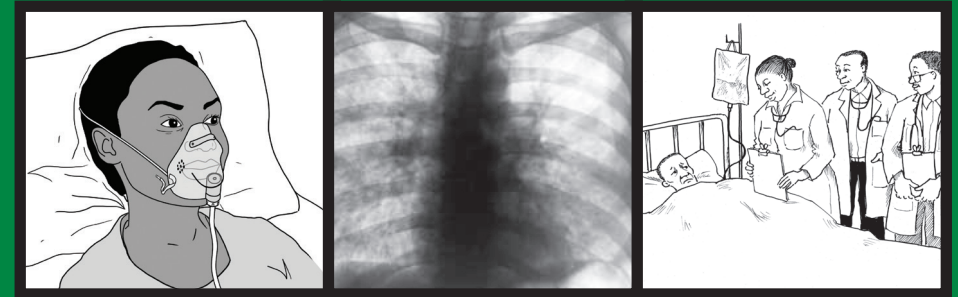


NEPAL IMAI DISTRICT CLINICIAN MANUAL: HOSPITAL CARE FOR ADOLESCENTS AND ADULTS

# Nepal IMAI District Clinician Manual: Hospital Care for Adolescents and Adults



## GUIDELINES FOR THE MANAGEMENT OF COMMON ILLNESSES AND NOTIFIABLE DISEASES

Integrated Management of Adolescent and Adult Illness (IMAI)



Government of Nepal  
Ministry of Health and Population  
Department of Health Services  
Epidemiology and Disease Control Division



World Health  
Organization  
Nepal

**Nepal IMAI District Clinician Manual:  
Hospital Care for Adolescents and Adults-  
Guidelines for the Management of  
Common Illnesses and Notifiable Diseases**

**13 January 2019**

**First version Sections 1 to 9-  
for Quick Check+ training and  
further review**

IMAI = Integrated Management of Adolescent and Adult Illness

**Acknowledgements:** This Nepal adaptation of the generic 2011 WHO IMAI District Clinician Manual was supported by the Nepal WHO Country Office and Nepal Ministry of Health EDCD, through contracts with the IMAI-IMCI Alliance; Dr Anup Bastola, Sukraraj Tropical and Infectious Disease Hospital; Drs Ashis Shrestha, Sumana Bajracharya and Kedar Baral at the Patan Academy of Health Sciences; as well as expert input from those attending the September 2018 adaptation workshop.

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# Nepal IMAI District Clinician Manual: Hospital Care for Adolescents and Adults- Guidelines for the Management of Common Illnesses and Notifiable Diseases

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## Foreword

### **Nepal IMAI District Clinician Manual: Hospital Care for Adolescents and Adults**

This manual is written for clinicians working at the district hospital (first-level referral care) who diagnose and manage sick adolescents and adults. The evidence-based 2011 WHO IMAI District Clinician Manual was adapted to Nepal country epidemiology and health system, in order to support clinicians in diagnosing and managing adolescent and adult patients at district hospitals. It aims to support clinical reasoning, and to provide an effective clinical approach and protocols for the management of common and serious or potentially life-threatening conditions at district hospitals, with an emphasis on notifiable diseases. The target audience includes the range of clinicians working at district hospital level -- medical officers, general practitioners, and other doctors; health assistants; and clinical nurses working in the emergency department and adult wards. Its target audience does not include ICU clinicians or internal medicine specialists.

The manual covers emergency triage assessment and treatment and acute care for a severely ill or acutely injured patient, as well as the management of acute and subacute illnesses by syndrome. The manual also describes the clinical procedures commonly used in emergency and acute care and the steps necessary for infection control. In this first full draft for review, key acute syndromes- fever, cough or difficult breathing, diarrhoea, and acute jaundice- are included. The full manual will cover all the main syndromes as well as short summaries of the management of communicable diseases that affect multiple systems of the body.

The Nepal adaptation process has chosen to focus the manual on communicable diseases while presenting them in the context of the full differential diagnosis for key signs and symptoms which must remain integrated, including the full range of possible communicable and non-communicable diseases. Although this Nepal-adaptation of the generic WHO IMAI District Clinician Manual does not include the clinical management of HIV, TB, alcohol and other substance use disorders, other non-communicable diseases, sexually transmitted diseases, reproductive health or pregnancy, it does address these conditions in the differential diagnosis when they present acutely.

Particular attention is paid to priority pathogens with epidemic potential and notifiable diseases more broadly. This should help strengthen the clinician's role in disease surveillance and response.

The manual is used as an integral component and resource during Quick Check+ training, as well as supporting ongoing learning through mentoring and practical use in providing clinical care.

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

Most emphasis to date in training and clinical manuals has been on children, pregnant women, reproductive health, and leading killers supported by strong international and national programs such as HIV and TB. It is important at this time to also address more broadly adolescent and adult illness management. Previously, mortality of adolescents and adults was high in Nepal as there were delays in reaching the hospital. Nowadays, most of the mortality is after reaching the hospital. So, the guideline will serve as an effective means to manage the illness promptly when the patient reaches the emergency department of the hospital.



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# 1. Introduction, assumptions, and principles of this manual

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## 1.1 Target audience and assumptions

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### 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 in the emergency department, adult outpatient or ward in a district hospital; the manual may also be helpful for clinicians working in the emergency department, outpatient or ward of a provincial hospital. The manual assumes that many district hospitals in these settings have general multipurpose practitioners, such as a medical officer or senior clinical nurse, but do not have specialist clinicians, such as an internist, paediatrician, or psychiatrist (although it may be possible to consult with one).

This manual is not aimed at internists, other specialists, or ICU clinicians.

Other assumptions are that these settings have:

- **Limited essential drugs** (see the Nepal Essential Medicines List and Free Drug list).
- **Limited equipment** – no mechanical ventilation except for during surgery. Patients requiring mechanical ventilation are referred to an ICU,
- **Limited laboratory and other investigations** – this manual assumes that there are limited laboratory and other investigations available onsite, listed in the Table: Essential laboratory tests at the district hospital, with additional tests available as “send-out” tests to referral laboratory facilities.

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

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

## 1.2 Laboratory tests at the district hospital

**Table: Laboratory tests at the district hospital- on site and to send out** [needs further review- what is currently available, what is planned; where to send out]

At district hospital	Send out laboratory tests
<b>Hematology</b> <ul style="list-style-type: none"> <li>Total WBC count</li> <li>Total platelet count</li> <li>Haemoglobin</li> <li>Differential WBC count</li> <li>Erythrocyte sedimentation rate (ESR)</li> <li>Bleeding time</li> <li>Clotting time</li> <li>PT (INR)</li> <li>Blood grouping (Rh typing)</li> <li>Type and cross match for transfusion</li> </ul>	
<b>Electrolytes and renal function</b> <ul style="list-style-type: none"> <li>Sodium, potassium</li> <li>Serum creatinine and blood urea nitrogen (BUN)</li> <li>Serum uric acid</li> <li>Serum calcium</li> </ul>	
<b>Liver function tests/ pancreas</b> <ul style="list-style-type: none"> <li>serum bilirubin (total), serum bilirubin (direct)</li> <li>SGPT (ALT)</li> <li>SGOT(AST)</li> <li>alkaline phosphatases</li> <li>serum amylase</li> <li>serum protein (total)</li> <li>serum albumin</li> </ul>	
<b>Urine examination</b> <ul style="list-style-type: none"> <li>Urine test- physical exam (colour, transparency, sp. Gravity), chemical(albumin, sugar, acetone, chyle, bile salts, urobilinogen), microscopic (RBC, pus cells, casts, Ca oxalates, epithelial cells, epithelial cells, uric acid crystals, triple phosphates)</li> <li>Urine pregnancy test</li> </ul>	<ul style="list-style-type: none"> <li>Urine culture</li> </ul>
<b>CSF</b> <ul style="list-style-type: none"> <li>CSF total protein</li> <li>CSF glucose</li> <li>CSF microscopy</li> </ul>	<ul style="list-style-type: none"> <li>Cryptococcal antigen (CrAg- serum or CSF) or India ink stain of CSF</li> </ul>
<b>Stool</b> <ul style="list-style-type: none"> <li>Stool test- physical examination (colour, blood, mucus, consistency), chemical (occult blood), microscopic (RBC, pus cells, macrophage, protozoal parasites, helminthic parasites, other)</li> </ul>	<ul style="list-style-type: none"> <li>Stool culture for cholera and Salmonella- send out in Cary Blair</li> </ul>
<b>Thoracentesis and paracentesis</b> <ul style="list-style-type: none"> <li>Basic microscopy (gram stain, AFB smear) and chemistry (protein, glucose, LDH, cell count and differential white cell count)</li> </ul>	<ul style="list-style-type: none"> <li>Culture for bacteria and mycobacteria</li> </ul>
<b>Malaria tests (if in endemic area or travel history)</b> <ul style="list-style-type: none"> <li>Peripheral blood smear (PBS) preparation and smear microscopy</li> <li>Malaria RDT - rapid test to detect and discriminate between <i>Plasmodium falciparum</i> and mixed <i>Plasmodium</i> species</li> </ul>	
<b>Dengue</b> <ul style="list-style-type: none"> <li>Rapid diagnostic test (RDT)</li> </ul>	

