (non-drinker) o 0.46 ml/kg/hour (heavy alcohol user). • Maintenance dose during dialysis: o 0.5 ml/kg/hour (non-drinker) o 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 $mOsm/kgH_2O$ may be indicative of ethylene glycol poisoning if serum ethanol is 0 (if not subtract 24 $mOsm/kgH_2O$ per 100 mg/dl of ethanol). Later a raised anion-gap metabolic acidosis develops. • *Arrange referral for 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 12–13 and 31). • If severe respiratory distress or SpO_2 <90, give oxygen (see Quick Check pages 14–16). • If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 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[4]



[4] Used with permission from All Wales Therapeutics and Toxicology Centre, Cardiff, UK.

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, H_2 receptor blockers • lipid-lowering agents

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 12–13 and 31). • Give high-flow oxygen aiming at 100% for 6–24 hours (see Quick Check pages 14–16 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 31). • 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 12–13 and 31). • 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 17). • 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).

Cyanide	Headache, dyspnoea, confusion, coma, convulsions, cardiovascular collapse, metabolic acidosis	• Manage airway and assist ventilation as needed (see Quick Check pages 12–13 and 31). • Give high-flow oxygen aiming at 100% (see Quick Check pages 14–16 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): o Give *sodium nitrite:* 300 mg (10 ml of 3% solution) by slow IV injection over 5–20 minutes. o Then give *sodium thiosulphate:* 12.5 g (50 ml of 25% solution) by slow IV injection over 10 minutes. o 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: o 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.[5] Soothing lotions such as calamine can be applied to irritated skin once decontamination has been don

[5] *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] and bee-stings

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 a 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.
- The type of field management
  - site cleansing, incisions, oral suction or with a device;
  - tourniquet or other pressure material applied;
  - beverages and drugs ingested; or
  - burning or shock treatment?
- 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).
- Some patients will have encountered the black-necked spitting cobra. The venom, which has cytotoxic and neurotoxic effects, causes burning and pain on the skin and in the eyes, marked tissue swelling and discolouration, poor coordination and visual impairment that can result in blindness.

[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

- Some patients may have escaped an African rock python which bites first but is non-venomous and eventually constricts its victims.

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 **A**irway, **B**reathing, and **C**irculation (see Quick Check pages 2–7).
- 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, nares, 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 (rhabdomyolysis), including muscle pains, muscle weakness and black urine (a urine dipstick test positive for blood is indicative of muscle breakdown resulting in myoglobinuria).
- Hypotension and shock may result from hypovolaemia, myocardial dysfunction or vasodilatation.
- Assess the renal function. Renal failure may result from hypotension, excessive rhabdomyolysis or disseminated intravascular coagulation.

It is difficult to give advice that can be generalized to all Regions of Uganda 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] in **Uganda**[5],[6]

	Insert Lugandan name	Local effects	Clotting disorders	Weak-ness	Muscle breakdown	Low BP	Renal failure
• *Bitis arietans* (puff adder)		+++	++				
• *Echis ocellatus* (carpet viper)		++	+++			+	+
• *Naja* spp (African spitting cobras)		+++					
• *Naja* spp (African neurotoxic cobras)		+++	±				
• *Atractaspis* spp (burrowing asps)		++	±			+	
• *Dendroaspis polylepis* (mamba)		+		+++		+	
Uganda							
• *Atheris acuminata* (bush viper)							
• *Atheris hispida* (African hairy bush viper)							
• *Atheris nitschei* (Great Lakes bush viper)							
• *Atheris squamigera* (green bush viper)							
• *Atractaspis aterrima* (slender burrowing asp)							
• *Atractaspis reticulate* (reticulate burrowing asp)							
• *Bitis arietans* (African puff adder)		+++	++				
• *Bitis gabonica* (Gaboon viper)							
• *Bitis nasicornis* (rhinoceros viper)							
• *Boiga blandingii* (Blanding's tree snake)							
• *Causus lichtensteinii* (Lichten's night adder)							
• *Causus resimus* (velvety-green night adder)							
• *Causus rhombeatus* (Rhombic night adder)							
• *Dendroaspis jamesoni* (Jameson's green mamba)							
• *Dendroaspis polylepis* (black-mouthed maba)							
• *Dispholidus typus* (boomslang)							
• *Elapsoidea laticincta* (African garter snake)							
• *Elapsoidea loveridgei*							

[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/

[5] Uganda Reptile Village (no date) Uganda snake bite guide by Kazibwe Y. Available at www.reptiles.ug/index.php/snake-bit 12.12.2013

[6] Iberianature.com/wildworld/guides/wildlife...Uganda/Snakes of Uganda/Venomous snakes of Uganda

(Loveridge's garter snake)							
• *Elapsoidea semiannulata* (Angolan garter snake)							
• *Naja haje* (Egyptian cobra)							
• *Naja melanoleuca* (forest cobra)							
• *Naja nigricollis* (black-necked spitting cobra)		+++					
• *Pseudohaje goldii* (Gold's tree cobra)							
• *Thelotornis kirtlandii* (twig or bird snake)							
• *Python sebae* (African rock python)							

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

Snakes with the highest medical importance in Uganda:

Highly venomous snakes which are common or widespread and cause numerous snakebites, resulting in high levels of morbidity, disability or mortality.)

Elapidae: Cobras: Naja ashei (giant spitting cobra - north-east), Naja haje (Eqyptian cobra - north), Naja nigricollis (black-necked spitting cobra)
Mambas: Dendroaspis polylepis (black mamba) & Dendroaspis jamesoni (Jameson's mamba)

Viperidae: Bitis arietans (puff adder) , Bitis gabonica (Gaboon viper)

3.9.2 Snake-bite treatment

Snake-bite victims are generally extremely anxious and restless. First aid measures performed in the field include reassurance of the victim, immobilization of the bitten limb, reduction of the spread of venom and rapid transport to a medical facility. The following field remedies should be discouraged:

- site cutting and suction
- stone, wood, herbal or animal horn applications that suck blood
- burning or shocking of the bite site or limb
- ingestion, inhalation, inoculation or injection of intoxicating or sedating agents

Some snake-bites lead to rapid onset of respiratory failure and cardiovascular collapse. Use Quick Check pages 2–7 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 laboratory) 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 tissue necrosis or extensive swelling (more than half the bitten limb), rapidly progressive local swelling, bites on fingers and toes
- renal failure

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 37). 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 12−17 and consider advanced airway management (see Quick Check pages 31−36).

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 11 and Section 3.1.3.
- Antihistamines should be combined with corticosteroids
- 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).
- An antivenom specific for snakes in other parts of the world or Africa and not for the snake species in Uganda
- 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.
- The antivenom is long expired.

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 or saline and a clean eye 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.
Monitor the patient for neurotoxic effects as the venom is not only cytopathic but also neurotoxic.

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 breaths, 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 14−16). 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 13). For cases that are easily reversible, bag-valve mask (BVM) ventilation 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 31−35) 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 of antivenom 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) and renal failure

- 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.

5. The administration of intoxicating or relaxing products to calm the snake victim will confuse the clinical picture

3.9.3 Bee-stings

The farming of *Apis mellifera* species of honey bees is popular in rural Uganda. While honey hunters, bee farmers and thieves of bees and their products approach bee hives, children often throw stones at hives or swarms causing themselves, other people and animals to be stung. Bee harvesters also encounter poisonous lizards and snakes when these hide inside the bee hives during rainy seasons or cold nights. People seek honey to treat cough, burns, abdominal upsets, measles and false teeth.[1] Alternative healers use bee venom delivered through bee stings to treat arthritis, neuralgia, high blood pressure and high cholesterol levels, to boost the immunity in HIV/AIDS and to treat infertility.

The bee species can be identified by locating the nest.

Key clinical features

- Honey bee-stings cause acute pain.
- Most people develop minor local reactions.
- Persons with venom allergy may develop severe systemic allergic reactions which may be immediate or delayed.
- Local reactions are often mild and confined to tissues around the sting but may progress to large local reactions, anaphylaxis or develop secondary bacterial infection.
- Toxic reactions are seen following massive envenomation by bee swarms.

Perform the Quick Check in all patients with bee stings and treat anaphylaxis if present

If the patient has signs of anaphylaxis, treat immediately with epinephrine- see Quick Check page 11 and Section 3.1.3:

- Give epinephrine (adrenaline) 0.5 ml 1:1000 IM– 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).

[1] Ministry of Agriculture, Animal Industry and Fisheries. National Bee keeping training and extension manual, 2012

- 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 14–16).
- 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.

Anaphylaxis is a venom-induced systemic reaction which can result from a single or multiple stings, is rapid in onset, involves several systems and may be fatal. The reaction resolves spontaneously or after treatment but may recur and persist. Clinical manifestations include:

- urticaria, flushing and angioedema more localised in adults, often generalised in children
- oedema of the upper respiratory tract may cause airway obstruction
- bronchoconstriction may cause shortness of breath and wheezing
- dizziness, fainting or loss of consciousness
- hypotension and circulatory failure occur with severe sting anaphylaxis

Before discharge, patients should be educated about the seriousness and potential fatality of venom allergy and be referred to the allergy specialist.

Toxic reactions to multiple bee stings

- The Africanised or 'killer' honey bees sting in large swarms causing massive envenomation when persons disturb a bee hive or fail to escape.
- Signs of systemic upset include fever, convulsions, haemolysis, cardiac dysfunction and anaphylaxis.

Treatment

- removal of bee stingers from the skin and clothing
- immediate epinephrine and supportive management
- monitoring of blood electrolytes, haemoglobin, renal and cardiac function
- consultation with a specialist in allergy

History

Determine whether the reaction is local or systemic.

- What insect stung the patient
- Number of stings sustained
- Duration since the stinging occurred
- Time-lapse between the sting and initial symptoms
- Occurrence of any delayed symptoms
- Medication since the sting, traditional or otherwise
- Reaction to previous and subsequent stings whether local or systemic

Examination

- The body sites that were stung
- Swelling and redness- size

Manage local reactions according to severity

Transient local reaction:

- red burning painful swelling at the site of the sting
- develops to 1-5 cm in minutes, resolves in hours or 1-2 days
- responds well to cold compresses

Large local reaction:

- some individuals develop marked swelling, burning and redness
- enlarges over 1-2 days up to 10 cm in diameter
- resolves over 5-10 days
- stings on the facial mucous membranes can cause marked angioedema as a local reaction
- facial swelling following a sting on a limb indicates a systemic reaction.

Treatment of local reactions:

- cold compresses to relieve the burning and swelling
- the extremity should be elevated
- If large local reaction, prednisone 40-60 mg as single dose or over 2-5 days to reduce marked swelling
- nonsteroidal antiinflammatory drugs for pain
- oral antihistamines or topical corticosteroids for pruritus
- antibiotics with suspected bacterial infection especially when there is:
    - redness, swelling and pain worsening after 3-5 days
    - fever, regional lymphadenitis and lymphadenopathy
- supportive care

3.10 Burns[1]

3.10.1 Initial management and stabilization of burns using Quick Check – Airway and breathing – Circulation – Remove all burned clothing, and cool skin with water. – 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 – Estimate the extent of the burn – Types of burns – Classify the burn to decide how to manage it 3.10.3 Burn management – Manage inhalation injury – Fluid resuscitation in patients with severe burns – Burn skin care

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 cannulae. 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

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.

[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

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.

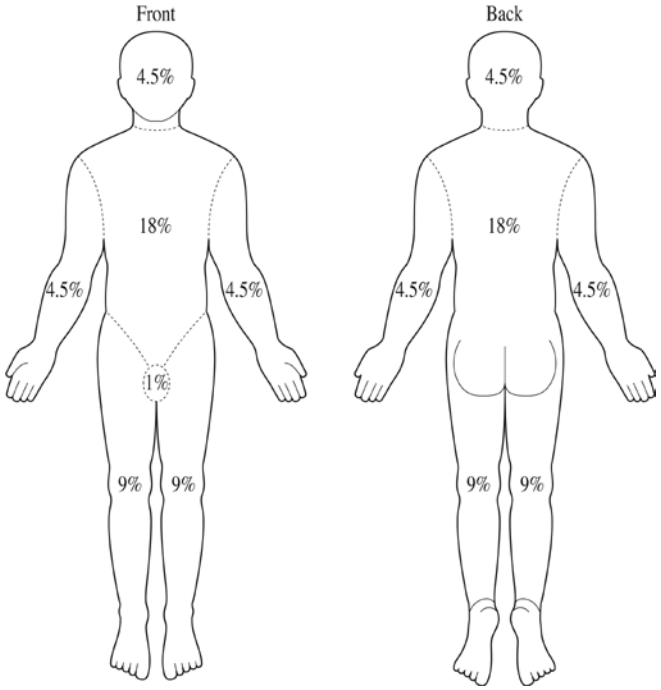
Skin grafting is indicated for deeper second-degree burns and third-degree burns to improve cosmetic and functional outcome. If the wound is not epithelialized by 21 days, it should be grafted.

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 (i.e. the front of the head, upper limbs, trunk, perineum and lower limbs; and, the back of the head, upper limbs, trunk and lower limbs).
- The percentage of area burned can also be estimated using the patient’s palm as equal to 1% of TBSA.
- 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. Manage patients with lightening burns in the same way as electrical conduction burns.

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
  ○
  ○ 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, increased pain or redness occur.

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 2 large-bore IV cannulae (16G) 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. Give
  - Half the total in the first 8 hours and the 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 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 mobilize 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 de-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 second and third degree 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.

[2] Ranitidine is an alternative.

Surgical referral. All significant burns should be evaluated by a surgeon. This includes extensive burns (>30% TBSA) and second and third degree burns involving special areas such as the eyes, joints, hands, neck. 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.

Other referrals or special care: Special care is needed for patients with other injuries and/or co-morbidities and patients at extremes of age.

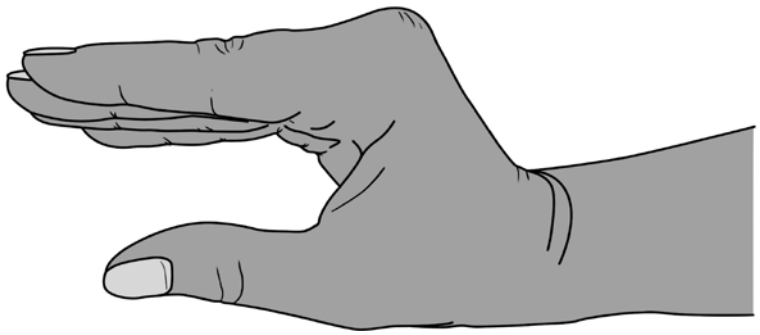
Patients with inhalation burns often require intubation and ventilation (see Section 3.2).

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 analgesics. Paracetamol and morphine provide good basal analgesia but should be supplemented with short-acting agents (e.g. Ketamine) 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 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 and is classified as severely ill (this may happen on arrival or later if the patient deteriorates in hospital). 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: **A**lert – Responds to **V**oice – Responds to **P**ain – **U**nresponsive. If trauma patient, fill in an initial Glasgow Coma Scale; repeat if head injury.
7. Record the following every 6 hours in the 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 empirical antimicrobial treatment 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).

BENCHMARKS – circle the relevant condition(s), then check if achieved

If severe respiratory distress, suspect pneumonia, or acute lung injury, within 30 minutes: ☐ **Oxygen by mask/ or nasal prongs started** ☐ **SpO_2 measured** ☐ **IV fluids started** ☐ **If wheezing, nebulised 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** ☐ **SpO_2 measured** ☐ **Furosemide 20 mg IV given** ☐ **If hypertensive, isosorbide dinitrate given** ☐ **If ischaemia (chest pain), aspirin given** **If wheezing, within 30 minutes:** ☐ **Nebulised 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 diazepam given after convulsing, give phenytoin** **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

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 fractures. Early identification and adequate, appropriate 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 cervical 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 crashes, 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 cervical spine injury is excluded clinically or by X-ray. See page 21 Quick Check.
- Stop any visible haemorrhage with manual pressure or a compression dressing.
- Insert at least 2 large bore IV cannulae (14 or 16 gauge), and send blood for haemoglobin and type and cross-match. Blood for transfusion may be needed quickly and in large quantities for some trauma patients.
- 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 (38-42 °C) are preferred.

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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

- 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, and 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 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 from a height more than 3 metres
Road traffic crash at speed more than 30 km/hour or with significant damage to vehicle
Thrown from a vehicle or trapped in a vehicle
Extrication time>20 minutes

[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

Pedestrian or cyclist hit by a car Motorcycle crash with separation of rider from bike Death of another person in the same incident 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 38). Replenish supplies after each resuscitation.
- Adequate supply of resuscitation fluids (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 specimens for laboratory investigations and documentation. Keeping the situation calm and controlled is important for delivery of 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 Talk to the patient's relatives
Primary nurse Obtain IV access and blood for Hb, Group and Cross matching Monitor and record vital signs and urine output Give IV fluids, blood, and medications
Nursing assistant Completely undress patient Help with obtaining vital signs Insert a urethral catheter 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. 37), 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. Patient monitoring must continue during transportation.

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:

- Resuscitation and stabilization
- Emergency treatments
- Definitive care and treatments.

Time	Assessment	Management
0–10 minutes	Quick Check (repeat if patient deteriorates) Secondary survey	Emergency treatments Resuscitation
After 10 minutes	Monitor using patient monitoring form Assess and record vital signs 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 (pages 12–13)
- management of tension pneumothorax or massive haemothorax (page 22)
- management of sucking chest wound (page 22)
- spine immobilization and clearance of the cervical spine (page 21)
- management of serious head injury (page 21)
- management of visible haemorrhage (page 22)
- initial management of suspected intra-abdominal injury (page 8)
- Application of pelvic binder

Oxygen therapy for trauma patients
Patients with traumatic injuries may have multiple pathophysiologies that result in deficient oxygen transport. For example, a patient involved in a motor vehicle crash 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 severe blood loss 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 contusion 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 14–16).

Immediately following Quick Check and the initiation of any emergency treatments, complete a full secondary examination (also known as a secondary survey) examining from head to toe, side to side and back to front for any other injuries.

Obtain further information including:

- detailed history of the injury
- past medical history
- medications patient is currently on
- 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 or chin lift. 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 31).
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 blood for Hb , 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 of LR or NS or suspect on-going heavy blood loss, transfuse blood as per national or local guidelines and consider giving tranexamic acid. Perform ultrasound exam (**f**ocused **a**ssessment **s**onography in **t**rauma – 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 and/or unequal in size 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 tenderness) 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)
	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 (subcutaneous emphysema)	Suspect pneumothorax or haemothorax. Suspect rib fractures. Treat pain. If available, obtain erect chest X-ray.

Then look for and treat other injuries (see next page).

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 50% 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 21). **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 nerve palsies Patient should avoid blowing his/her nose. 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 21). Arrange for radiographic evaluation.
Thorax	Bruising, deformity Uneven chest wall movement Subcutaneous emphysema Decreased breath sounds Muffled heart tones Severe back pain	**Pneumothorax or haemothorax, flail chest, sucking chest wound** (see Quick Check page 22) **Rib fracture** Treat pain. Check for associated pneumothorax. Deep breathing exercises. If sub-acute, check for secondary pneumonia. **Vascular injury** Manage airway. Send blood for Hb, type and cross-match. Call for surgical help. **Pericardial tamponade** If haemodynamically unstable (SBP <90 mm Hg), emergent pericardiocentesis. FAST 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 on back or abdomen, seatbelt sign across lower abdomen	**Liver or spleen injury, pancreatic injury, bowel injury, retroperitoneal haemorrhage, aortic injury** NPO. Give IV fluid bolus. Send blood for Hb, type and cross-match. Give pain medication. Call for surgical help. **Perform FAST 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 22). NPO. Give IV fluid bolus. Send blood for Hb, Hct, ype 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 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 spineand/ or step deformities. Motor function Rectal tone, saddle anaesthesia Pain and sensation	**Vertebral injury or spinal cord injury** Keep spine immobilized (see Quick Check page 21). Monitor airway. Treat pain. Document and monitor neurovascular exam. Obtain radiographic evaluation. **Call for surgical help.**
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, : • give antibiotics and tetanus toxoid • copiously irrigate, apply dressing and splint • call for surgical help. If femur fracture, : • send blood for Hb, 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. Treat pain. Give tetanus toxoid. **Contusion** Treat pain, elevate, and apply an ice pack, 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 cardiogenic and neurogenic shock.

Intravenous fluids:

- 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 (response).
- Monitor urine output.

Blood: (for complete information on blood transfusion see WHO's *The Clinical Use of Blood Handbook.*[1])

If 2 litres of IV fluids are given and the patient is still hypotensive, 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).

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[1] *The Clinical Use of Blood Handbook*. WHO, 2002 (in revision). Available at http://www.who.int/bloodsafety/clinical_use/en/

- 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 significant haemorrhage. Because the effect of tranexamic acid of preventing 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 height, should also 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 <38°C) 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
	limbs normally to pain	4
	Flexes limbs abnormally to pain(decorticate)	3
	Extends limbs abnormally to pain (decerebrate)	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 treated 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 to safely take food by mouth, start nasogastric feeds slowly and increase 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 H_2 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.[1]

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 preventing injury. Preventive strategies include:

- improvements in road safety
- pedestrian and cyclist awareness
- wearing of seatbelts in cars and 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.

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[1] *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

4.4 Manage rape or abuse in adolescents and adults[2]

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.
- 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;
  - wounds or fractures at various stages of healing;
  - 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.

[2] *Clinical management of rape survivors*. WHO, UNFPA and UNHCR, 2004. Available at http://www.who.int/reproductivehealth/publications/emergencies/924159263X/en/

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.[3] Recommended medications should be adapted based on the country. For example, (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 – 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, 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.

[3] *Guidelines for the management of sexually transmitted infections*. WHO, 2003. Available at http://whqlibdoc.who.int/publications/2003/9241546263.pdf

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 first (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.
  - o Document findings (often it is helpful to draw a picture of the wound).
  - o Explore and remove any foreign body.
  - o 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.
  - o Call for help if not familiar with debridement technique.
  - o Inject local anaesthesia. Debridement of a large area of necrotic skin may need to be performed under general anaesthesia in the operating theatre.
  - o Using aseptic techniques and scissors or blade, cut dead skin away in thin layers until pink, bleeding tissue is visible.
  - o 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).
  - o 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 after injury

- ◊ Close the wound with sutures to bring wound edges together, preventing wound contamination and facilitating healing.
- ◊ Shave the surrounding skin if necessary before wound closure.
- ◊ The goal is to bring the sides of the wound close together (good apposition) and limit tension or pulling on the skin. It may be necessary to use both deep sutures (the subcutaneous layer and muscle) and superficial sutures (at the surface) to reduce tension on the wound.

o 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 of 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.

o Secondary healing
- ◊ This method should be used for:
  - grossly contaminated or infected wounds
  - wounds with large gaping defects when there is not enough skin at the edges to close the wound
  - puncture wounds
  - gunshot wounds
  - bite wounds (both human and animal).
- ◊ 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 (contracts), 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 wounding, 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 time between injury and first presentation at health unit is less than 8 hours;
  - o the wound is large (usually greater than 1 cm);
    - ◊ large wounds may need to be considered for eventual consultation or skin grafting (patient may need to be referred);
  - o the wound continues to bleed;
  - o the wound is over a joint;
  - o the wound is in a location where the cosmetic result is important (e.g. face).
- Antibiotic use
  - o Antibiotics are not routinely indicated for all wounds.
  - o 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.
- If the lignocaine is a 2% preparation,dilute wth an equal amount of water for injection to make a 1% concentration,
- Give the anaesthesia solution through a small needle and inject slowly to minimize pain.
- Inject the solution through the cut 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.

Special considerations for human bite wounds

Human bites are a recognised injury around the world and are more prone to infection than other animal bites. Fresh bite wounds that are seen in health units require meticulous management from the start to prevent complications. Many persons hide or ignore bite wounds until there is pain, swelling or disability, thus the injuries are often infected at presentation. The bites may require exploration of underlying structures, deliberation regarding primary surgical closure, may result in hospital admission and can cause marked morbidity, disability and disfigurement. Management requires appropriate antibiotic coverage, vaccination and close monitoring.

In Uganda animal bites are inflicted on humans usually by dogs, cats, jackals, rodents, rabbits and humans. Human bites are sustained during fights, attendance to persons with seizures, restraint of rabid children and some are self-inflicted.

Types of human bite wounds: bruises, skin breaks, cuts, puncture wounds, crush injuries

Human bites carry a high risk of infection with bacterial flora of the oral cavity. Clinical manifestations of wound infection include tenderness, erythema, swelling, purulent discharge, lymphangitis, lymphadenitis and fever. Pain that is out of proportion to the severity of the injury suggests bone involvement. Complications include trauma to deep structures, infection of underlying structures and bloodstream infection.

Infection is due to a mixture of organisms. Potential pathogens are:

- the oral flora of the biting person
- the skin flora of the person bitten
- pathogens in the body fluids of the biting person

Bacteria include aerobic streptococci, *Staphylococcus aureus*, *Eikenella corrodens* and anaerobic bacteria. Hepatitis viruses, HIV, herpes simplex virus and *Treponema pallidum* can be transmitted.

Investigations

- Complete blood count - values may be normal even with established infection
- Wound culture - done prior to the initiation of antibiotics, not done in uninfected wounds. Laboratory request must note that the specimen is from a human bite wound, requiring Gram staining, aerobic and anaerobic cultures and bacterial susceptibility testing
- Debridment material - sent for aerobic and anaerobic cultures
- Plain x-rays and ultrasound - deep bite wounds can disrupt bone and joints. X-rays may detect fractures and soft tissue injury, subcutaneous gas, changes associated with osteomyelitis, septic arthritis and tendonitis. Ultrasound may identify abscesses and locate foreign bodies

Treatment

As with all other wounds, exam should include evaluation for nerve, vascular and muscular function. Surgical consultation is necessary for:

- nerve and circulatory compromise
- penetrating wounds involving bone, tendons, joints, other major structures
- complex facial lacerations
- abscess formation, osteomyelitis, joint infection

Surgical toilet:

- irrigate with plenty of sterile saline to remove debris, a local anesthesthetic may be required
- carefully explore to identify damage to underlying structures and foreign bodies
- debride dead tissue but avoid enlarging the wound thus impairing skin closure
- clean with 1% povidone-iodine or 1% benzalkonium chloride

Puncture wounds:

- remove any foreign bodies or gross wound contaminants
- trim superficial dead tissue, avoid drilling deeply
- avoid high pressure irrigation into the wound

Fresh bite wounds should be left open and the edges approximated to enable closure by secondary intention. Delayed primary closure is preferred to primary wound closure when cosmetically necessary**:** bite wounds may be cleansed, debrided, drained and covered with saline dressings 12 hourly then closed 72 hours later.

Primary wound closure is generally not recommended for human bites due to high rates of infection, however suturing may be considered with**:**

- facial lacerations
- wounds less than 12 hours old, 24 hours for the face
- clinically uninfected wounds
- wounds not on the hands and feet

Infected human bite wounds: require aggressive debridement, abscess drainage, intravenous broad-spectrum antibiotics until infection starts resolving then oral therapy for up to 14 days.

The patient should be admitted and the following done if possible:

- take blood for aerobic and anaerobic cultures if there is systemic infection
- remove suture material if any
- send material from the depth of the wound for Gram staining and for aerobic and anaerobic cultures and bacterial susceptibility testing
- consult a surgeon
- consider referral

Clenched fist injuries need splinting of the fingers and elbow, maintaining the maximum length of the ligaments and intrinsic muscles.

Antibiotic therapy

- should always be administered for human bites, based on activity against potential contaminants
- should be changed based on the culture and susceptibility results.

The initial dose may be given parenterally then oral doses are given subsequently. Signs of infection call for further evaluation and extension of the antibiotic course. Persons with infected wounds should be admitted given intravenous antibiotics, this can be changed to oral therapy with clinical improvement.

Vaccination: Tetanus immune globulin and tetanus toxoid should be administered according to the patient's vaccination status.

Virus prophylaxis: An HBsAg-negative patient, when bitten by a HBsAg-positive person, should receive hepatitis B immune globulin and hepatitis B vaccine. The HIV is not easily transmitted via saliva; the patient may need counselling about post-exposure HIV prophylaxis.

4.6 Fractures

Refer to *Surgical Care at the District Hospital* manual (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, the patient's 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 fracture should be immediately reduced before X-rays are obtained.
  - 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 mal-union or non-union and a poor functional outcome.
    - ◊ Always check neurovascular status before and after any reduction.
    - ◊ Reduce any dislocated joints as soon as possible.
  - Immobilization (keep the fracture ends 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
    - ◊ treat pain
    - ◊ perform immediate reduction if any neurovascular compromise
    - ◊ carefully remove any gross debris
    - ◊ splint
    - ◊ irrigate with saline and cover the wound with saline soaked gauze
    - ◊ begin IV antibiotics (for example, a first generation cephalosporin)
    - ◊ administer tetanus prophylaxis based on immunization status and local protocols
    - ◊ consider consultation or referral for further managment in the operating theatre.

Splints and casts

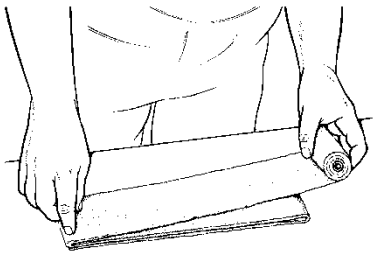
Key points about splints and casts

- Splints and casts support and protect injured bones, joints and soft tissues, reducing pain, swelling, and muscle spasm.
- Splints are of a rigid material used to immobilize acutely injured extremities (fractures, strains and sprains, soft tissue injuries). Splints (usually only on one side of the limb 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 of Paris (POP) 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 POP.
  - If necessary, wood or 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). Metacarpal-phalangeal joints (where fingers attach to the hand) should always be immobilized in flexion, never straight.
- Apply POP 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 POP has set.