<b>HIV diagnostics</b> <ul style="list-style-type: none"> <li>• HIV ELISA</li> <li>• Rapid HIV antibody tests (first, second and third tests)</li> <li>• Infant diagnosis; preparation of dried blood spot (DBS) then send out for virological testing</li> </ul>	<ul style="list-style-type: none"> <li>• CD4 absolute count and percentage</li> <li>• ?HIV viral load (VL)</li> <li>•</li> </ul>
<b>TB</b> <ul style="list-style-type: none"> <li>• Mantoux test</li> <li>• Acid fast bacilli smear microscopy</li> </ul>	<ul style="list-style-type: none"> <li>• Sputum send-out for culture and drug susceptibility testing</li> <li>•</li> </ul>
<b>Syphilis</b> <ul style="list-style-type: none"> <li>• VDRL test</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• rapid plasma reagin (RPR)</li> <li>•</li> </ul>
<b>Hepatitis</b> <ul style="list-style-type: none"> <li>• Hepatitis B - HBsAg</li> </ul>	<ul style="list-style-type: none"> <li>• HBV: anti-HBc, anti-HBs, IgM anti-HBc</li> <li>• HCV: Anti-HCV</li> <li>• HEV: Anti-HEV IgM</li> </ul>
<b>Other communicable diseases</b> <ul style="list-style-type: none"> <li>• Gram stain</li> <li>• ASO titre</li> <li>• Widal test- (<i>S. typhi</i> (O antigen), <i>S. typhi</i> (H antigen), <i>S. paratyphi</i> (AH antigen), <i>S. paratyphi</i> (BH antigen))</li> <li>• Saline and potassium hydroxide (KOH) wet mounts (for bacterial vaginosis (BV) or trichomonas)</li> <li>• Visceral leishmaniasis- Napier's aldehyde test</li> <li>• Kala-azar rapid test?</li> <li>• Scrub typhus rapid test</li> </ul>	<ul style="list-style-type: none"> <li>• Blood culture</li> <li>• Sputum cultures</li> <li>• Serological tests for leptospirosis, scrub typhus, etc</li> <li>• Silver stain or direct fluorescent antibody (DFA) for <i>Pneumocystis jiroveci</i> pneumonia (PCP) diagnosis</li> <li>• General fungal cultures, including blood</li> <li>• Fungal stains</li> <li>• Toxoplasma serology</li> </ul>
<b>Cytology and histology</b>	<ul style="list-style-type: none"> <li>• Cytology (e.g. CSF, cervical)</li> <li>• Histology (e.g. cervical, lymph node, skin biopsy)</li> </ul>
<b>Cardiovascular/ diabetes</b> <ul style="list-style-type: none"> <li>• CPK-MB</li> <li>• Lipid profile: Total cholesterol, Triglycerides, HDL, LDL)</li> <li>• HbA1C</li> <li>• Blood sugar (glucose)- fasting, post-prandial, random</li> </ul>	
<b>Other</b> <ul style="list-style-type: none"> <li>• RA factor</li> <li>• LDH</li> <li>• CRP (C-reactive protein)</li> </ul>	

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. See specific disease sections and Section 7.



## Additional investigations that require special equipment

### At the district hospital

- Mid upper arm circumference (MUAC) tape
- Blood pressure (BP) measurement: digital BP machine
- Auscultation and BP measurement: stethoscope
- Respiratory rate: timer
- Oxygen saturation by pulse oximetry (SpO<sub>2</sub>)
- Peak flow meter
- 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

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### 1.3 Other companion manuals and guidelines

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This manual assumes that companion Nepal or WHO manuals and guidelines 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:

- Nepal Essential Medicines List
- Nepal National Formulary 2018
- Nepal Emergency Trauma Guidelines
- Nepal Infectious Diseases Guideline
- IMPAC Managing complications in pregnancy and childbirth (MCPC) (WHO, UNFPA, UNICEF, World Bank 2003)<sup>3</sup>
- Pocket book of hospital care for children (WHO 2013- second edition)  
TB clinical guidelines: .....
- HIV care clinical guidelines:.....
- National Guidelines on Case Management of Sexually Transmitted Infections
- Reproductive health guidelines: .....
- Family planning: A global handbook for providers (USAID, John Hopkins, WHO 2011<sup>6</sup> or update—what is available to district hospitals?
- Surgical care at the district hospital (WHO 2003)<sup>7</sup>- is this used?

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

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### 1.4 District network

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#### Relationship to the first-level guideline modules

Nurses and clinical officers in the outpatient department and at health centre level will be using simpler primary health care guidelines. [What are these?],

- IMPAC *Pregnancy, Childbirth, Postpartum and Newborn Care*<sup>11</sup> (PCPNC) [used?]
- IMEESC toolkit (Integrated Management of Emergency and Essential Surgical Care)<sup>12</sup> [used?]

[insert others currently available and used and health centre level]

#### 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

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<sup>3</sup> [http://www.who.int/reproductivehealth/publications/maternal\\_perinatal\\_health/9241545879/en/index.html](http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9241545879/en/index.html)

<sup>6</sup> [http://www.who.int/reproductivehealth/publications/family\\_planning/9780978856304/en/index.html](http://www.who.int/reproductivehealth/publications/family_planning/9780978856304/en/index.html)

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

<sup>10</sup> [http://www.who.int/child\\_adolescent\\_health/documents/9789241597388/en/](http://www.who.int/child_adolescent_health/documents/9789241597388/en/)

<sup>11</sup> [http://www.who.int/making\\_pregnancy\\_safer/documents/924159084x/en/](http://www.who.int/making_pregnancy_safer/documents/924159084x/en/)

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

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*.<sup>13</sup>

### Addresses acutely ill adolescents and adults but does not address management of pregnancy, reproductive health, sexually transmitted diseases

The manual was developed to improve acute care for adolescents and adults including people living with HIV (PLHIV). Common diseases that occur in HIV-negative people are also common in PLHIV. 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. 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.

### 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.
	<b>Notifiable diseases.</b> These are communicable diseases that need to be reported to national authorities as their presence has a broader significance to the public. These are usually uncommon or even rare, but are included in the differential diagnosis tables because of the importance of early recognition and of the need to report dangerous pathogens and diseases targeted for elimination. See Section 9.
	<b>Surgery may be needed</b> – call for help.

### The manual has the following Sections:

Section 1	
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	Acute and subacute presentations for key main symptoms
Section 9	Notifiable diseases- identification, reporting and response
Section 10	Acute (and subacute) care: organized by the main symptoms
Section 11	Multisystem communicable diseases and renal problems (in alphabetical order)

<sup>13</sup> [http://www.who.int/child\\_adolescent\\_health/documents/9241546700/en/](http://www.who.int/child_adolescent_health/documents/9241546700/en/)

Consult the Nepal National Formulary for the formulation, dosage, adverse effects, contraindications, and cautions when administering or prescribing medicines.

### **Integrating palliative care into acute and chronic care**

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, specific management is summarized and symptom management either summarized or cross-referenced to a palliative care source, which 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.

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## **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 10.10).

### **Clinical reasoning and medical uncertainty**

Health workers in resource-limited settings frequently need to make clinical decisions with incomplete diagnostic support from radiology or the laboratory. The processes of clinical

reasoning used, and the knowledge possessed to support decision-making, are critical determinants of the quality of clinical practice.

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

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

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

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

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

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

### Establishing clinical diagnosis using different differential diagnosis tables

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

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

## Avoiding errors in clinical reasoning

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

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

## 2. Quick Check and emergency treatments

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## 2. Quick Check and emergency treatments for adolescents and adults

The assessment in the Quick Check should be performed for all patients on arrival at the facility. The **ABCDE** emergency signs (**A**irway, **B**reathing, **C**irculation, **D**isability, **E**xpose and **E**valuate for LifeThreats) 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 4-11 (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 and other auxiliaries. 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).

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](http://www.who.int/child_adolescent_health/documents/9241546700/en/index.html). Use Nepal obstetrical guidelines for emergencies during pregnancy.

Several parts of this Section have been adapted from *Surgical Care at the District Hospital*.<sup>1</sup> 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>

**Abbreviations:**

<b>AVPU</b>	Alert, Voice, Pain, Unresponsive
<b>l</b>	litres
<b>oxygen 5 litres</b>	5 litres/minute
<b>Hb</b>	haemoglobin
<b>LR</b>	lactated ringers
<b>NS</b>	normal saline (0.9%) RR = respiratory rate
<b>SBP 90</b>	systolic blood pressure 90 mm Hg
<b>SpO<sub>2</sub> 90</b>	oxygen saturation 90%

# Infection prevention during triage

## **SAFETY FIRST**

If a dangerous pathogen with human-to human transmission (MERS-CoV, human avian influenza, Ebola, CCHF or Lassa fever) is occurring in your province:

- do screening and complete only a visual assessment
- call for help in full PPE if positive screening or if cannot determine contact status.
- If screening negative, continue with assessment and management using standard PPE

**If cough, sneezing or other signs of respiratory illness**, use droplet precautions and source control for the patient- tissues, handkerchiefs or medical masks and accommodate patient at least 1 meter away from other patients or in a room; evaluate as soon as possible.

## **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

At first, you may not know the cause of illness or injury and may expose yourself to diseases, chemicals or poisons without appropriate PPE.

Always protect yourself from any exposure to a patient's bodily fluids.

Use standard precautions when performing the Quick Check triage assessment of any patient including basic PPE (scrubs and boots, gloves, face shield (or face mask + goggles);

- add droplet precautions if acute respiratory infection;
- add aerosol precautions if airway management or intubation.

# Quick Check for adolescents and adults

## EMERGENCY SIGNS

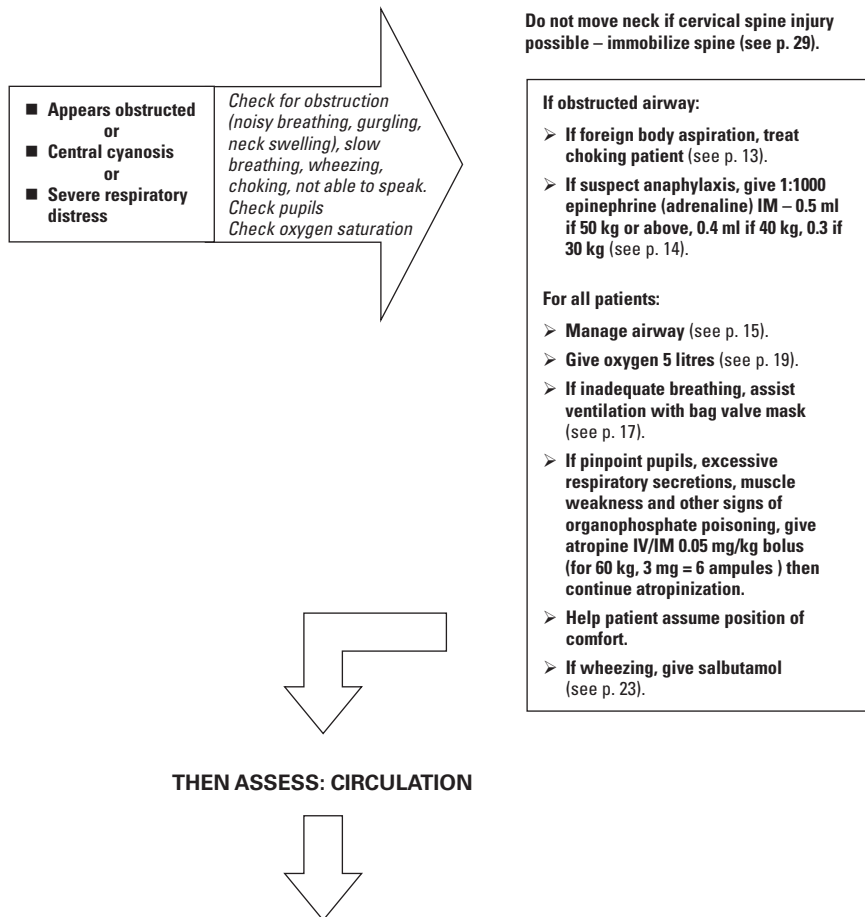
All staff should be able to assess these signs. If any sign is present, patient is severely ill. Call for help. Clinical staff should immediately give emergency treatment(s).

**If not breathing or unresponsive, check pulse and follow BLS.**

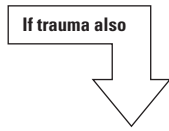
## FIRST LINE EMERGENCY TREATMENT

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



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



**CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS**

**If head or neck trauma, manage airway and immobilize spine.**

**Look for**

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

→

Treat tension pneumothorax with emergency needle decompression.

- Give oxygen 5 litres.
- If wound to chest wall which sucks air in when patient breathes in → treat sucking chest wound.
- Treat pain (Section 20).
- If chest trauma, call for help for possible surgical intervention.

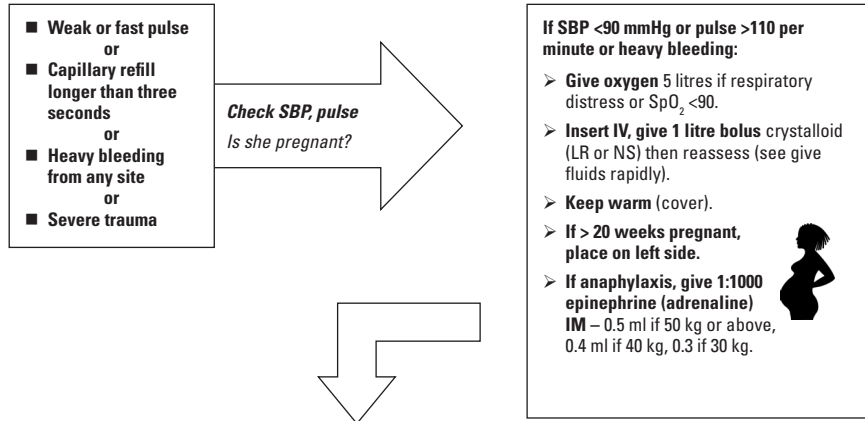
Use **standard precautions** for all patients. Use **droplet precautions** if acute respiratory infection of concern. Add **aerosol precautions** if airway management or intubation. See Section 6.

**Finish remainder of Quick Check then:**

- Count pulse, RR; measure SBP, SpO<sub>2</sub>
- Titrate oxygen to SpO<sub>2</sub> 90
- Give antibiotics if fever and RR >30 (see Section 3.2)
- Give antiviral if suspect influenza. Send throat swab
- 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 Section 3.2 for other causes wheezing.
Pinpoint pupils and suspect organophosphate intoxication	Give atropine.  See Section 3.8.
Pinpoint pupils and suspect opioid intoxication and RR <10 or SpO <sub>2</sub> <90	Assist ventilation and give naloxone.  See Section 3.6.
Suspect other poisoning or snakebite	See Sections 3.8 and 3.9.
Suspect inhalation burn	See Sections 3.2 and 3.10.

## First assess: Circulation (shock or heavy bleeding)



THEN ASSESS: CONSCIOUSNESS/CONVULSING

If trauma also



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

- Give oxygen 5 litres if SpO<sub>2</sub> <90 or respiratory distress.
- Give rapid IV fluids.
- Keep warm.
- Urgently send blood for type and cross match.

**If external bleeding:**

- Apply pressure immediately to stop bleeding.

**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.
- Call for help and plan emergency surgical intervention (see Section 4).
- If patient remains in shock after 2 litres of IV fluids – transfuse (see Section 4).

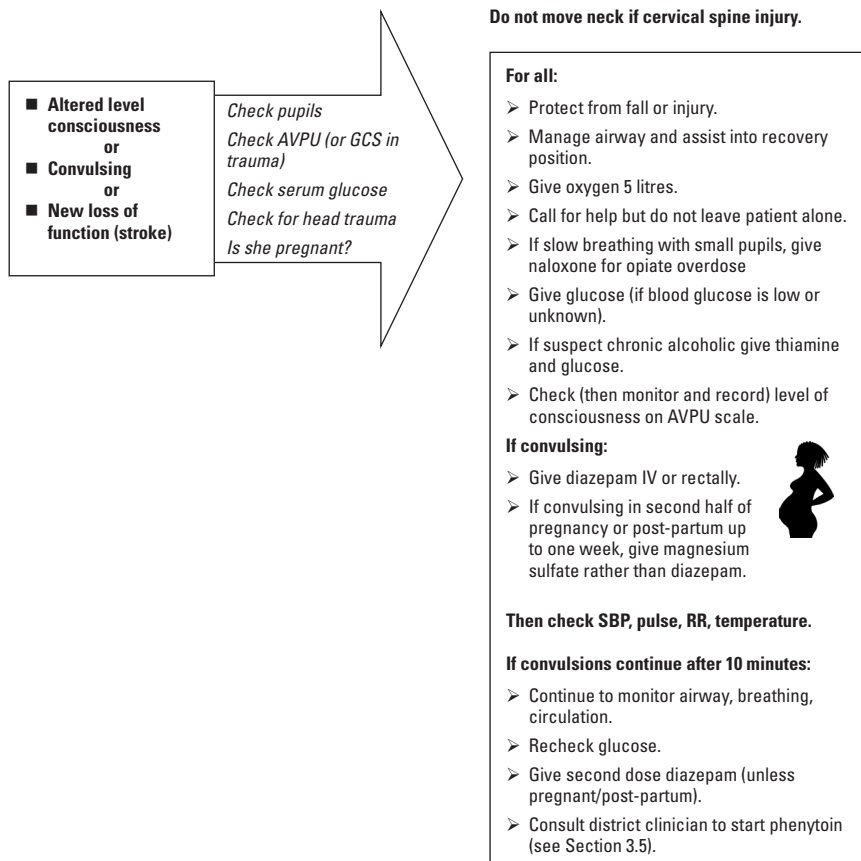
**CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS**