Splint application

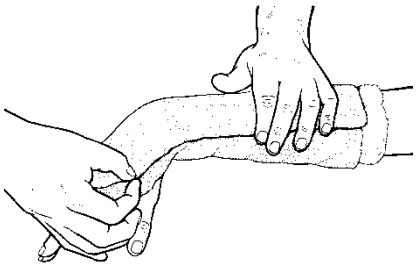
- Materials
  - stockinet and padding – protect the skin and allow swelling
  - support material – POP, pre-formed splints, modified local materials
  - elastic bandages secure the splint in place
  - adhesive tape
  - knife or scissors to cut the splint to the proper length:
  - bucket or pail of water
  - 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 stockinet over the skin:
    - the stockinet should extend 10–15 cm beyond the area to be splinted at each end;
    - make sure the stockinet 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 POP 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.



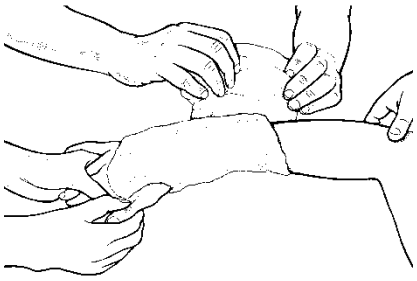
13. Soak the POP roll in a pail containing water at room temperature. Do not use warm water as the heat given off by the plaster as it sets may burn the patient. Leave the plaster in the water until it is completely soaked and the air bubbles cease to rise.

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, before it sets.



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 stockinet 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 a crepe 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:
  - the splint gets wet or becomes soft or broken;
  - there is 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 muscle 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 on passive stretch of the involved muscles
- 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* 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 utero-placental blood flow. (Log roll if suspected spine injury – see Quick Check page 21.)
- 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

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

↓ ↓

$\frac{120}{200}$ = sensitivity = 60%

$\frac{792}{800}$ = 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:
  - o 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).
  - o insufficient water intake
    - ◊ lack of availability
    - ◊ decreased intake due to decreased level of consciousness.
  - o 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)
- the 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

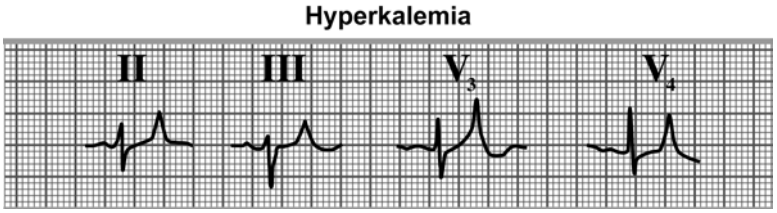
Causes

- 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

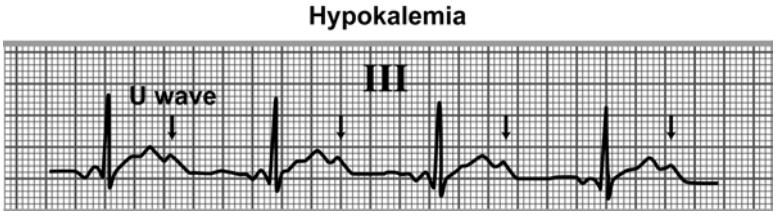
Causes

- 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.

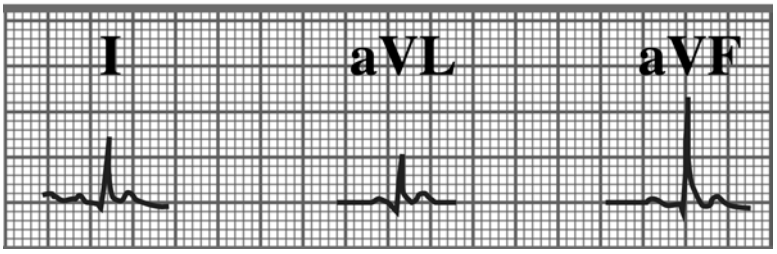
Ionized calcium = Ca + (40 – serum albumin (g/l) x 0.02

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.

Hypercalcemia



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

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 oral transmitted pathogens, acute respiratory diseases.[5] It also prevents infections during medical (see Section 7 Procedures) or surgery procedures (covered in other sources).[6]

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, through transmission to other patients, visitors, and health workers. These practices are routine requirements that are applied to care of all patients , as well as when there are new 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[7], training health workers in IPC, providing adequate infection control commodities, assuring a safe blood supply, managing a central sterilizing unit/department within the hospital,[8] 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, patient placement, traffic flow and natural ventilation. The common design of narrow, poorly ventilated corridors should be avoided as patient waiting and triage areas. Instead, open air shelters with a roof should be used to maximize use of natural ventilation. (). Rooms for patient care should be well ventilated as well. The design of such rooms should allow for cross ventilation. Ventilation can be enhanced by leaving windows and doors open when possible to maximize cross ventilation. IPC recommendations based on assessment of the risk of nosocomial infection in the specific health-care facility and in specific patient care areas should be prioritized**.**

This Section is aimed at health workers who should refer to the IPC guidelines and use appropriate precautions in their clinical work.

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[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] The original little yellow infection control book. Grampians Region Infection Control Group, 2014. Available at http://www.grhc.org.au/infection-control/lyicb-booklets

[7] *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

[8] *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

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[10] 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:[11,12]

- Hand hygiene (see Section 6.2)
- Appropriate Personal Protective Equipment (PPE) (see Section 6.3):
  - Gloves
  - Facial protection (eyes, nose, and mouth)
  - Gown
  - Apron
  - Gumboots
- 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)
- Aseptic technique (see Section 6.10)

[10] *Infection control standard precautions in health care*. WHO, 2006. Available at http://www.who.int/csr/resources/publications/4EPR_AM2.pdf

[11] *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

[12] *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[13]

- 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 dirtyWhen to use alcohol-based hand rub:
  - When hands appear clean (i.e. are not visibly soiled) but are contaminated.
  - To augment hygienic hand washing

Indications for hand hygiene

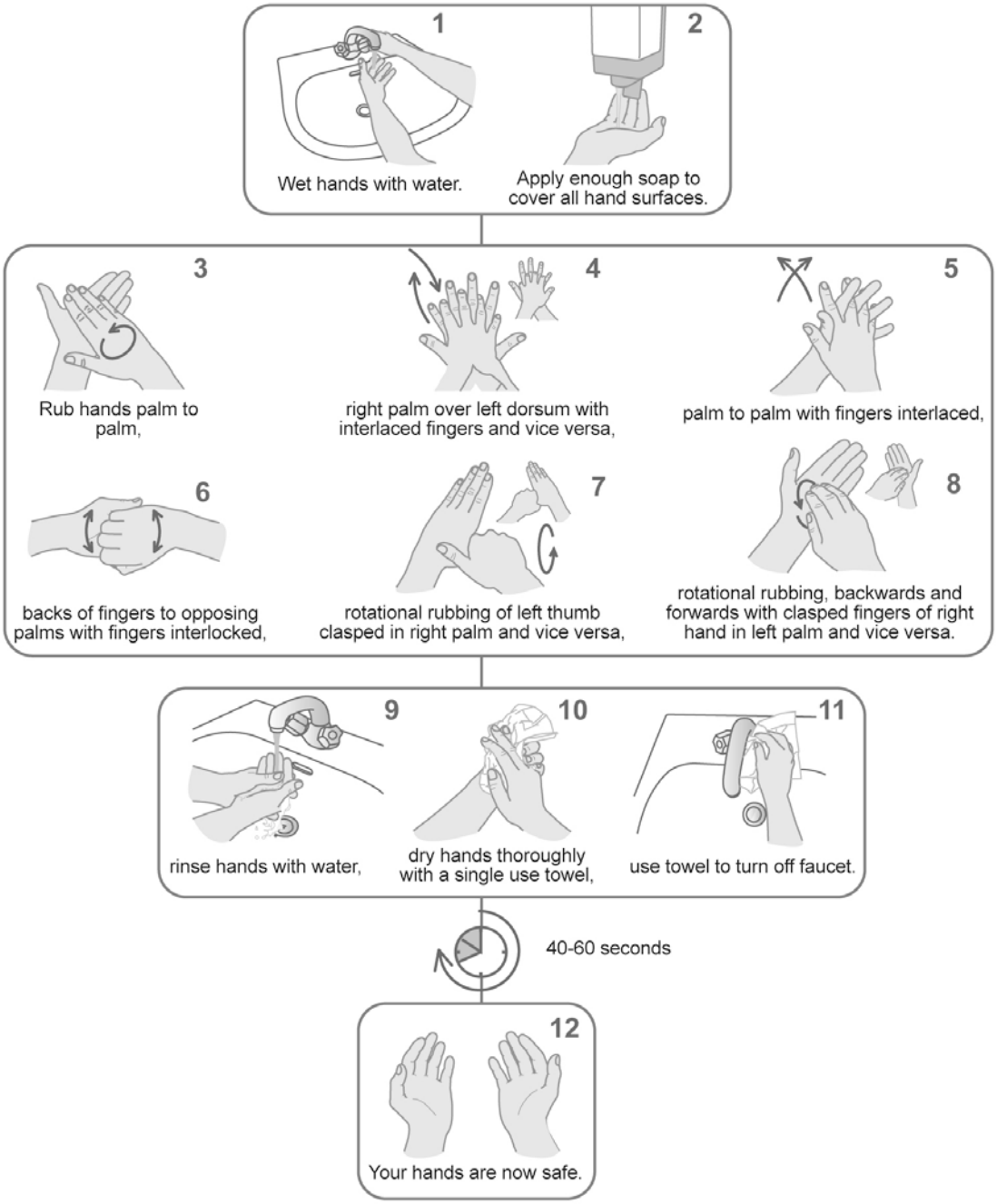
- Before and after any direct contact between a health worker and a patient and contact between patients, whether or not gloves are worn. Hands should be washed before gloves are put on.
- Immediately after gloves are removed.
- Before handling an invasive device.
- After touching blood, body fluids, 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.

[13] *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 and make a good lather; rub all surfaces; rinse hands and dry thoroughly with a single use re-usable towel; use towel to turn off tap, place the used towel in a receptacle and wash used towels at the end of the shift.

Figure: How to wash the hands with soap and water[14]

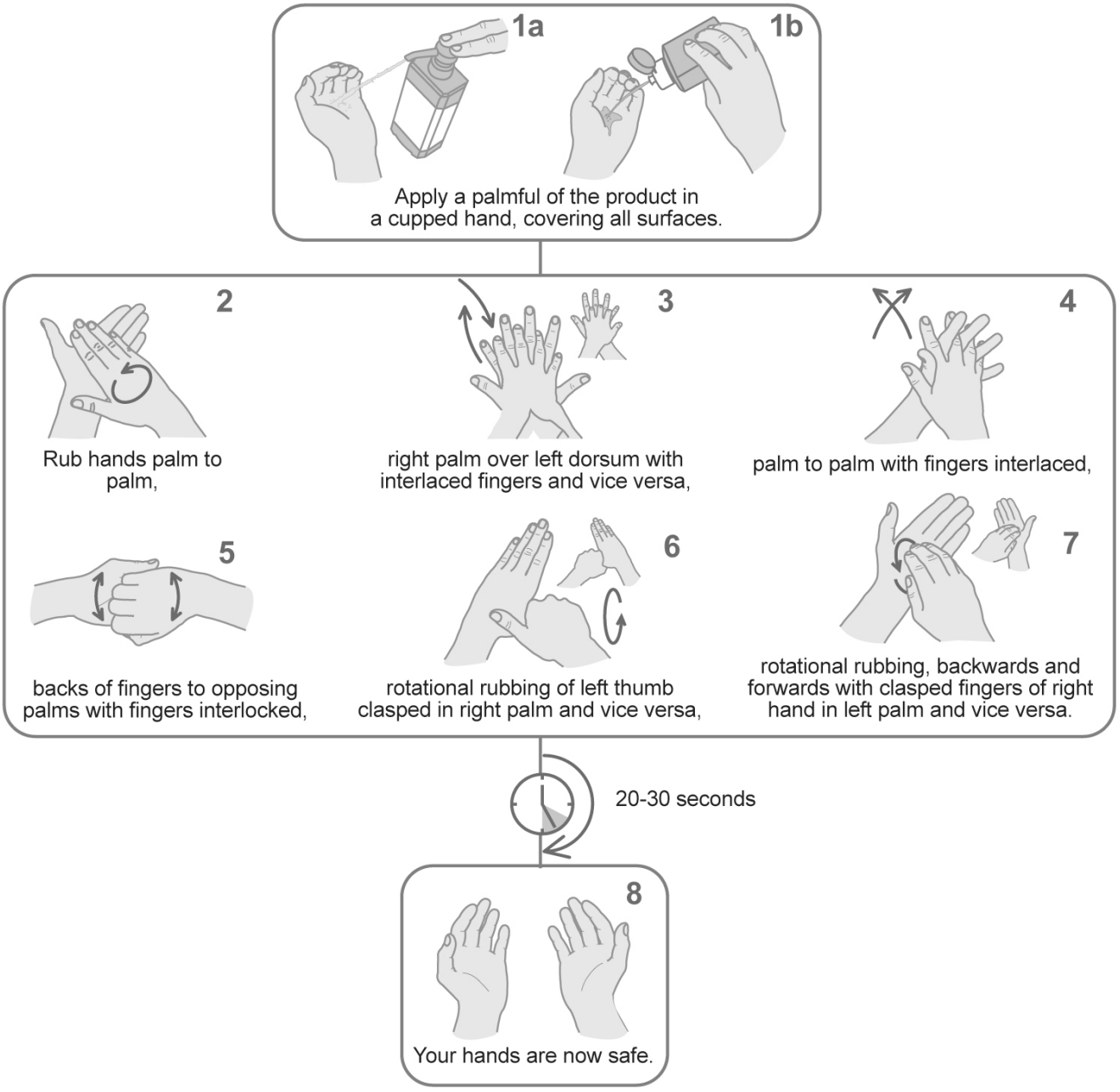


[14] *WHO Guidelines on Hand Hygiene in Health Care*. WHO, 2009. Available at http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.07_eng.pdf

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[15]



[15] *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!**

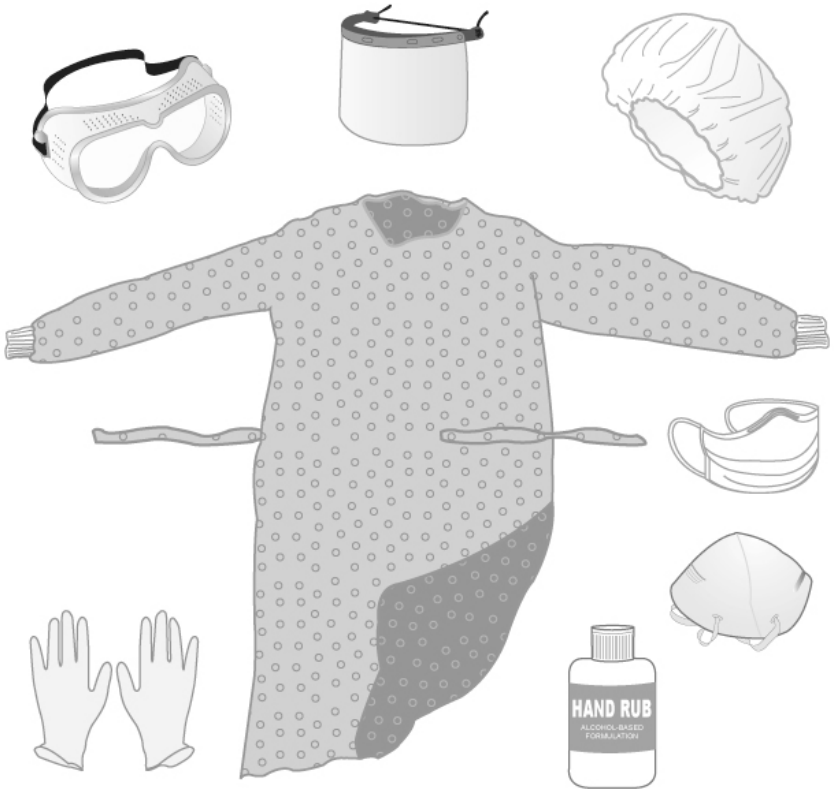
- Select PPE based on the assessment of risk:
  - o Clean, non-sterile gloves or sterile gloves or heavy duty gloves
  - o Clean, non-sterile fluid-resistant gown or sterile fluid resistant gown
  - o Mask and eye protection or a face shield

  The health facility managers should ensure that there is a continued supply of PPE. Hospital staff should be educated and trained 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 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. Wash hands 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 wash hands.