**Decide on type of shock and treat accordingly.**

If...	Then...
<b>Fever</b> , consider septic shock and malaria, scrub typhus, dengue, enteric fever, kala-azar, Japanese encephalitis	Give empirical antibiotics and glucose (if blood glucose is low or unknown). Send blood culture if feasible before starting antibiotics. Do RDT for malaria; treat with antimalarials if positive.
<b>Suspect heart failure, cardiogenic shock or severe anaemia</b>	Be cautious with giving fluids. See Section 3.2.
<b>Diarrhoea</b>	Classify dehydration. If severe, give rapid fluids for shock and follow Fluid Plan C.  See Sections 3.1.2 and 8.3.
<b>Vaginal bleeding</b>	Assess pregnancy status and amount of bleeding and treat.
<b>Large nosebleed</b>	See Quick Check emergency treatments.
<b>Vomiting blood</b>	See Quick Check emergency treatments.



## Disability



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](http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548335/en/index.html)

If trauma also



**Check for signs of serious head and spine trauma:**

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

**CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS**

<b>If...</b>	<b>Then...</b>
<b>Altered consciousness</b>	See Section 3.4.
<b>Convulsions</b>	See Section 3.5.
<b>Fever</b>	Give empirical antibiotics. If in a malaria endemic area or travel history, do RDT and give antimalarial if positive. See Section 11.23.
<b>Pinpoint pupils and suspect organophosphate intoxication</b>	Give atropine. See flowchart in Section 3.8.
<b>Alcohol intoxication or withdrawal</b>	See Section 3.7.
<b>Poisoning</b>	See Section 3.8.
<b>If elevated blood glucose, suspect diabetic ketoacidosis.</b>	Give IV normal saline. See Section 3.4.3 for further management.

## Expose and evaluate for life threats

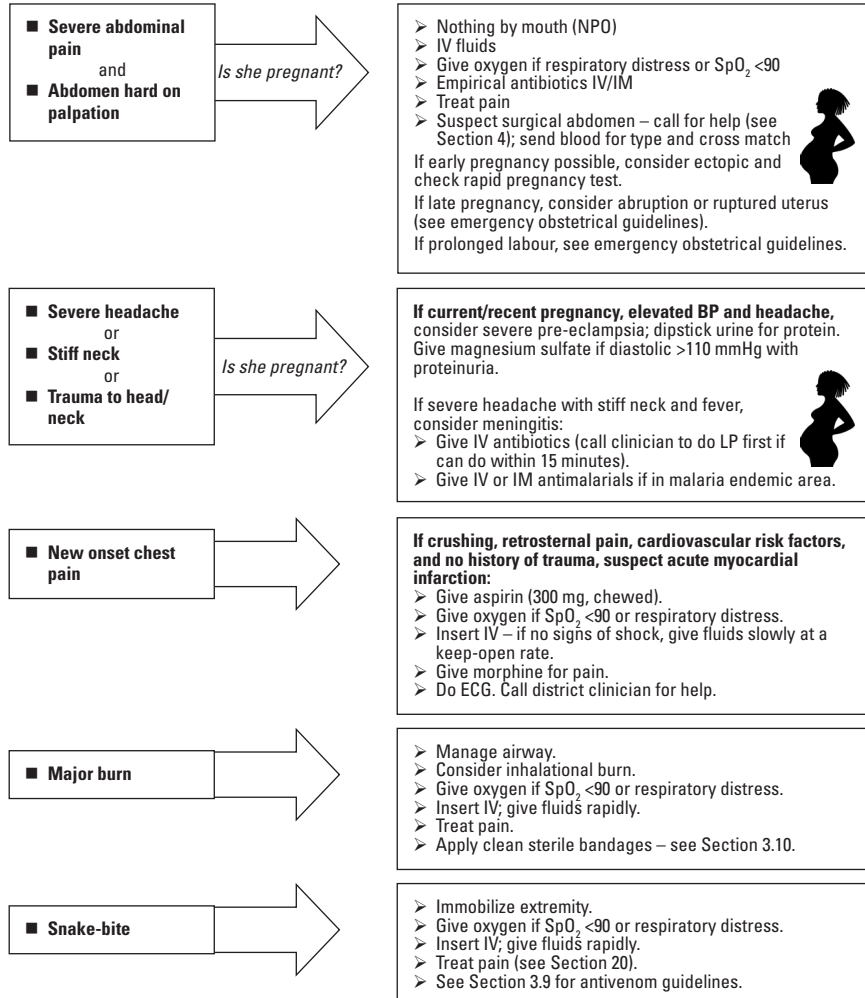
EXAMINE ENTIRE BODY FOR INJURY, RASH, BITES, AND LIFE THREATS.

DOES PATIENT FEEL VERY COLD OR VERY HOT?

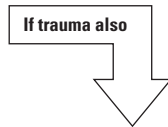
IF PRESENT CHECK SBP, PULSE, RR, TEMPERATURE.

COVER AFTER EXAM TO PRESERVE DIGNITY AND PREVENT HYPOTHERMIA.

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



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.



**Do not move neck if cervical spine injury.**

<p><b>If trauma with abdominal pain:</b></p> <ul style="list-style-type: none"> <li>➤ Consider possible spleen or liver injury.</li> <li>➤ If penetrating injuries to abdomen or distended or painful abdomen:             <ul style="list-style-type: none"> <li>• Check Hb.</li> <li>• Send type and cross match.</li> <li>• Consider diagnostic peritoneal lavage or ultrasound to check for internal bleeding.</li> </ul> </li> </ul>
---

<p><b>If trauma with neck pain or possible cervical spine injury:</b></p> <p><b>DO NOT MOVE NECK</b> → immobilize the neck.</p> <ul style="list-style-type: none"> <li>➤ If severe headache, manage as possible head injury.</li> </ul>
---

<p><b>If trauma with chest pain:</b></p> <ul style="list-style-type: none"> <li>➤ Palpate chest for rib fractures.             <ul style="list-style-type: none"> <li>• If present, consider pneumothorax.</li> </ul> </li> </ul>
---

**CONTINUE WITH URGENT MANAGEMENT OF PATIENTS WITH EMERGENCY SIGNS**

If...	Then...
<b>Trauma</b>	See Section 4.
<b>Pregnant with abdominal pain or severe headache with elevated BP</b>	Decide if severe pre-eclampsia.  See Nepal obstetrical guidelines.
<b>Severe headache</b>	See Section 10.9b.
<b>Suspect acute myocardial infarction</b>	Follow national guidelines.  See Section 3.3 for DDx.
<b>Major burn</b>	See Section 3.10.
<b>Snakebite</b>	See Section 3.9.

## Priority signs and symptoms

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

### CIRCULATORY

Very pale, weak, or recent fainting.	Measure haemoglobin if any bleeding, pale, weak, fainting, abdominal pain.
Bleeding: <ul style="list-style-type: none"> <li>• Large haemoptysis;</li> <li>• GI bleeding (vomiting or in stools);</li> <li>• External bleeding (if major, see Circulation).</li> </ul>	If melena or vomiting blood, manage as on QC34 and admit. If large haemoptysis see QC34.
Frequent diarrhoea >5 times per day.	Assess for dehydration. Use fluid plan A, B or C – see Section 8.3.