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.
  - o Covering mouth and nose when coughing or sneezing.
  - o Hand hygiene after contact with respiratory secretions.
  - o 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

- Identify patients with acute febrile respiratory symptoms and fast track them (take them through the service points very fast)
- 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, masks and disposal bins 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[16]

Unsafe injection practices can transmit blood-borne pathogens, including hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV.

Use care when handling, using, 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. Immediately after use, without recapping or passing to another person, discard single-use needles and syringes as a unit directly into the sharps container..
- Close, seal, and send sharps containers for incineration when they three quarter (3/4) full (follow your facility protocol carefully).

[16] *WHO best practices for injections and related procedures toolkit*. WHO, 2010. Available at http://whqlibdoc.who.int/publications/2010/9789241599252_eng.pdf

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: o if the health worker's skin is intact o 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.

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. • Remove excess disinfectant with sterile swab • Discard used swab in bin for infectious waste • Use dry sterile swab to stop bleeding at injection site • Discard the used device (a needle and syringe is a single unit) immediately into a safety box . • 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. • Place laboratory sample tubes in a sturdy rack before injecting into the rubber stopper. • Seal the sharps container when ¾ full with a tamper-proof lid. • 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 use swab for disinfecting site to stop bleeding • 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.
  - Clean in piece meal manner; do not pour a lot of water on the surface and push it along
  - Designate cleaning equipment to particular areas according to perceived risk of contamination
  - Use a two bucket system; one for soapy water and another for clean water
  - Dry sweeping with a broom should never be done as it causes organisms to be air born.
  - 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.
- Disinfect spills with chlorine releasing agent before cleaning.
- Change cleaning solutions and equipment frequently, as these items will get contaminated quickly (follow your hospital protocols).
- Wash and dry cleaning equipment before storage

Table: Cleaning, disinfecting, or sterilizing[1]

Setting	Disinfection (sodium hypochlorite 1% in-use dilution, bleaching powder, alcohol (70%)	Manual cleaning with water and detergent	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		✓	✓

[1] *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[2]

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.
  - Avoid vigorous agitation of used patient's linen to avoid release of microorganisms in air, surfaces and persons.
  - Contaminated patient linen should be decontaminated by soaking in 0.5% chlorine. solution at the site of contamination before transporting it to the laundry.
  - Used linen should be washed according to normal routines.
  - Contaminated linen should be stored away from processed linen.
  - Linen should be carried in carts; designated carts for contaminated and clean line.
  - Linen handlers should put on protective clothing (gown and heavy duty gloves) while handling linen.

[2] *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

6.8 Waste disposal

- Ensure safe waste management.
- Consider waste contaminated with blood, body fluids, secretions, and excretions as highly infectious waste, in accordance with local regulations.
- Human tissue and laboratory waste that is directly associated with specimen processing should be treated as highly infectious waste.
- Segregate at the point of generation the 4 categories of waste:
  1. Sharps
  2. Infectious waste
  3. Domestic waste
  4. Hazardous waste
- Transport waste in rigid covered containers
- Waste handlers should use appropriate PPE
- Waste should be either buried or incinerated and ash buried
- Discard single use items properly.

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.
infectious waste* (items soiled with blood/body fluid, anatomical waste, pathological waste, dressings, used syringes, used single-use gloves)	**YELLOW OR RED** • bin liners or waste bins • 15–40 litre capacity, with lids	• waste bins should be collected, emptied, disinfected, cleaned , 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 infectious waste.	• 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. • Placentas should go in the placenta pit.
Domestic waste (paper, packaging, leftover food, beverage bottles/cans)	**BLACK** • Bins and bin liners • 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.

6.9 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.
    - Use appropriate PPE while handling contaminated equipment; gown and heavy duty gloves
- Reprocess reusable equipment appropriately before use with another patient; disinfect, clean, and sterilize
- Store reprocessed equipment in a dust and pest free environment

6.10 Aseptic technique

- Carry out all invasive procedures (surgery, deliveries, injection administration, phlebotomy) under sterile or aseptic conditions.
- Wash hands and lay clean trays with sterile equipment.
- All equipment and supplies including medicines should be maintained sterile throughout the procedures.
- Prepare for the procedure ensuring that all equipment and supplies needed for the procedure is available to avoid moving forth and backward and contact with contaminated surfaces.
- Disinfect body site before starting a procedure.
- Use non touch technique (do not touch sterile part of equipment, supplies and medications or any part of these that goes to tissue below the skin or blood vessels)
- Maintain sterile field during surgery.
- Store medicines in accordance with the manufacturer's recommendations; discard if sterility is compromised, questionable or after 6 hours of reconstitution in case of vaccines and 24 hours in case of other reconstituted medicines.
- Reprocess critical patient equipment once sterility is compromised.

6.11 Additional Precautions/Transmission-Based Precautions.

These are applied after/ when an infectious disease condition is suspected or confirmed. They are additions to standard precautions. The provider should select additional infection control interventions including PPE, based on the risk assessment, epidemiology, or likely pathogen.

Droplet precautions

These are additional precautions for infections transmitted by large droplets that are more than 5 µm in diameter. Because of their large nature, they

typically remain suspended in the air for a limited period of time and settle within 1 m (3 feet) of the source. Such droplets are generated from the respiratory tract or source patient during coughing, sneezing or during procedures such as suction or bronchoscopy.

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 or performing a procedure that may result into coughing should wear amedical mask or surgical mask (tight fitting).
- Use single rooms for infectious patients recommended and door should remain open. Otherwise, cohort patients with same suspected diagnosis. If not possible, place patient beds at least 1 m apart and arranged to keep a distance between patients.
- Immunised health workers against the disease should be rostered to care for certain infectious patientsTeach patients the cough etiquette and provide masks/tissues for covering mouth and nose when sneezing or coughing
- Patient leave the room only for essential procedures and a surgical mask worn during movement

Airborne precautions

These are additional precautions for infections transmitted by small droplet nuclei that are equal or less than 5 µm in diameter

Such small particles evaporate quickly. The resulting dried residues settle slowly from the air, and remain suspended in the air for longer periods of time compared to droplet infections. They also move a longer distance; more than 1 meter from the source. Organisms transmitted by airborne infections are widely dispersed by air currents.

What to do in addition to standard precautions when airborne transmission is possible.

- Provider should apply particulate respirator, e.g. N-95 or similar.
- Ask patient to wait in an open shelter or under a tree.
- Patients diagnosed or suspected to have an airborne infection should be given a medical/surgical mask or requested to place a handkerchief over the nose and mouth.
- Restrict patient movement for essential procedures only
- Teach patients the cough etiquette and provide masks/tissues for covering mouth and nose when sneezing or coughing.
- Placement in 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

- Use single rooms if possible. 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.
- Gloves and gowns for all patient care. These should be removed before leaving patient room or ward
- Wash hands after removal of gloves and gowns while still in the room/ward

- Use disposable equipment or dedicate equipment for patient care. If equipment must be shared among patients, disinfect, clean and sterilize or perform High Level Disinfection between each patient use.
- Patient leaves room for essential procedures only. Precautions should be maintained during transport
- Limit traffic within room/ward; essential staff only and a minimum essential visitors

Combined Precautions

Some organisms are transmitted by more than one route; airborne and contact or droplet and contact. Appropriate combined precautions should be applied in such circumstances.

Table: Precautions by suspected organisms – examples

Additional precautions by suspected organisms – IN ADDITION TO STANDARD PRECAUTIONS	
Additional precautions:	**Disease or organisms include**

Droplet precautions	• Acute respiratory diseases (ARD) transmitted through large droplets including:
	  o influenza (seasonal, pandemic) and
	  o ARD with no pathogen identified, no risk factor for tuberculosis or ARI of potential international concern (influenza-like illness= ILI)
	• Pneumonic plague
	• *Neisseria meningitides* for first 24 hours of antimicrobial therapy
	• Mumps (infectious parotitis)
	• Diphtheria- pharyngeal
	• Pertussis (whooping cough)

Contact precautions	• Vibrio cholera, Shigella species • Ebola/Marburg, Crimean-Congo haemorrhagic fever • Resistant bacteria (such as methicillin-resistant Staphylococcus) • *Clostridium difficile* • Different forms of gastroenteritis • Diphtheria- cutaneous • Herpes simplex or localized zoster
Contact plus droplet precautions	• Adenovirus, para-influenza, RSV • Ebola/Marburg, Crimean-Congo haemorrhagic fever with respiratory symptoms • Avian influenza (e.g. H5N1, H7N9) • SARS, MERS-CoV
Airborne precautions	• Infectious pulmonary TB- especially MDR • Measles • Varicella (chickenpox) (not localized zoster) • ARIs, whenever performing aerosol-generating procedures such as endotracheal intubation or bronchoscopy
Contact plus airborne	• When a novel ARI is identified and the mode of transmission is unknown, it may be prudent to implement the highest level of IPC precautions whenever possible, including the use of particulate respirators, until the mode of transmission is clarified.
No additional - standard precautions only	• 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. • Anthrax

6.12 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.
  - o They should move to the front of the queue for all services and be assessed promptly.
  - o They should wait 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.
  - o Place the patient in a single room or cohort with similarly infected patients.
  - o Limit patient unprotected movement and have them wear a mask when moving about.
  - o Provide hand hygiene facilities for patients for regular sanitizing of their hands.

Table: Precautions for ARDs according to specific clinical settings and procedures[1]

	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**
Reception (without direct patient contact)							✓	
ER Quick check Physical exam	✓	✓	✓					
Patient waiting area	✓						✓	
General nursing care	✓			✓			✓	
Blood collection	✓	✓		✓			✓	
Nebulization	✓			✓			✓	
Induced sputum	✓	✓	✓		✓	✓		✓
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	✓	✓			✓	✓		✓

[1] *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

6.13 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.
- "Fast-track" them for rapid diagnosis and treatment to minimize time spent in the hospital for patients suspected of having TB.
  - o They should move to the front of the queue for all services and be assessed promptly.
  - o They should wait in an open place or in a comfortable area separate from the general waiting room.
- Community-based approaches for the management of TB patients (including MDR-TB) should be prioritized over hospitalization
  - o Complement with education of household members and other close contacts on TB infection control.
- Avoid unnecessary admissions of TB patients to health-care facilities.
  - o 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.
  - o 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 patient.

6.14 Precautions when caring for patients with suspected or confirmed Filovirus (Ebola, Marburg) haemorrhagic fever[1]

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.

[1] *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/

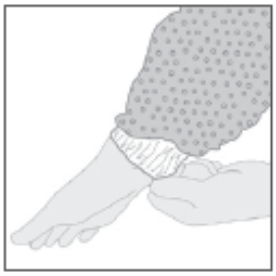
Steps to put on essential required PPE

1 Always put on full PPE when handling either a suspect, probable or confirmed case of VHF. Gather all the necessary items of the PPE beforehand according to the checklist.

2 The dressing and undressing of PPE should be supervised by another trained member of the team. These instructions should be displayed on the wall in the dressing and undressing room.

3 Put on the scrub suit in the changing room.

4 Put on gum boots if available.



5 Put on first pair of gloves (will go under cuff).

6 Put on the gown and head cover

7 Put on plastic apron

8 Put on the medical mask.

OR

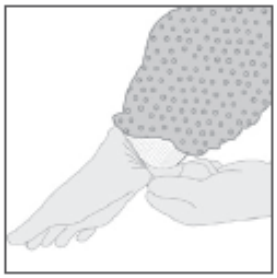
9 Put on eye protection

10 Put on second pair of gloves (over cuff).

Whilst wearing PPE:

- Avoid touching or adjusting other PPE
- Remove gloves if they become torn or damaged
- Perform hand hygiene before donning new gloves

Steps to remove PPE

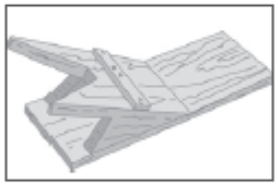


1 Remove the outer pair of gloves and dispose of safely

2 Peel off plastic apron and dispose of safely, (if the apron is to be reused, place in a container with disinfectant)

3 Remove gown and roll inside-out and dispose of safely.

4 Perform hand hygiene "with gloves on"



5 Remove gum boots without touching (ideally use boot remover) and place in container with disinfectant.

6 Remove eye protection (from behind head).

7 Put eye protection in a separate container for reprocessing.

Steps to remove PPE

8 Remove mask from behind head. When removing a mask, untie the bottom strings first and the top strings next. Then remove hood.

9 Remove second pair of gloves.

10 Perform hand hygiene.

11 Proceed to the clean area of the isolation facility.

See Section 19 for TB and HIV prevention and care services for health workers.

7. Procedures

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.
- Have a witness, clinician or nursing staff countersign on the consent document.
- 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 sharp materials.
- Treat waste contaminated with blood, body fluids, secretions, and human tissue as clinical waste in accordance with local regulations.

[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

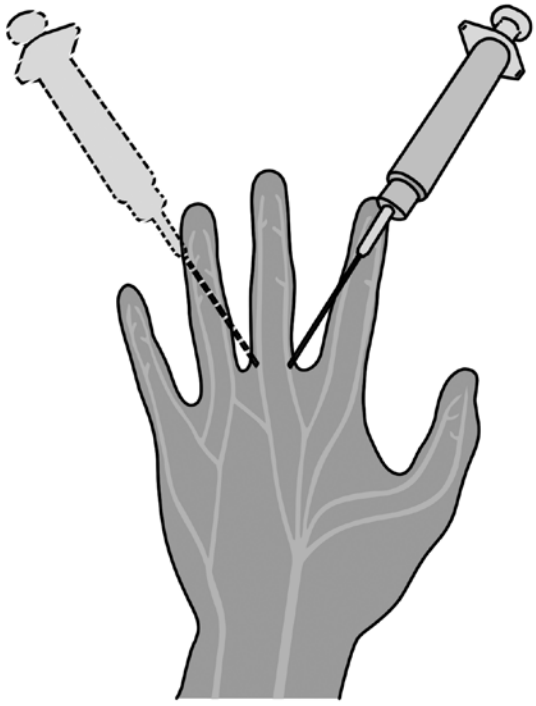
- Sterile gloves should be used and a sterile field maintained for:
  - excision skin biopsy
  - lymph node biopsy
  - nodulectomy
  - thoracocentesis
  - chest tube placement
  - lumbar puncture
  - paracentesis, arthrocentesis, pericardiocentesis
  - bone marrow biopsy
  - liver biopsy
  - spleen aspirate
  - 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, cautions

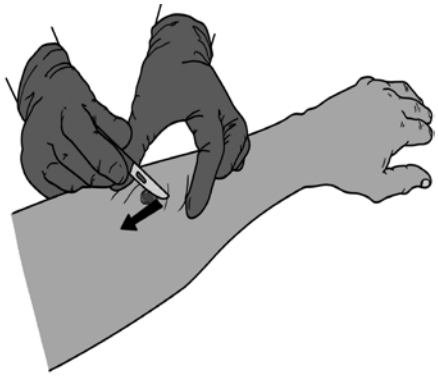
- Do not perform shave biopsy of pigmented lesions – melanoma is more difficult to stage if shaved.
- Take specimens from lesions away from the face and areas of the limbs that are less exposed

Material and equipment

- Antiseptic solution
- lidocaine
- 5–10 ml syringe, 23- to 25-gauge needle
- surgical blade and handle
- culture media
- buffered formalin
- 10% formalin
- microscope slides
- specimen containers
- paper labels
- gauze and cotton swabs
- elastic strapping

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.

Investigations

- If suspicion is for a neoplasm, send specimen in 10% formalin. Buffered formalin is preferred for molecular analyses. Prepare a thin smear, allow to air dry, and fix with methanol.

Diagnosis of cutaneous leishmaniasis (see Section 11.20)

- The diagnostic yield for cutaneous leishmaniasis will be increased by:
  - using several techniques (lesion aspirate, skin biopsy, dermal scraping)
  - making several preparations from each specimen
  - biopsying multiple areas of the lesion, including the centre, the active edges and adjacent skin

Note that scrapings should be taken last to avoid contamination of the site.

- Lesion aspirates should be sent for parasite culture, PCR analysis
- Punch biopsy samples should be divided into four parts and sent for:
  - culture
  - impression smear (similar to thin smear)
  - histopathology (poor for diagnosis, but useful for excluding other causes)
  - PCR analysis
- Scrapes should be sent for histopathology

7.2.2 Skin biopsy –punch

Indications

- any inflammatory lesions or suspected Kaposi sarcoma
- cutaneous leishmaniasis

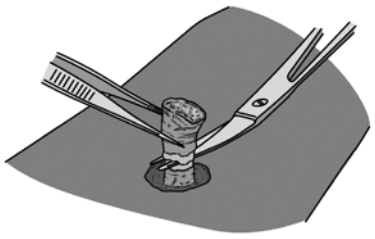
Material and equipment

- antiseptic solution
- lidocaine
- 5–10 ml syringe, 23- to 25-gauge needle
- cylindrical punch biopsy knife
- surgical blade and handle
- tissue forceps
- microscope slides
- specimen containers
- buffered formalin
- 10% formalin
- gauze and cotton swabs
- elastic strapping
- suture material, needle driver, scissors

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

- The biopsy should be divided in two and on part sent in formalin for histopathology, and the other sent saline for culture. If there is a clinical suspicion of CL impression smears should be performed after sample is divided.

7.2.3 Skin snip for the diagnosis of microfilariasis

In a health facility, the procedure should be performed in the vicinity of the laboratory where microscopy is done. Where there are many patients and under field conditions when several samples are collected, skin snips are placed in a multi-well round-bottomed microtitre plate. The surgical blades, razor blades and needles should be used on one person and then disposed of; none of these materials should be disinfected for reuse.

Indications

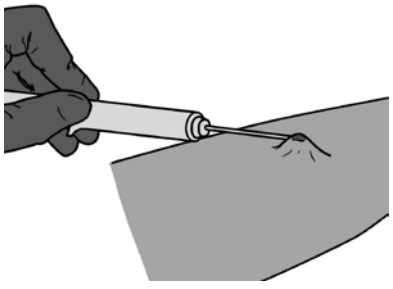
- Diagnosis of onchocerciasis or other skin filariases.

Equipment

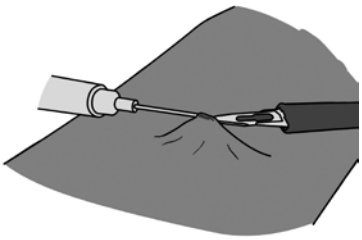
- antiseptic solution
- cotton swabs
- 23- to 25-gauge needles
- 5-10 ml syringes
- razor blade or surgical blade
- saline
- microscope slides and cover slips
- a multi-well round-bottomed microtitre plate with a cover plate
- adhesive paper labels
- parafilm strips or cellotape
- plaster strips
- inverted light microscope

Procedure

1. Label the glass slides or microtitre plate with: individual's number, **R** for the right snip and **L** for the left snip
2. Put two drops or 50 µL of saline where the snips will be placed on the glass slide or in the respective wells of the microtitre plate. Use a 5 mL syringe to place the drops
3. 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 upper outer quadrant of the buttock.
   - In Yemen – a skin snip is not indicated because the most frequent clinical manifestation is a lichenified dermatitis (sowda) in which microfilaria are rarely found.
4. One snip should be taken from the left and one from the right buttock or iliac crest.
5. Clean the skin with antiseptic solution and allow it to dry.



6. 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.



7. Cut off the piece of skin with a sterile razor blade or surgical blade. There should be no blood on the snip. The snip site should be covered with a plaster strip.

8. The blades and needles used during the procedure should be for one person and then disposed of. They should not be reused.
9. Place the skin snip on a microscope slide with a few drops of saline. Cover with cover slip. Send the specimen to the laboratory immediately for microscopy before the saline dries.

10. On a labelled multi-well round-bottomed microtitre plate:
    - two saline drops (50 µL) are placed per receiving well
    - skin snips from each individual are placed, the right snip in one well and the left snip in the next well
    - the plate is covered with parafilm strip or cellotape to prevent evaporation
    - the plate is kept at room temperature for up to 12 hours to allow the microfilariae to emerge from the skin snip
    - whether the microfilaria are dead or alive they can be seen very well on microscopy and counted if they have emerged from the skin

11. For microscopy after 12 hours' incubation at room temperature
    - suck the saline out of the microtitre plate well, place it on a glass slide
    - identify and count the microfilaria under a microscope
    - dry the skin on filter paper and weigh on an analytical balance
    - if the weighing is for later put a drop of formalin in the well to preserve the skin and cover
    - calculate the number of microfilaria per snip, then microfilaria per milligram of skin (mf/mg). This indicates the intensity of infection and reflects the individual's parasite load

Comments

- Usually, the species and number of microfilariae emerged 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*, microfilaria of *Mansonella streptocerca* in Africa and *Mansonella ozzardi* in Latin America may also inhabit the human skin.
- Microfilariae in the eye may be identified using a slit lamp.
  See Section 10.12.

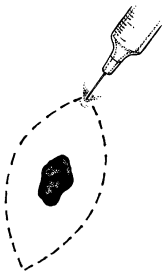
7.2.4 Skin biopsy – excision

Indications

- basal cell and squamous cell carcinomas (squamous cell carcinoma is life-threatening and should be treated with wide local surgical excision)
- melanoma
- parasitic diseases like:
  - cutaneous leishmaniasis
  - onchocercomata in onchocerciasis
  - subcutaneous cysticercosis
  - subcutaneous fascioliasis

Material and equipment

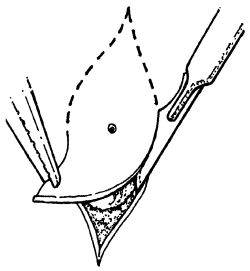
- sterile gloves and sterile towels or drapes
- antiseptic solution
- lidocaine
- 5–10 ml syringe, 23- to 25-gauge needle
- surgical blade and handle
- tissue forceps
- microscope slides
- specimen containers
- paper labels
- 10% formalin
- buffered formalin
- culture media eg RPMI ± FCS
- 70% alcohol
- suture material, needle driver, scissors
- gauze and cotton swabs
- elastic strapping



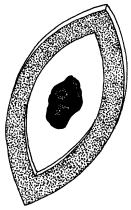
Procedure

1. Cleanse the area of the biopsy with skin antiseptic solution.

2. Anaesthetize the area with 1–2% lidocaine.

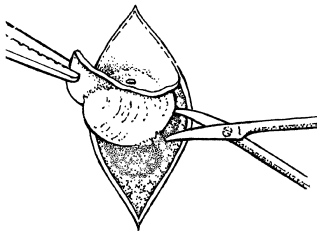


3. Incise the skin with a scalpel parallel to the direction of the skin lines (Langer's lines). These can be found by placing two fingers on opposite sides of the incision and gently squeezing them and the skin together.



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.

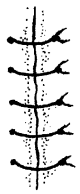
5. Lift the sample with forceps and separate it from the underlying tissue.



6. Excise subcutaneous lesions after gaining access through the skin incision. Do not remove skin unless the subcutaneous mass is adherent.

Subcutaneous nodules may be onchocercomata caused by *Onchocerca volvulus*. These should be sent for histology after removal. The disease is **onchocerciasis** and the procedure is a nodulectomy. An intact subcutaneous cyst or fibrous capsule should be sent in its entirety for histological examination. It may be a cysticercus of etraneural **cysticercosis** or an infiltrate around a liver fluke in ectopic **fascioliasis**.

7. Close the wound with simple interrupted sutures as needed.



8. For the diagnosis of **cutaneous leishmaniasis**, ensure enough biopsy and aspirate material.
   - incise with a surgical blade several millimetres outward from the centre through the active border of the lesion to include normal skin at the periphery, making sure to go deep enough to penetrate the dermis
   - take aspirates from the incision
   - obtain a full-thickness biopsy

Investigations

With suspicion of cutaneous leishmaniasis

- Aspirated material is subjected to - culture for trypomastigotes
  - PCR analysis for species identification
  - thin smear preparation to demonstrate amastigotes
- The full-thickness biopsy is divided thus: - culture medium eg RPMI ± FCS
  - buffered formalin for PCR analysis
  - 10% formalin for histology
  - on glass slide for impression smear
- Excised material should be sent for histology

7.2.5 Fine needle aspiration (FNA)

Indications

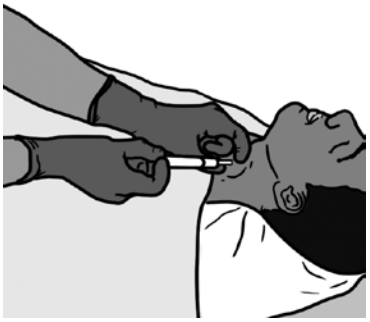
- FNA is a quick and minimally invasive procedure to evaluate a mass or lymphadenopathy (see Section 10.5)
- Parasites may be demonstrated in aspirates from:
  - the trypanosomal chancre and lymph nodes in human African trypanosomiasis (HAT)
  - lymph nodes in visceral leishmaniasis (VL)
  - the spleen in VL but this is done at a designated VL treatment centre
  - skin lesions in cutaneous leishmaniasis (CL)

Contraindications

- Pulsatile or air-filled mass

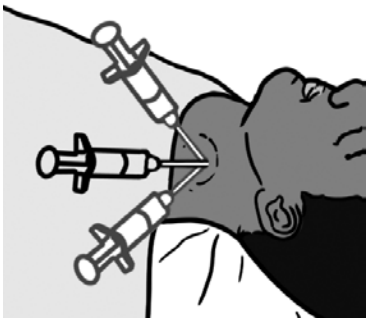
Equipment

- Antiseptic solution
- 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).

- In suspected parasitosis the aspirated material is subjected to the following:
  - culture for trypomastigotes (HAT, CL, VL)
  - thin smear preparation to demonstrate trypomastigotes (HAT) or amastigotes (CL, VL)

Complications
- Pneumothorax – see Quick Check page 22 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 and microbiology.

7.2.6 Lymph node biopsy (excisional)

Equipment
- sterile gloves and sterile towels or drapes
- antiseptic solution
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel blade and handle
- suture material, needle driver, forceps
- 10% formalin
- culture media

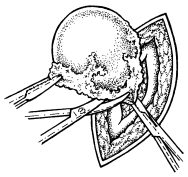
Procedure
1. Lymph nodes are located beneath the fascia and, therefore, require deeper dissection than skin or subcutaneous lesion biopsies. A general anaesthetic may be required.

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 or mycobacterial 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, trypanosomiasis, 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 solution
- 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.

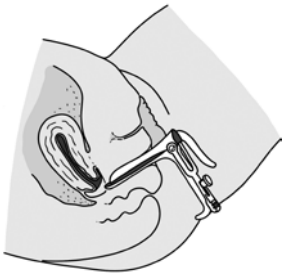
External genital exam

- 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.

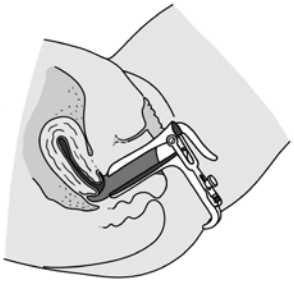
Speculum exam

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.

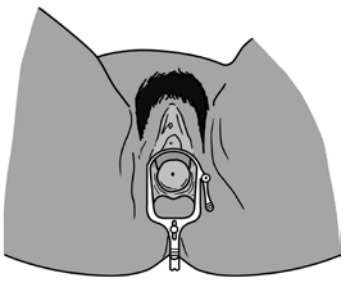
2. When the speculum is halfway in, turn it so the handle is down.



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.