### RESPIRATORY

Any respiratory distress/complaint of difficulty breathing.	If any respiratory distress/complaint of difficulty breathing – measure SpO <sub>2</sub> ; give oxygen 5 litres if SpO <sub>2</sub> <90 (see Sections 3.2 and 8.2) If wheezing, give salbutamol (see QC23 and Section 3.2.4).
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### NEUROLOGICAL/PSYCHOLOGICAL

Acute visual changes.	See Section 10.11.3.
Violent behaviour toward self or others or very agitated.	If violent behaviour or very agitated, protect, calm, and sedate the patient as appropriate (see QC38). Protect patient from harming self or others. Check glucose, temperature and SpO <sub>2</sub> , consider causes (acute psychiatric decompensation, substance use, intracranial bleed (see Section 3.4).
Hyperventilation/ panic attack	Reassure and calm patient, encourage to breathe at normal rate and volume; if unsuccessful, give small dose rapidly-acting benzodiazepine.

### INJURY/POISONING

Fractures or dislocations.	If visible deformity, assess and treat possible fractures/dislocations (see Section 4). Consider nerve or vessel injury.
Burns (not major).	Manage burns (see Section 3.10).
Bite (or lick or scratch) from suspected rabid animal.	Wound care- scrub with soap and water, flush for 15 minutes then povidone-iodine or benzalkonium chloride. Post-exposure vaccination and immunoglobulin depending on contact type. See Section 11.27
Poisoning.	Try to identify the toxin and treat with the appropriate antidote if available and supportive care. (see Section 3.8).

### OTHER

Rape/abuse (maintain a high index of suspicion).	If suspect rape or abuse (see Section 4).
New extensive rash with peeling and mucous membrane involvement (Stevens-Johnson).	Give IV fluids. Keep wounds clean. Discontinue any suspected causal agent. Refer to specialty care or burn centre.
Acute pain, cough or dyspnea, priapism, or fever in patient with sickle-cell disease.	If painful vaso-occlusive crisis from sickle-cell disease – control pain, hydrate and give oxygen if SpO <sub>2</sub> <90 (see Section 10.14.)

#### In all cases of trauma, consider:

- Was alcohol a contributor? If yes, counsel on harmful alcohol use. See mhGAP.
- Was drug use a contributor? If yes, counsel and arrange for treatment. See mhGAP.
- Was this a suicide attempt? If possible, ask the patient, were you trying to harm yourself? (See Section 10.10 or mhGAP.)
- Was abuse or sexual violence involved? (See Section 4.4.)
- Was interpersonal violence a contributor? Is there a risk of further violence in retaliation? If yes, get help to interrupt this and prevent further violence.

If no emergency signs and no priority signs,  
**NON-URGENT**



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

## How to help the choking patient

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

### IN THE CONSCIOUS PATIENT

#### If patient is able to speak or cough

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

#### If the patient is not able to speak or cough

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

**Abominal  
thrusts**



**If patient is  
pregnant, give  
chest thrusts**



### IN THE UNCONSCIOUS PATIENT

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

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## How to give epinephrine

---

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

# Emergency treatments

## How to manage the airway

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

### STEP 1 ASSESS AIRWAY

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

### STEP 2 IF AIRWAY OBSTRUCTED, OPEN AIRWAY AND CLEAR OBSTRUCTION AS FOLLOWS: IF NO OBSTRUCTION, GO TO STEP 4

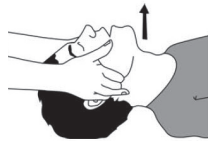
#### No trauma

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



#### Trauma

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



#### If SEVERE head or neck trauma

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

- give oxygen 5 litres.
- place oral airway.

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

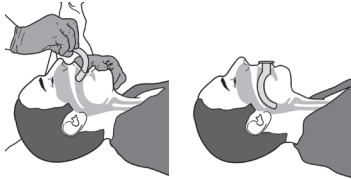


**STEP 3**

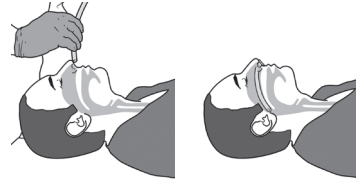
**IF AIRWAY OBSTRUCTED BY TONGUE, INSERT AIRWAY DEVICE TO KEEP AIRWAY OPEN, AND THEN GO TO STEP 4.  
IF AIRWAY IS NO LONGER OBSTRUCTED, GO TO STEP 4.**

**INSERT AIRWAY****Oropharyngeal airway**

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

**Nasopharyngeal airway**

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

**STEP 4****ASSESS VENTILATION**

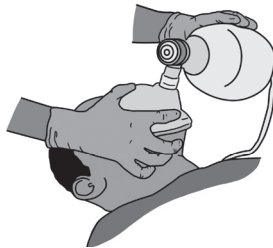
- If ventilation is inadequate, or patient is cyanotic or unconscious with respiratory distress, then assist breathing via bag valve mask ventilation (go to STEP 5).
- If ventilation is adequate, give oxygen and titrate flow (see p. 19-20).

## STEP 5

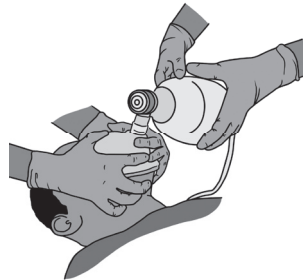
### ASSIST VENTILATION WITH BAG VALVE MASK

- 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  $\text{SpO}_2 < 90$ , 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. 41).**

## How to give oxygen

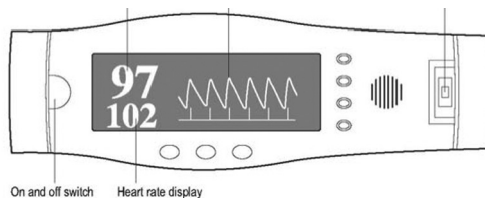
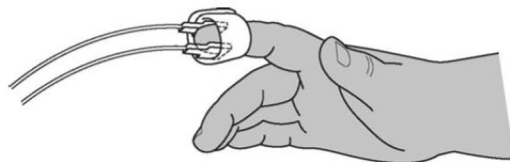
### SET UP OXYGEN EQUIPMENT

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<sub>2</sub>

- Turn on the pulse oximeter.
- Attach the oximeter probe to the finger or toe.
- Wait until there is a consistent pulse signal (this may take 20–30 seconds).
- Record the SpO<sub>2</sub> on a monitoring chart.
- If titrating oxygen down, recheck SpO<sub>2</sub> within 15 minutes and record on the monitoring chart.
- If problems with the reading or inconsistent with clinical state, remove nail polish.



## HOW TO DELIVER INCREASING OXYGEN



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

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

■ If increasing respiratory distress or  $SpO_2 < 90$



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

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

■ If increasing respiratory distress or  $SpO_2 < 90$



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

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

■ If increasing respiratory distress or  $SpO_2 < 90$

*or*  
■ If not improving with BVM on high flow oxygen  
**AND**

■ Patient has an easily reversible condition (e.g. drug overdose, snakebite) and manual ventilation (bagging – p. 17) possible  
*or*

■ Transfer to a hospital with available invasive mechanical ventilator possible. See Referral and transfer of severely ill patients, p. 49.

- Call for help from district clinician for possible tracheal intubation – see advanced airway management, p. 18.
- **Start manual ventilation (bagging) with high flow oxygen** – see p. 17.

### RESPOND TO DROP IN $\text{SpO}_2$ 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 8.2).
- 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  $\text{SpO}_2$ .
- If patient is in increased respiratory distress or  $\text{SpO}_2 < 90$ , then increase oxygen flow to previous flow rate.
- If patient remains stable and  $\text{SpO}_2 > 90$ , continue to titrate oxygen down as tolerated.

**Recheck clinical status and  $\text{SpO}_2$  on patients after 1 hour for delayed hypoxia or respiratory distress.**

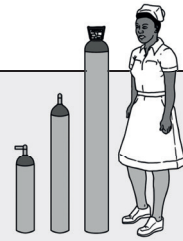
## LITRES IN FULL O<sub>2</sub> TANK

### BY HEIGHT OF TANK/CYLINDER LETTER

Rate of oxygen administration:

Top row: How long will a tank of this size last.

Bottom row: How many tanks required for 24 hours of oxygen administration.



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

## If wheezing – how to give sequential bronchodilators

Also see Section 3.2.4

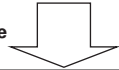
### GIVE SALBUTAMOL FOR MODERATE–SEVERE WHEEZING

Signs of severity: breathless at rest or with talking; speaking in incomplete phrases, single words or not at all; confused, sleepy or agitated; or SpO<sub>2</sub> <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

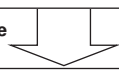


If incomplete or poor response – signs of severity continue

**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.



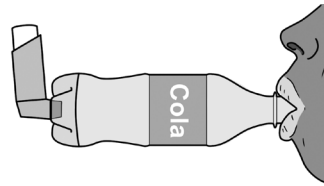
### GIVE SALBUTAMOL FOR MILD WHEEZING

**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 8.2.

### 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.



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## How to insert IV and give fluids rapidly

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- If heavy bleeding or shock, insert two large bore cannulae – at least 16 or 18 gauge.
- Attach LR or NS. Give one litre as rapidly with infusion wide open.
- Assess response of pulse, SBP and signs of perfusion (urine output, mental status).
- If still in shock and no evidence of fluid overload, give another bolus.
- If still in shock after 2 litres and suspect ongoing blood loss, start blood transfusion and search again for source of bleeding.
- If still in shock after 2 litres, call for help from district clinician and see Section 3.1.
- Insert urinary catheter (see Sections 7.3.2 and 7.3.4), and monitor hourly urine output. A urine output of at least 30 ml/hour suggests adequate hydration.