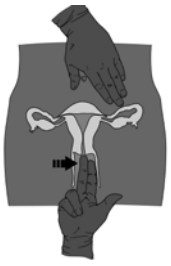
Bimanual exam

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.

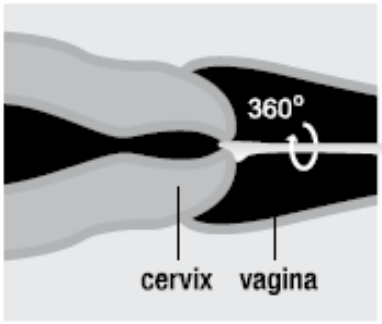


5. Palpate the inside of the vagina. Make sure there are no unusual lumps, tears, or sores.
6. Ask the woman to cough or push down as if she were passing stool
   - Look to see if something bulges out of the vagina.
     If it does, she may have a fallen (prolapsed) womb or fallen bladder.

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.
  - o 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).
  - o 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.
  - o 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.

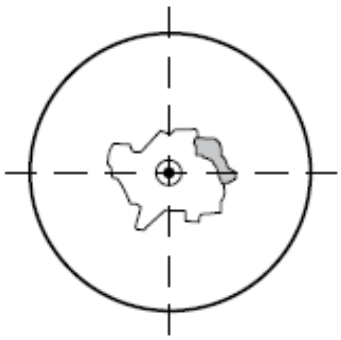
Equipment

- 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

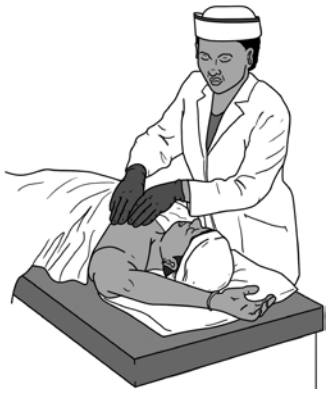
The clinical breast examination consists of 2 components, inspection and palpation. The examination should include the neck, chest, and axillae in addition to the breasts. A female chaperone or assistant should be present throughout.

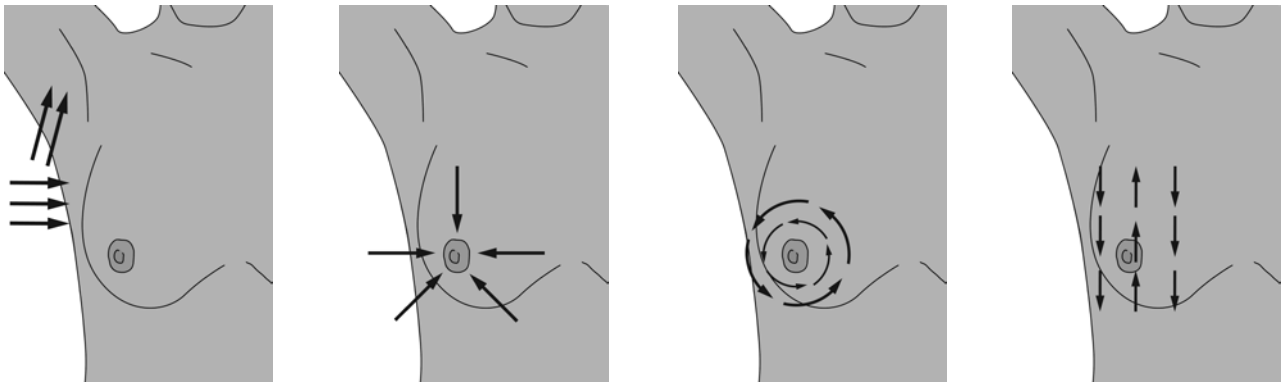
Inspection

- 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

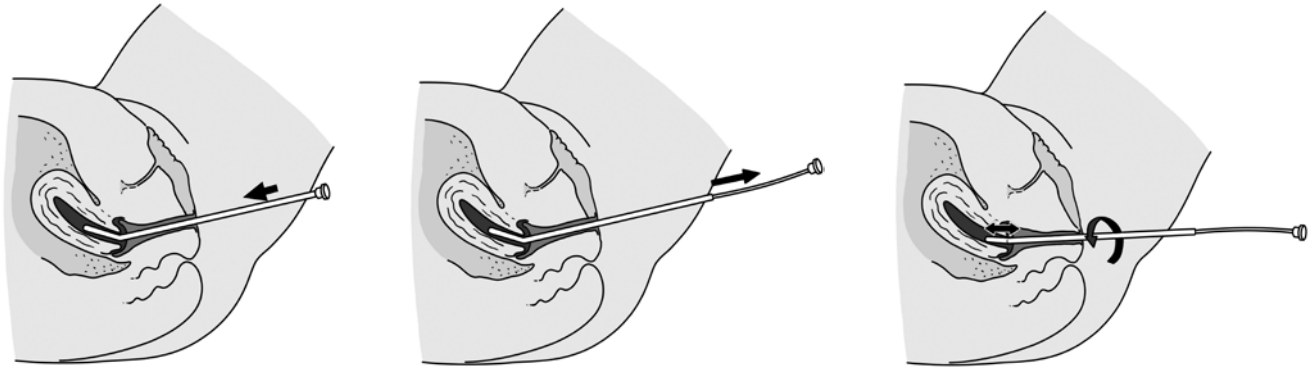
- forceps
- tenaculum or vulsellum
- uterine sound
- long needle and syringe
- lidocaine, long needle, syringe
- cervical dilators
- biopsy curette and syringe
- formalin
- microscope slides
- culture media.

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
- crystal 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 Vaginal secretion 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 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.

[3] *Bench aids for the diagnosis of intestinal parasites.* WHO, 2004.
Available at http://www.who.int/wormcontrol/documents/benchaids/training_manual/en/

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.
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 (-)

[4] *Manual of basic techniques for a health laboratory, 2nd edition.* WHO, 2003. Available at http://whqlibdoc.who.int/publications/2003/9241545305.pdf

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

Indications

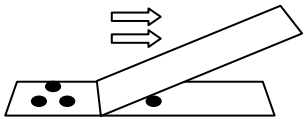
- diagnosis of
  - malaria (see Section 11.25) [6]
  - human African trypanosomiasis
  - lymphatic filariasis
  - loiasis

Equipment

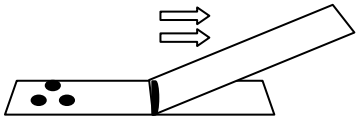
- 2 microscope slides
- methanol
- Giemsa solution.

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] *Bench aids for the diagnosis of malaria infection. WHO, 2002.*
Available at *http://*whqlibdoc.who.int/publications/2000/9241545240.pdf

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.
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)[7]

Indications

- diagnosis of - TB
  - Buruli ulcer disease

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.

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.[8,9] 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.

[7] *AFB smear staining.* WHO/Union, 2004. Available at http://www.theunion.org/index.php/en/resources/scientific-publications/item/185-afb-smear-staining.

[8] *Manual of diagnostic ultrasound. Volume 1, Second Edition.* WHO, 2011. Available at http://whqlibdoc.who.int/publications/2011/9789241547451_eng.pdf

[9] Manual of ultrasound for low-resource settings. Partners in Health, 2011. Available at http://parthealth.3cdn.net/6e013074d8f4c4c7d8_mlblfxb8q.pdf

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

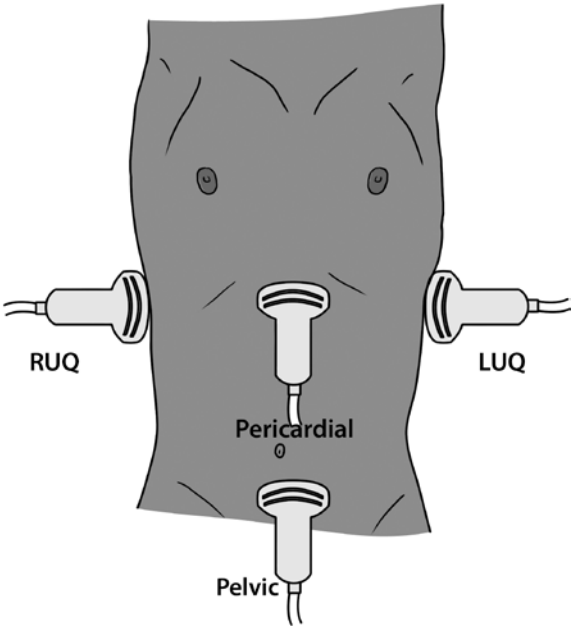
1. Place the patient in the supine position, using cervical spine stabilization if necessary.
2. Place the ultrasound probe on the patient's body in 4 regions to assess for free fluid, which will appear black on the ultrasound screen. The fluid will accumulate between the solid organs, which appear grey 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).

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.

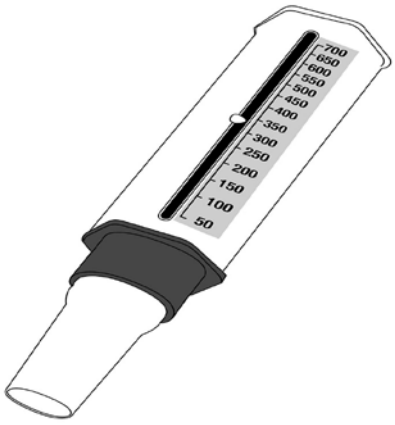
- Failure to suspect ectopic pregnancy in patients with vaginal bleeding, abdominal pain, or hypotension during pregnancy.
- Misdiagnosis of fluid inside the uterus as a true intra-uterine pregnancy and missed diagnosis of ectopic pregnancy.
- Failure to diagnose free fluid in the abdomen and pelvis 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.

7.2.22 Peak flow measurement[10],[11]

Indications
For asthma or COPD (see Section 10.6.4), the peak flow meter is useful:
- To regularly monitor lung function and response to treatment over the short- and long-term
- To determine the severity of an asthma attack or COPD exacerbation
- To assess response to treatment during an attack

Equipment
A peak flow meter is a portable, inexpensive, hand-held device used to measure how air flows from the patient's lungs. It measures the ability to push air out of the lungs in one "fast blast." Use a standard range peak flow meter for older children, teenagers and adults.



Procedure

Establish a baseline measurement—unlike a blood pressure reading or a cholesterol test, there is no peak flow measurement that is normal for everyone. For this reason, it is important to determine what peak flow value is normal for an individual.

Re-measure the personal best peak flow value once each year to measure changes in the disease.

[10] American Lung Association

[11] UpToDate- accessed ……

Instructions to health worker and patient: **Step 1:** Before each use, make sure the sliding marker or arrow on the Peak Flow Meter is at the bottom of the numbered scale (zero or the lowest number on the scale).
Step 2: Stand up straight. Remove any foreign substance from your mouth. Take a deep breath. Put the mouthpiece of the peak flow meter into your mouth. Close your lips tightly around the mouthpiece. Place the peak flow meter in the mouth, with the tongue under the mouthpiece. In one breath, blow out as hard and as quickly as possible until you have emptied out nearly all of the air from your lungs.
Step 3: The force of the air coming out of your lungs causes the marker to move along the numbered scale. Note the number on a piece of paper.
Step 4: Repeat the entire routine three times.
Step 5: Record **the highest** of the three ratings.

Cleaning to prevent cross-infection
Peak flow meters need care and cleaning. Dirt collected in the meter may make the peak flow measurements inaccurate. Use peak flow meters with an integral one-way valve that prevents patients from inhaling through the meter during use. In addition, disposable cardboard one-way mouthpieces are available for other brands of peak flow meter (which do not have the inbuilt protection). Alternatively proper cleaning with mild detergent in hot water can be done.

Interpretation of peak flow rates
A "normal" peak flow rate is based on a person's age, height, sex and race. A standardized "normal" may be obtained from a chart comparing the patient with a population without breathing problems. [insert}

To determine the patient's **normal** peak flow measurement, one should measure the peak flow when there are no asthma symptoms. Perform three measurements with the same peak flow meter two to four times daily for two to three weeks. Note the highest peak flow measurement achieved; this is the "personal best." This number is used to determine if future peak flow measurements are normal or low, and is also used to create a normal range (between 80 and 100 percent of the personal best peak flow measurement).

Readings below the normal range are a sign of airway narrowing in the lungs. A low peak flow measurement can occur before asthma symptoms such as wheezing or shortness of breath develop.

Three zones of measurement are commonly used to interpret peak flow rates. It is easy to relate the three zones to the traffic light colors: green, yellow, and red. In general, a normal peak flow rate can vary as much as 20 percent.
Green Zone:
80 to 100 percent of the patient's "normal" peak flow rate signals all clear. A reading in this zone means that the asthma is under reasonably good control. Advise patient to continue prescribed program of management.
Yellow Zone:
50 to 80 percent of the patient's usual or "normal" peak flow rate signals caution. This means airways are narrowing and the patient may require extra treatment.
Red Zone:
Less than 50 percent of the patient's usual or "normal" peak flow rate signals a medical emergency. Immediate decisions and actions need to be taken. Severe airway narrowing may be occurring. Use the acute asthma (or COPD exacerbation) management plan.

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.

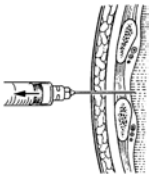
Equipment

- 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.

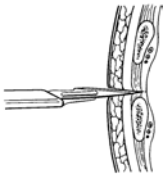
Procedure

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).

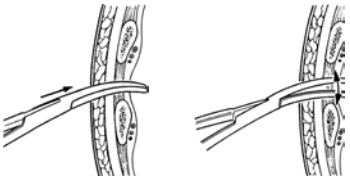


7. Aspirate fluid from the chest cavity to confirm position of the needle.
8. Make a 3–4 cm horizontal incision just above the rib to avoid damaging the vessels under the lower part of the rib.

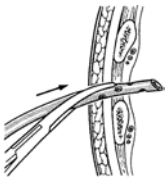


9. Use more lidocaine to anaesthetize the intercostal tissues and pleura at the site of insertion.

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.

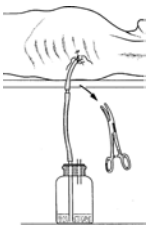


11. Insert a finger into the tunnel to confirm that it has penetrated through to the pleural space. A finger should be swept around to ensure the liver or spleen is not nearby.



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.



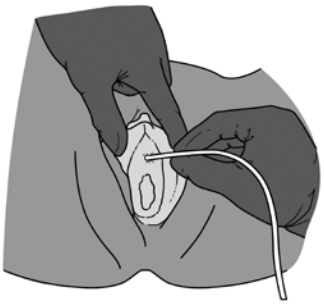
Aftercare and tube removal

- 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

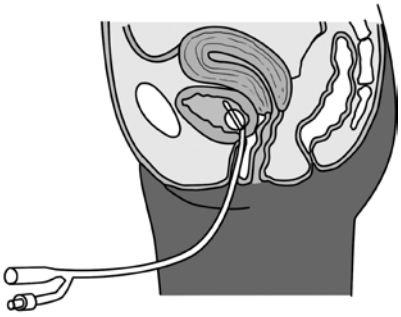
- acute urinary retention
- monitoring urinary output.