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

**If not able to insert peripheral IV, use alternative:**

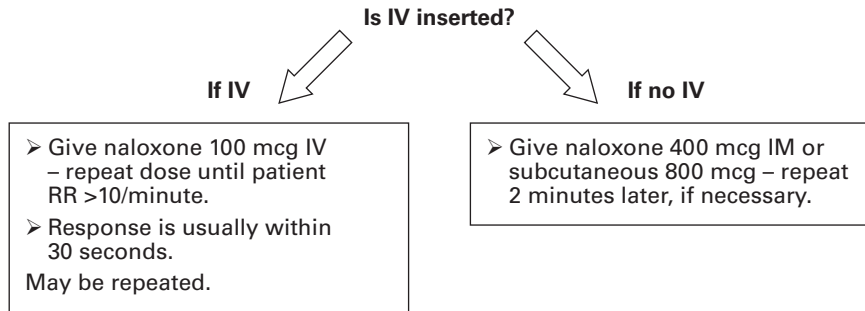
- Call for more experienced help, consider:
  - External jugular vein cannulation.
  - Femoral vein cannulation (or internal jugular or subclavian vein cannulation, if trained).
  - Venous cut-down – see 7.3.7.

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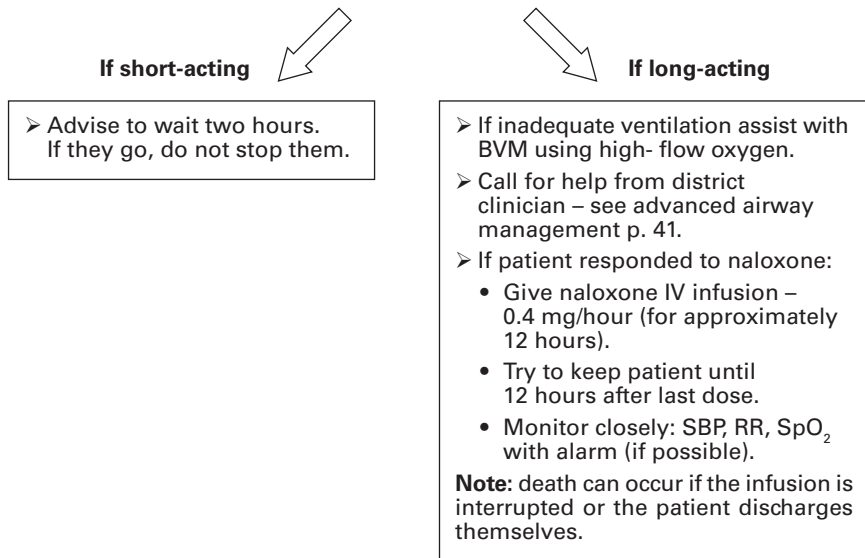
## How to give naloxone

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**Important: naloxone effect lasts only 40 minutes.**



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



- 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

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### 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

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- **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. 17).
- **Consider all causes if convulsions continue – see Section 3.5.**

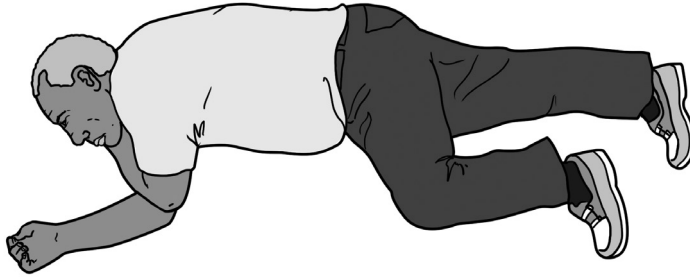
Typical dose for 50 kg adult	IV	RECTALLY
	(10 mg/2 ml solution)	(10mg/2 ml solution)
Initial dose	2 ml (10 mg)	4 ml (20 mg)
Second dose after 10 minutes	1 ml (5 mg)	2 ml (10 mg)

- 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.

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## How to put patient in recovery position

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## How to give empirical IV/IM antibiotics for emergency management

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- 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 National Formulary for alternatives.

## How to give emergency antimalarial treatment for *P. falciparum* malaria<sup>5</sup>

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).

Weight	ARTESUNATE IV or IM		ARTEMETHER IM		QUININE IM or IV			
	For IV, further dilute with 5 ml of 5% dextrose (for 10 mg/ml)	For IM, further dilute with 2 ml of 5% dextrose (for 20 mg/ml)	80 mg/ml (in 1 ml ampoules)	80 mg/ml (in 1 ml ampoules)	150 mg/ml (in 2 ml ampoules)	300 mg/ml (in 2 ml ampoules)	150 mg/ml (in 2 ml ampoules)	300 mg/ml (in 2 ml ampoules)
30 kg	7.2 ml	3.6 ml	1.2 ml	0.6 ml	4.0 ml	2.0 ml	2.0 ml	0.5 ml
40 kg	9.6 ml	4.8 ml	1.6 ml	0.8 ml	5.4 ml	2.6 ml	2.6 ml	0.7 ml
50 kg	12.0 ml	6.0 ml	2.0 ml	1.0 ml	6.6 ml	3.3 ml	3.3 ml	0.8 ml
60 kg	14.4 ml	7.2 ml	2.4 ml	1.2 ml	8.0 ml	4.0 ml	4.0 ml	1.0 ml
70 kg	16.8 ml	8.4 ml	2.8 ml	1.4 ml	9.3 ml	4.7 ml	4.7 ml	1.2 ml
80 kg	19.2 ml	9.6 ml	3.2 ml	1.6 ml	10.6 ml	5.3 ml	5.3 ml	1.3 ml
90 kg	21.6 ml	10.8 ml	3.6 ml	1.8 ml	12.0 ml	6.0 ml	6.0 ml	1.5 ml

**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 11.23).

## How to give emergency antiviral treatment<sup>6,7</sup>

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	75 mg twice daily	150 mg twice daily for 10 days

5 EDCD: Nepal national malaria treatment protocol, 2015

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](http://www.who.int/csr/resources/publications/swineflu/h1n1_guidelines_pharmaceutical_mngt.pdf)

7 EDCD Interim guideline on use of Oseltamivir, 2016

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## How to immobilize spine UNTIL CLEARANCE: NO SPINE INJURY

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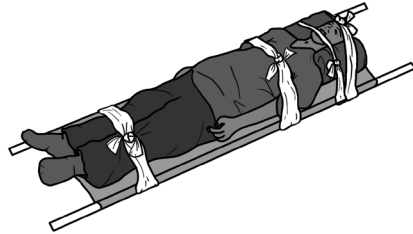
Every patient with a suspected spinal injury should be immobilized until spine can be cleared clinically or with X-ray. It is important to document all examination findings.

### Who to immobilize:

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

### How to immobilize cervical spine:

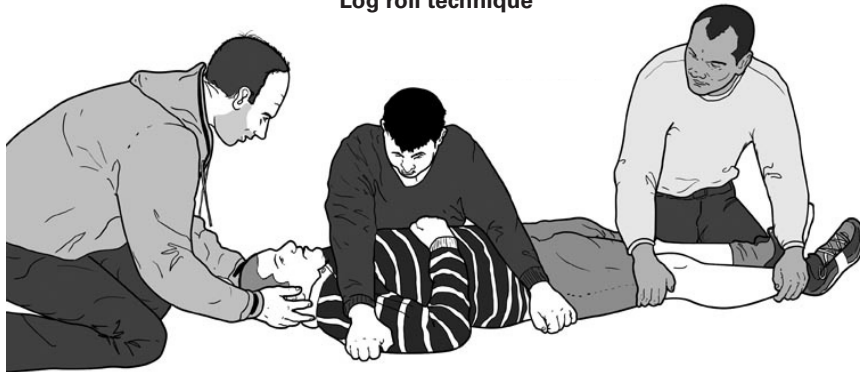
- apply cervical collar or stabilize the neck with locally available material.
- keep the patient lying on a flat surface.
- prevent the neck from moving with locally available materials (towel rolls, newspaper, sandbags, or bags of IV fluids) or cervical collar if available.
- if patient vomits, turn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



### How to immobilize thoracic and lumbar spine:

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

### Log roll technique



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

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

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

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

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

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

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

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### **How to manage serious head injury**

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

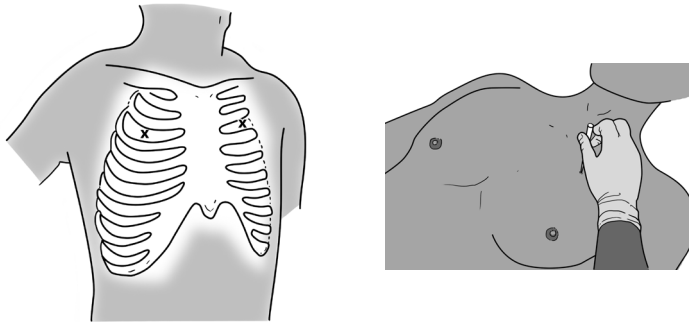


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## How to manage tension pneumothorax or massive haemothorax

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



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

---

## How to treat sucking chest wound

---

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

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

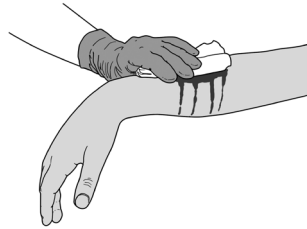
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## How to apply pressure to stop bleeding

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

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



### Tourniquet technique:

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

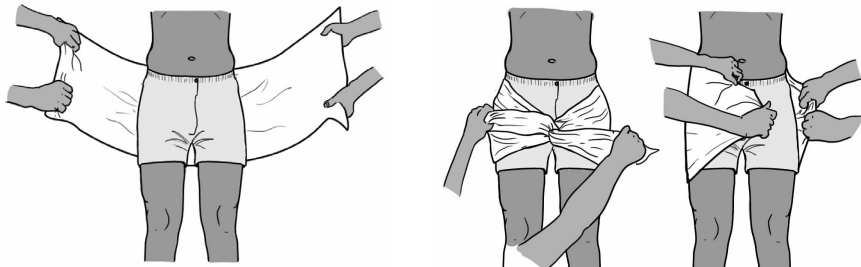
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## How to apply pelvic binder

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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.



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## How to manage heavy upper gastrointestinal bleeding

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### Call for help.

- Insert IV and give fluids rapidly (see p. 25).
- 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 7.3.5).
- If endoscope and trained provider: locate site and cauterize.
- Give proton pump inhibitor in high dose (e.g. omeprazole 80 mg).
- Check whole blood clotting time.

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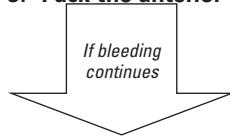
## How to manage large haemoptysis

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- Manage airway.
- Send blood for type and cross match then transfuse as needed.
- Consider antibiotics.
- Monitor Quick Check and haemoglobin (see Section 8.2).
- Check chest X-ray. If unilateral process, place affected side down.

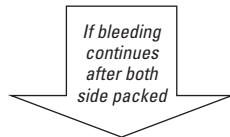
## How to manage large nose bleed (epistaxis)

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

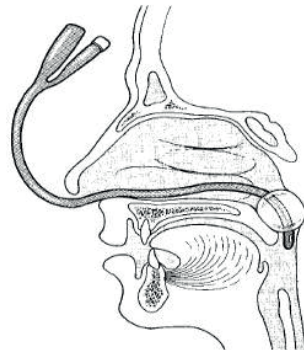
**For all patients:** monitor airway, breathing and circulation (follow Quick Check).

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.



---

## How to give magnesium sulfate

---

**For severe pre-eclampsia and eclampsia or very severe asthma (see p. 23 and Section 8.2):**

**Give IV and IM combined dose (loading dose):**

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

AND

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

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

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

**If convulsions recur:**

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

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

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

**Monitor:**

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

---

## How to give ketamine for a procedure

---

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

---

## How to manage the violent or very agitated patient

---

### Calm and protect

- Protect patient from harming him/herself, you or others.
- Ensure that you are in a quiet area where there is no audience.
- Use space to protect yourself.
- Get help from colleagues, security, and family members who can help mediate the situation and calm the patient down for the safety of staff and the patient.
- Approach in calm and confident manner.
  - Speak in a calm and reassuring way.
  - **Be non-confrontational, non-judgemental, and deflect criticism.**
- Keep your own emotions in check. Do not let yourself be affected by verbal abuse or threats.
- Be aware of potential weapons and remove unsafe objects.
- **Consider differential diagnosis:**
  - Check blood glucose and give glucose if low (see p. 41).
  - Check vital signs including temperature.
  - Check SpO<sub>2</sub> and give oxygen if < 90.
  - Use the delirium differential diagnosis to consider medical causes including poisoning and substance use (see Section 3.4).
  - Decide what is the likely cause of the aggression and agitation.

### Sedate – as appropriate

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

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

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

■ **For most patients:**

- Give haloperidol 2 mg IM or orally every hour up to 5 doses (max dose = 10 mg).

■ **For elderly patients and those with complicating medical illness, including delirium and dementia:**

- Give haloperidol 0.5–1 mg orally or IM every hour up to 3 doses (max dose = 3 mg).

■ **For the most uncontrollable patients at risk to themselves and others:**

- Seek immediate assistance from security staff or police. Ensure the safety of staff.
- If sedation is required give haloperidol 5 mg IM, repeating in 15–30 minutes if necessary (seek specialist advice before using more than 15 mg).

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

**If suspect agitation is due to poisoning with organophosphates or chloroquine**

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

See Sections 3.6, 3.7, and 3.8.

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.

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 10.10 for appropriate management.

■ If patient remains agitated despite the above interventions:

- Reconsider possible causes including pain.
- Recheck SpO<sub>2</sub> and glucose.
- Seek assistance and advice.



---

## How to manage the suicidal/self-harm patient

---

### ■ Evaluate whether the person has attempted a medically serious act of self-harm or suicide:

- Ask the patient or accompanying friends or family about self harm attempt or recent poisoning.
- Look for signs of poisoning or intoxication or signs of self injury.
- Medically treat as necessary.
- Ensure that the person is closely monitored to prevent further self harm.
- Do not leave the patient alone or unsupervised.

### ■ Evaluate whether there is an imminent risk of self-harm or suicide:

- Ask the patient about current thoughts or plans to commit suicide or self harm and about access to means to follow through on those thoughts or plans.
- Look for signs of emotional distress, hopelessness, agitation, uncommunicative behaviour, social isolation.

### ■ If risk is imminent:

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

### ■ If risk is not imminent but there is a recent history of thoughts of suicide or self harm:

- Remove, or advise removal, of access to means of self harm.
- Attend to emotional distress and mental state, problem solve and explore reasons and ways to stay alive.
- Offer and activate psychosocial support.
- Assess for a presence of a mental health disorder and treat as indicated.
- Consult mental health specialist if available.

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

**See Section 10.10 mental health for more on managing the suicidal patient and for managing mental health disorders.**

## Advanced airway management: for district clinicians with training

### INDICATIONS FOR TRACHEAL INTUBATION

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

#### Before attempting intubation ask these questions:

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

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

## HOW TO PERFORM TRACHEAL INTUBATION

**Tracheal intubation should take no more than 30 seconds.**

### **Procedure:**

- Give high flow oxygen via BVM or face mask with reservoir before the procedure.
- Position patient in sniffing position (place pillow under neck if no trauma).
- Give sedation if required (if not comatose) – midazolam 0.2 mg/kg IV or ketamine 1.5 mg/kg IV.\*
- Open the patient's mouth by separating the lips and pulling on the upper jaw with the index finger.
- Hold a laryngoscope in the left hand, insert it into the mouth of the patient with the blade directed to the right tonsil. Once the right tonsil is reached, sweep laryngoscope to the midline, keeping the tongue on the left to bring the epiglottis into view.
- Advance the laryngoscope blade until the angle between the base of the tongue and the epiglottis is reached.
- Next, lift laryngoscope up and away from you at a 45 degree angle to bring the vocal cords into view. An assistant should press downward and upward on the larynx to help bring the vocal cords in view.
- Take the endotracheal tube in the right hand and insert it into the mouth. Insert the tube through the cords to the point that the cuff rests just below the cords.
- Inflate the cuff to provide a minimal leak when the bag is squeezed.
- Attach tube to bag connected to high flow oxygen.
- If successful, start post – intubation care (see p. 45-46).
- 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. 44).