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 2–4 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 page 4 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.

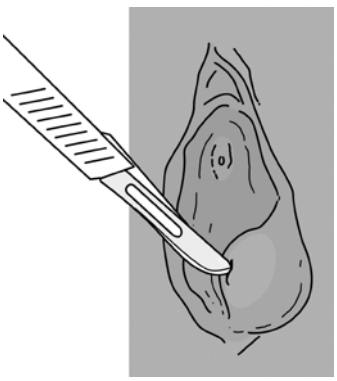
Procedure

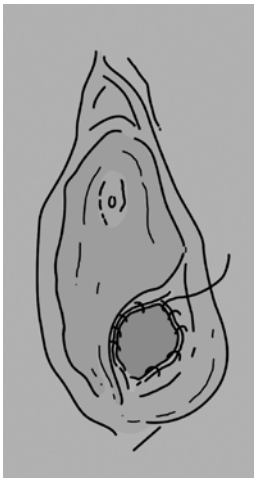
A female chaperone or assistant should be present throughout.

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

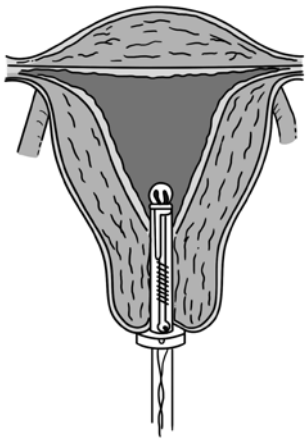
A female chaperone or assistant should be present throughout.

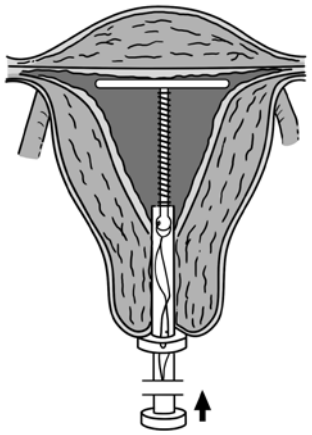
1. Explain the insertion procedure to the patient; show her the instruments to be used and the IUD. Tell her that she will experience some discomfort or cramping during the procedure, and that this is to be expected.
2. Ibuprofen (200–400 mg), paracetamol (325–1000 mg), or other pain relief may be given 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.

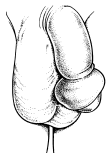




Complications

- 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 4 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 page 4 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

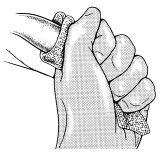
- sterile gloves and sterile towels
- antiseptic
- lidocaine without epinephrine, 5–10 ml syringe, 23- to 25-gauge needle
- scalpel
- two artery forceps
- straight scissors
- suture material, needle driver, forceps.

Procedure

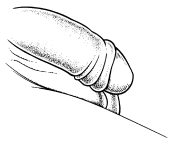
- Treat paraphimosis by reduction of the foreskin or, if this fails, by dorsal slit. Circumcision, performed as a non-emergent procedure is the definitive treatment.

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.

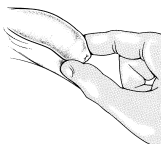


5. Usually then, the foreskin can be pulled over the glans.



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.

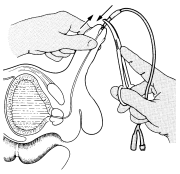
Procedure

1. Position the patient lying face up.

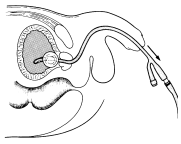
2. Wash the area with soap and water, retracting the foreskin to clean the furrow between it and the glans. Put on sterile gloves and, with sterile swabs, apply antiseptic to the urethra and glans. Isolate the penis with a perforated sterile towel.

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.

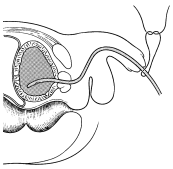
   If right-handed, stand to the patient's right, hold the penis vertically and slightly stretched with the left hand, and introduce the urinary catheter gently with the other hand.



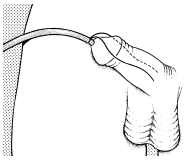
   At 12–15 cm, the catheter may stick at the junction of the penile and bulbous urethra, in which case angle it down to allow it to enter the posterior urethra. A few centimetres further, there may be resistance caused by the external bladder sphincter. This may be overcome by asking the patient to relax the perineal and rectal region while gently advancing the catheter.



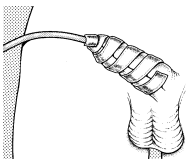
4. Urine escaping through the catheter confirms entry into the bladder. Advance the catheter 5–10 cm before inflating the balloon. This prevents the balloon inflating in the prostatic urethra.



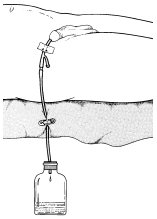
5. Remember to pull the foreskin back over the glans once the catheter has been placed. If left retracted (glans exposed), the foreskin can contract, causing a paraphimosis.



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.

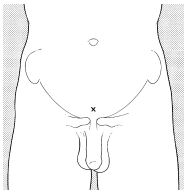
Complications
- Urinary tract infection, sepsis. If the patient appears to be in shock, with fast heart rate and low blood pressure, see Quick Check page 4 for immediate management.
- Bladder rupture is a rare complication of chronic indwelling urinary catheters. If the patient is in severe pain or shock, or the rupture is determined to be intraperitoneal, see Quick Check page 4 for immediate management and arrange for emergency surgery.
- Urethral or prostate trauma.

7.3.7 Suprapubic catheter

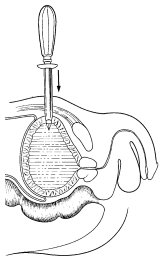
Indications
- Bladder puncture may become necessary if urethral catheterization fails.

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.

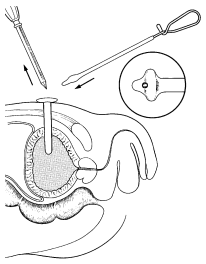
Equipment
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- 16-gauge needle, 50 ml syringe
- trochar and cannula
- 10 ml syringe filled with water or saline
- tape and suture material
- a container for drainage
- dressing material.



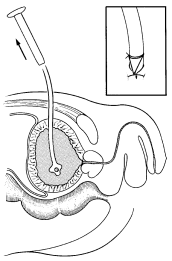
Procedure



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.

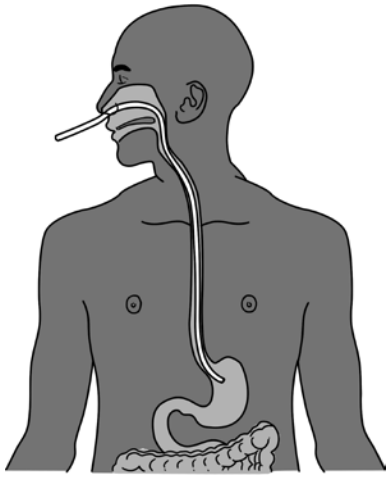


6. Introduce the catheter well into the bladder. Once urine flows freely from the catheter, withdraw the cannula. Inflate the catheter balloon.
7. Fix the catheter to the skin with the stitch used to close the wound and connect it to a bag or bottle. Take care that the catheter does not become blocked, 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 8 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 2 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 22 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

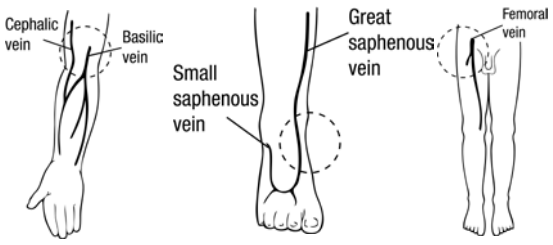
- Should not be performed if less invasive means of obtaining venous access are available.
- There is infection over cutdown site.
- Relative:
  - coagulation disorders
  - impaired immunity
  - impaired wound healing.

Equipment

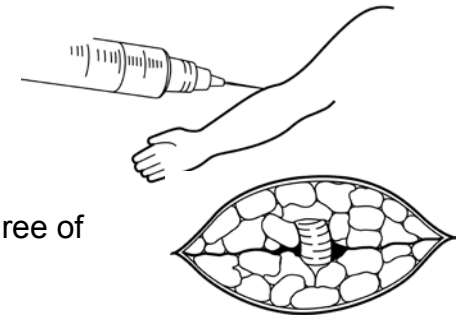
- sterile gloves and sterile towels or drapes
- antiseptic solution
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- suture material
- scalpel
- curved haemostat
- scissors
- venous dilator
- large bore IV catheter
- IV tubing
- needle driver
- forceps
- antibiotic ointment
- tape
- dressing material.

Procedure

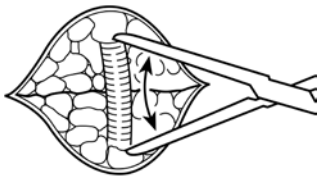
1. The most commonly used vessels for venous cutdown include the greater saphenous, basilic, and cephalic veins. The saphenous vein is easily accessible at its location just anterior to the medial malleolus, and the accompanying nerve is relatively unimportant, making it a good site for cutdown.



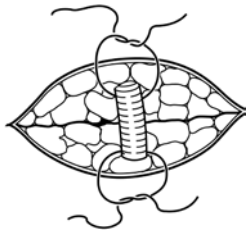
2. Clean the area with antiseptic and cover with sterile drapes; be sure to maintain strict aseptic technique.
3. The skin and subcutaneous tissue should be anaesthetized with lidocaine.
4. A tourniquet may be placed proximal to the cutdown site; this will help visualize the vein.
5. Using the scalpel, incise the skin perpendicular to the vein. A longitudinal incision will not allow the required degree of exposure.



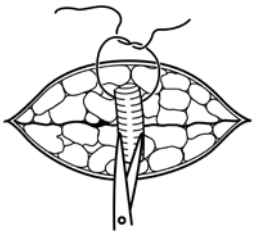
6. Carefully isolate and mobilize the vein using blunt dissection.



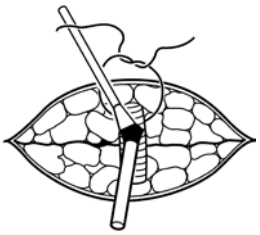
7. Using the haemostat, gently lift the vein free from the underlying connective tissue and pass two sutures under it proximal and distal to the site on the vein that will be cannulated.



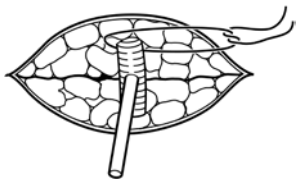
8. Tie the distal suture. The proximal suture may be left untied, as it will be used to control any bleeding.



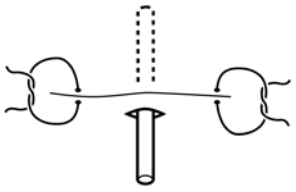
9. Incise the vein at a 45° angle between the two sutures. Do not incise more than halfway through as this may cause the vein to tear and retract from the field.



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

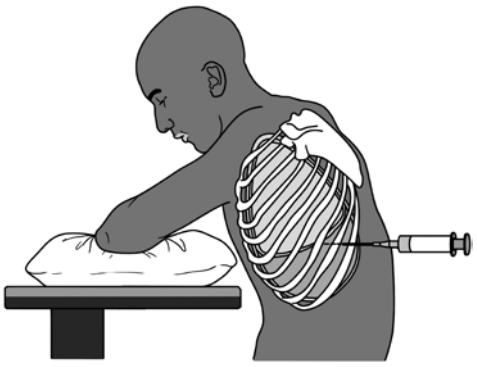
- thrombocytopaenia
- bleeding diathesis
- pre-existing infection at the site of needle insertion.

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.

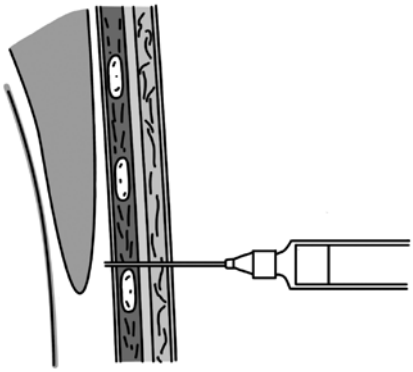
Procedure

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 22 and Section 4.2 for immediate management) – if significant, the patient will require a chest tube
- haemothorax (see Quick Check page 22 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 4 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 2 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
- staging of human African trypanosomiasis

Contraindications

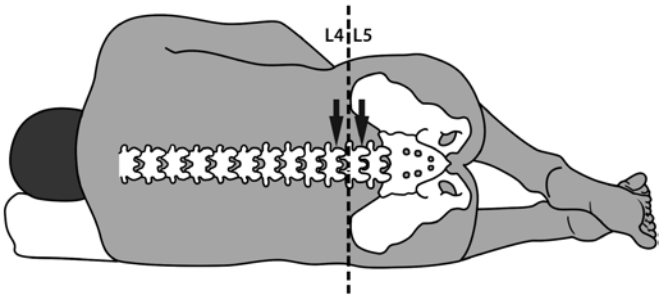
- Infection at the site.
- Increased intracranial pressure evidenced by focal neurological signs, papilloedema, altered mental status, or recent seizure. Lumbar puncture performed on a patient with increased intracranial pressure can lead to fatal cerebral herniation (brain shift) (see Section 10-10b).
- Bleeding disorder or low platelets.

Equipment

- sterile gloves and sterile towels or drapes
- antiseptic solution
- 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.

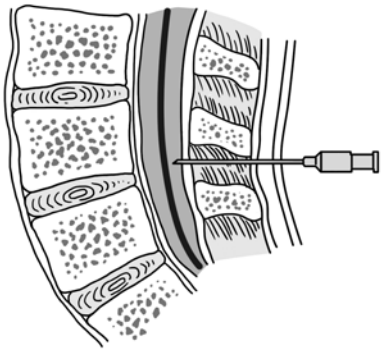
Procedure

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.

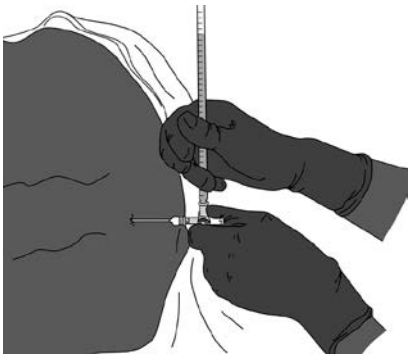


5. Lumbar punctures are typically performed at the level of the L4–L5 interspace, well below the end of the spinal cord. The interspace may be found by drawing an imaginary line

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 cmH_20).
    - 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 6 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

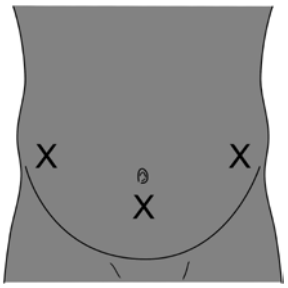
- Diagnostic
  - sample for investigation of ascites of undetermined etiology
  - evaluation for peritonitis
  - evaluation of intra-abdominal haemorrhage or bowel perforation in trauma
- Therapeutic
  - relief of abdominal pain and discomfort caused by tense ascites
  - relief of dyspnoea caused by 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

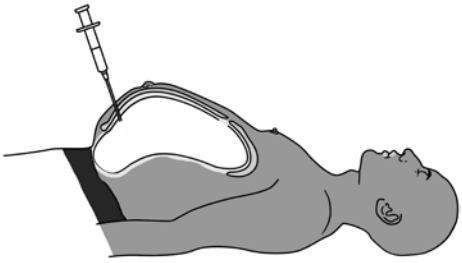
Equipment

- sterile gloves and sterile towels or drapes
- Antiseptic solution
- 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



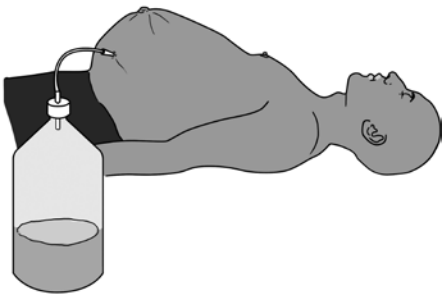
Procedure

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.



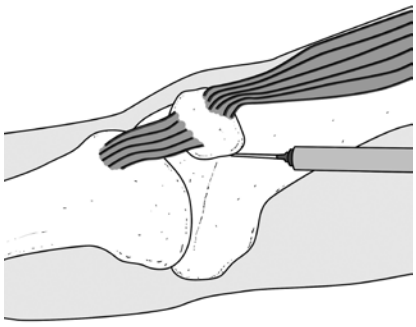
Investigations
(see Section 10.9 for interpretation)
- Routine investigations include cell count and differential, albumin, total protein, Gram stain, and culture.
- If tuberculous peritonitis is suspected, send sample for AFB smear and mycobacterial culture.
- If malignancy is suspected, send sample for cytology.
- Glucose and amylase may be useful.

Complications
- Post-paracentesis hypotension. Give fluids acutely – usually self-resolving (see Quick Check page 4 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 8 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)

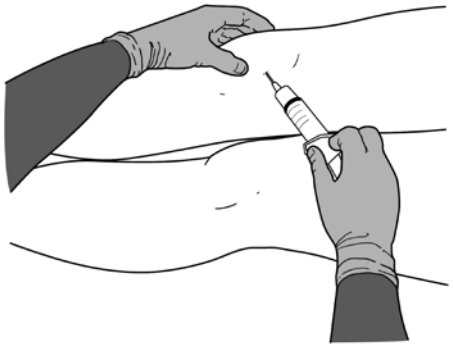
Indications
- suspected infectious or crystal-induced arthropathy
- unexplained joint effusion or monoarthritis
- symptomatic relief from a large effusion
- see Section 10.13 Painful joints.

Contraindications
- significant overlying cellulitis or soft tissue infection
- bleeding diathesis
- joint prosthesis.



Equipment
- sterile gloves and sterile towels or drapes
- antiseptic solution
- 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

- Iatrogenic septic arthritis if the patient appears to be in shock, with fast heart rate and low blood pressure, see Quick Check page 4 for immediate management.

Other complications may include:

- joint instability
- re-accumulation of joint effusion

7.4.5 Pericardiocentesis

Indications

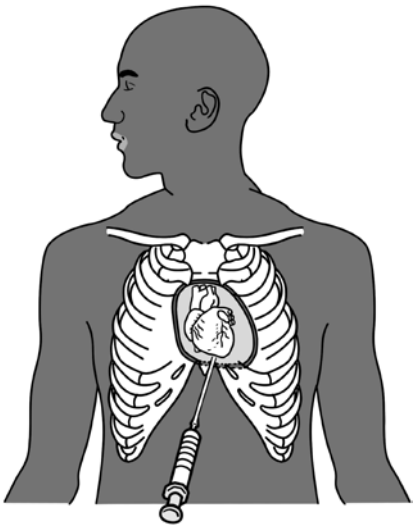
- diagnostic sample to determine etiology of effusion
- cardiac tamponade (emergent).

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 solution
- lidocaine, 5–10 ml syringe, 23- to 25-gauge needle
- long 16-gauge cannula
- dressing material
- microscope slides and culture media



Procedure

1. If possible, this procedure should be done by an experienced operator with guidance of echocardiography or fluoroscopy.
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. Tap as much as possible.

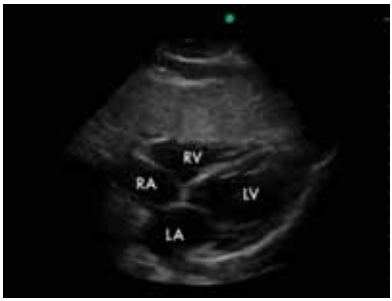
Investigations

- Gram stain, Zn/auramine stain, chemistry and culture
- Cytology (take off a large volume >200 mls)
- for culture, inoculate into the culture bottle immediately.

Complications

- Myocardial or coronary vessel laceration may present in a delayed fashion as hemopericardium or cardiac tamponade – (see Quick Check page 4 for immediate management and call for surgical help).
- Acute left or right ventricular failure with pulmonary oedema (see Quick Check page 4 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 4 for immediate management.
- Pneumothorax (see Quick Check page 22 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 2 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 8 for immediate management and call for surgical help.

Fig 1a Normal Pericardium



1b Free fluid in Pericardium

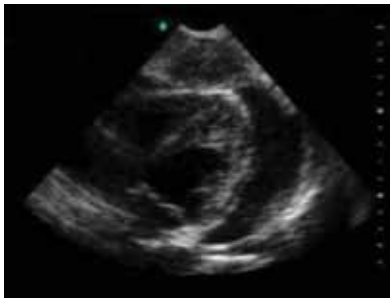
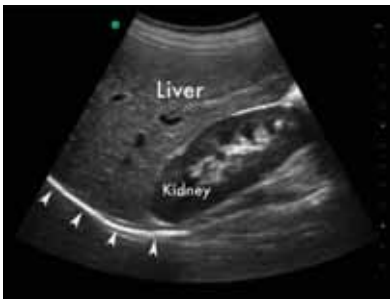


Fig 2a Normal RUQ



2b Free fluid in RUQ

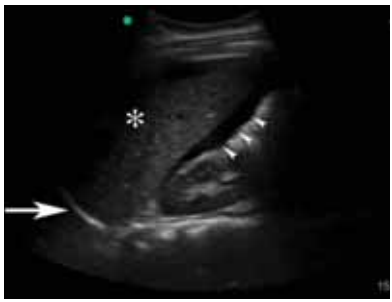
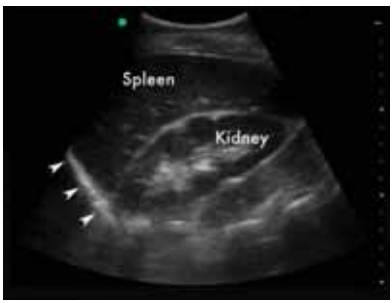


Fig 3a Normal LUQ



3b Free fluid in LUQ

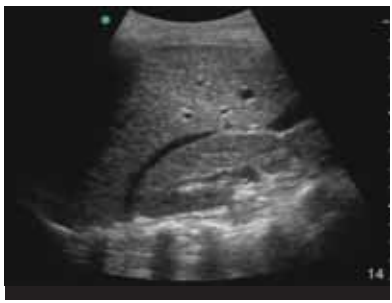
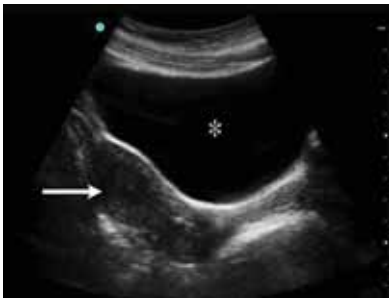


Fig 4a Normal Pelvis



4b Free fluid in Pelvis

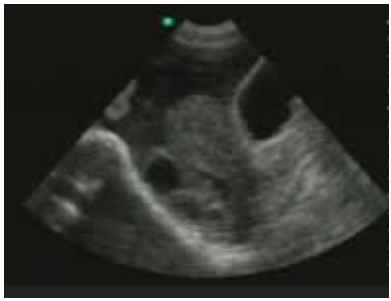


Fig 5 Gestational sac with yolk sac in early pregnancy

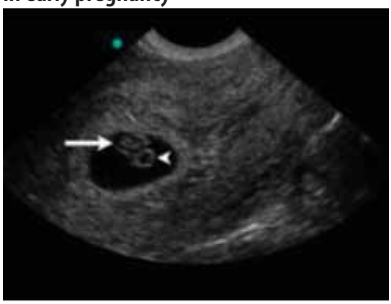


Fig 6 Early pregnancy with fetus

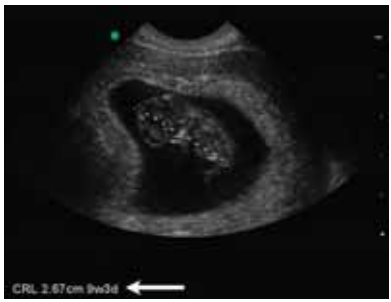


Fig 7 Fetal Heart Rate with M-mode

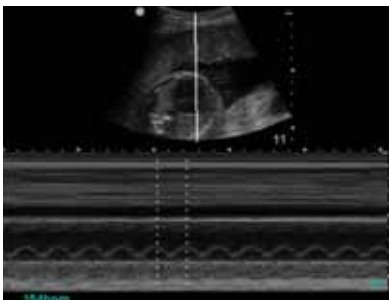
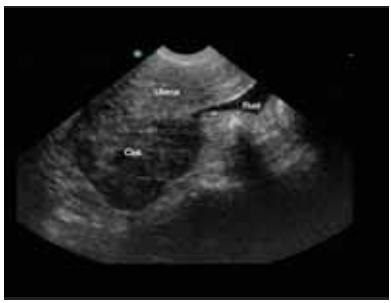


Fig 8 Ruptured ectopic with empty uterus and free fluid



Abbreviations, acronyms

/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
AMI	acute myocardial infarction
ANC	antenatal care
ARD	acute respiratory diseases
ART	antiretroviral therapy
ARV	antiretroviral
AST	aspartate aminotransferase
ATS	amphetamine-type stimulants
ATV	atazanavir
AVPU	**a**lert, **v**oice, **p**ain, **u**nresponsive
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 (mm3)
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	**h**aemolysis, **e**levated **l**iver enzymes & **l**ow **p**latelets
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
MI	myocardial infarction
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
PAD	peripheral artery disease
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
RHD	rheumatic heart disease
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
US DOD DTRA	United States Department of Defence and Defence Threat Reduction Agency
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)

INDEX to syndromes, diseases, conditions (in both Volumes 1&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.

Writers and reviewers and process of development:

Uganda IMAI District Clinician Manual

The Ugandan adaptation of the WHO IMAI District Clinician Manual was initiated in November 2012 and completed in 2013-2014 under the direction of Dr Jacinto Amandua, Commissioner Clinical Services, Ministry of Health, Uganda. Technical support was provided by the IMAI-IMCI Alliance, including Drs. Sandy Gove (responsible for overall clinical editing), Nathan Kenya-Mugisha (Director, Uganda IMAI-IMCI Alliance), Shevin Jacob, and Hillary Cohen.

Copyediting, formatting and final production for printing: Robert Gaynor, Sarah Gove
Illustrations: Robert Thatcher

See the generic WHO IMAI District Clinician Manual for a full description of the original process of development of the manual; the use of WHO normative guidelines and evidence review where these guidelines did not exist; fieldtesting of the manual; and the contributing writers and reviewers for the generic manual (WHO: IMAI District Clinician Manual: Hospital Care for Adolescents and Adults. Guidelines for the Management of Illnesses with Limited Resources. Geneva, 2011, http://www.who.int/hiv/pub/imai/imai2011/en/). The Ugandan writers and reviewers are listed at the end of this Section.

Adaptation of the manual in Uganda Volumes 1 & 2

The review and adaptation of each Section has been overseen by the Clinical Services Department, Ministry of Health Uganda, with input from multiple individual experts and several expert subgroups. Individual reviewers and experts in the subgroups (each subgroup addressed a particular content area) were chosen by MOH from MOH national programme staff and clinical experts at Mulago Hospital, Makerere University, and other institutions, based on their experience in providing or organizing clinical care in Uganda 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.

Technical assistance was provided by the IMAI-IMCI Alliance and the WHO country office as well as the WHO Headquarters Departments of Pandemic and Epidemic Diseases, Neglected Tropical Diseases, and Substance Use. Wherever possible recommendations in the manual are based on WHO normative guidelines developed by various WHO departments and disease control programmes. In Uganda, the relevant Departments and Programmes reviewed and adapted the relevant Sections as necessary, including the National Programmes for HIV/AIDS, TB, and malaria and the several Programmes addressing neglected tropical diseases, maternal and child health, mental health, reproductive health, and non-communicable diseases. The relevant WHO normative guidelines and Ugandan National Programme guidelines are listed in footnotes in each Section. Where evidence-based WHO guidelines had not yet been developed, non-communicable disease and other guidelines were developed by Ugandan experts, based on their clinical expertise and knowledge of the published literature. These drafts were then circulated for peer and international review and comment, revised, and then circulated again.

An adaptation workshop was held in November 2013, followed by final work on the Sections by a small group of facilitators including Drs. David Meya, Elizabeth Sentongo, Charles Musoke, Richard Ssekitoleko, and Mohammed Lamorde. A cardiology consultation was held in May 2014 to finalize several new Sections.

Funding for the adaptation was provided by US DOD DTRA, through a grant to WHO.

Plans for updates

It is important that this manual remains consistent with new Ugandan and WHO guidelines as these are updated or newly developed. The manual will therefore be periodically updated.

Expert reviewers in Uganda for Volume 1 and 2- Uganda IMAI District Clinician Manual

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Dr. Isaac Lwanga	Dr. Emmanuel Ssekasanvu
Dr. J. Mabweijano	Dr. Richard Ssekitoleko
Dr. L.K. Makanga	Dr. Fred Ssemitala
Dr. Issa Makumbi	Dr. Isaac Ssenabulya
Mr. Mugaga Malimbo	Dr. Robert Ssentongo
Dr. Victoria Masembe	Dr. Edrida Tukahebwa
Dr. Concepta Merry	Mr. Edson Tukashaba
Dr. David Meya	Dr. Susan N. Tumwesigye
Dr. Charles Mondo	Dr. Patrick Turyaguma
Ms. Molline Ninsiima	Dr. Francesco Vairo
Dr. Frank Mugabe	Dr. Musa Waiswa
	Dr. William Worodria