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

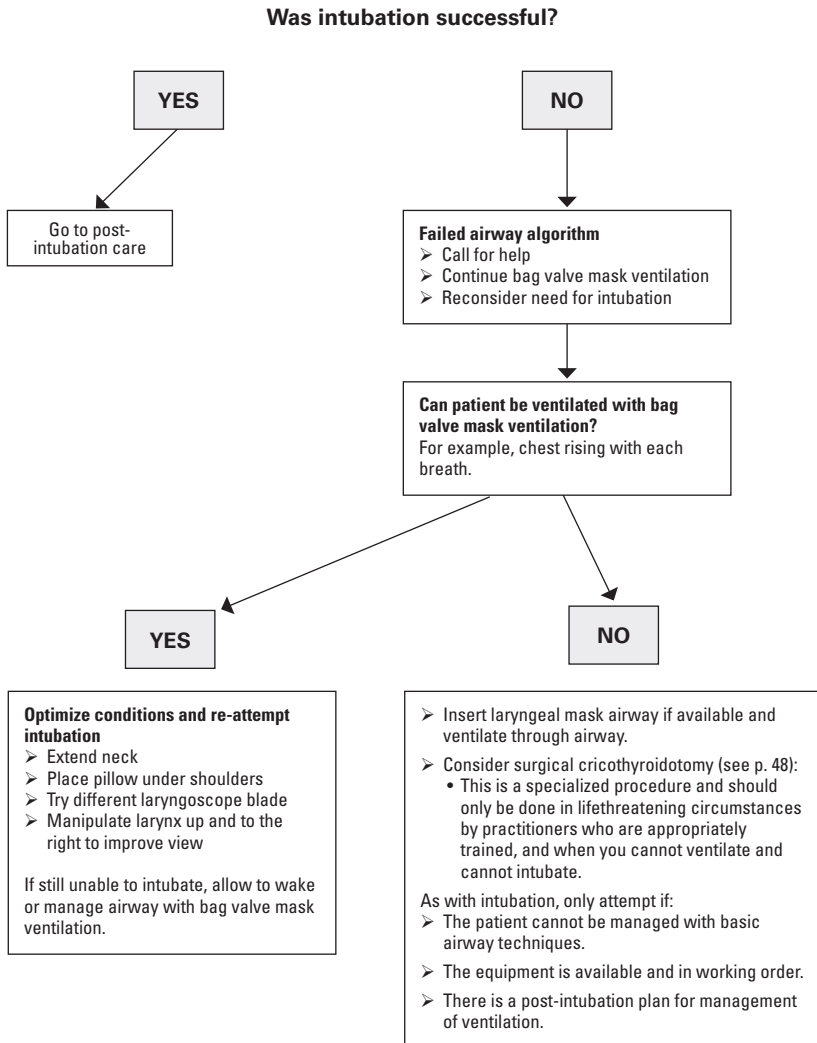
## HOW TO CONFIRM ENDOTRACHEAL TUBE (ETT) PLACEMENT

- 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. 45-46.

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

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

## WAS INTUBATION SUCCESSFUL?



## POST-INTUBATION CARE

### ■ How to ventilate the intubated patient

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

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

### ■ How to sedate the intubated patient

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

## POST-INTUBATION CARE

### ■ If patient becomes blue, cyanotic or hypoxic

- Confirm placement of ETT (see p. 43).
- 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. 4).
- 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. 32).
- 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<sub>2</sub>.
- *If available place patient on continuous pulse oximeter monitoring.*
- Place nasogastric tube (orogastric tube if head trauma suspected; see Section 7.3.5).
- Use soft hand restraints.
- Record all your observations.

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

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

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

### **Demonstrate how to bag, then watch them do it**

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

### **When to call for help**

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



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

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

### Technique:

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

Figure 1

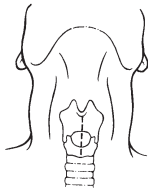


Figure 2

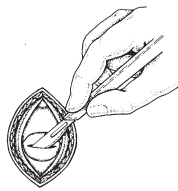


Figure 3

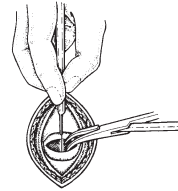


Figure 4

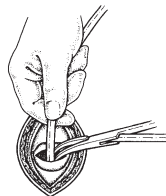


Figure 5



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

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

---

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

---

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

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

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

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

---

## How to transport the severely ill patient

---

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

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

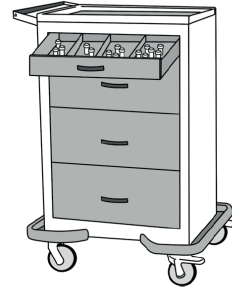
### Transfer checklist

- Airway and NG tube.
- Breathing and adequate SpO<sub>2</sub>.
- Circulation, monitoring and IV.
- Disability/cervical collar/head injury care.
- Exposed, examined and equipment sorted out and secure.
- Family informed.
- Final considerations:
  - Ask for notes and X-rays and other results.
  - Bed confirmed at receiving hospital.
  - Continuity of care assured? Communication equipment.
  - Drugs and spare? Documentation, including patient history.
  - Everything secure? Enough drugs? Enough oxygen? Enough fuel? Enough IV fluids?
- Health worker accompanying patient-prepared?

## Emergency trolley

### Health worker protection

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



### Supplies/equipment (in child and adult sizes)

Suction catheter	Angiocatheters – 14, 16 and 18 gauge
Nasal prongs	Intravenous tubing
Oxygen mask	Syringes
Oxygen mask with reservoir bag	Needles
Oxygen mask with nebulizer attachment	Intraosseus
Oxygen tubing	Alcohol wipe or equivalent antiseptic for skin
Bag valve mask-hung on side of cart	Tourniquet
Oral airway	Tubes for blood draw
Nasal airway	Sterile pads and gauze
Pulse oximeter with probes	Bandage
Tongue depressor	Suture
Laryngoscope	Tape
Magill forceps	Lubricant
Spacer	

### Medication

Epinephrine (adrenaline) IV	Emergency antibiotics
Atropine IV	Emergency antimalarials
Naloxone IV	Oseltamavir
Salbutamol MDI with spacer	Glucose (dextrose D50)
Salbutamol ampoules	Paracetamol
Hydrocortisone IV, oral	Aspirin
Furosemide IV, oral	Morphine or equivalent*
Ipratropium MDI	Diazepam IV/PR*
LR or NS fluids	Magnesium sulfate IV
	Haloperidol
	Ergometrine IM
	Oxytocin IV

\*Lock box.



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

#### 3.0 General principles for caring for the severely ill patient

3.0 General principles for caring for the severely ill patient <ul style="list-style-type: none"><li>– Rapid assessment and immediate management</li><li>– Monitor – record – respond</li><li>– Give oxygen</li><li>– Nursing care for severely ill patients</li></ul>	<ul style="list-style-type: none"><li>– Involving the family in caring for severely ill patients</li><li>– Limiting therapy and palliative care</li><li>– Nutrition</li><li>– Considerations when caring for the pregnant patient with severe illness</li></ul>
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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<sub>2</sub> (normal: >95%, give oxygen if <90%)
- mental status (AVPU scale – alert, responding to voice, responding to pain, unresponsive)
- heart rate (normal 60–100).

**Monitor the following every 6 hours.**

- temperature (normal 36°–38°C)



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

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

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

Similarly, administration of oxygen to a breathless and hypoxaemic patient should result in an immediate rise in SpO<sub>2</sub>. 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<sub>2</sub> <90. Most patients will respond to oxygen with improvement in their respiratory distress or SpO<sub>2</sub> within a few minutes. However, some patients will continue to have severe respiratory distress or SpO<sub>2</sub> < 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<sub>2</sub> 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 nasogastric 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 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 – Section 3.9
- burn – Section 3.10

## 3.1 Severely ill patient with shock

3.1.0 Approach to the patient with shock <ul style="list-style-type: none"> <li>– General signs of shock common to all causes</li> <li>– Five main categories of shock</li> <li>– DDX shock</li> <li>– General principles of managing shock</li> <li>– Monitor – record – respond</li> </ul>	3.1.3 Manage anaphylactic shock
3.1.1 Manage haemorrhagic shock <ul style="list-style-type: none"> <li>– Identify source of bleeding</li> <li>– Urgent investigations</li> <li>– Stop ongoing blood loss</li> <li>– Restore circulating blood volume</li> </ul>	3.1.4 Manage cardiogenic shock
3.1.2 Manage hypovolaemic shock	3.1.5 Manage septic shock <ul style="list-style-type: none"> <li>– Give fluids rapidly</li> <li>– Give empirical IV antimicrobials within first hour</li> <li>– Identify the source of infection</li> <li>– Table: Modified management of septic shock associated with certain infections</li> <li>– Flowchart: Management of septic shock and severe respiratory distress without shock</li> </ul>
	Table: How to administer peripheral vasopressors (in cardiogenic or septic 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 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
<b>Haemorrhagic</b>	<ul style="list-style-type: none"> <li>• Trauma</li> <li>• Bleeding – external or internal</li> <li>• Pregnancy complications</li> </ul>
<b>Hypovolaemia</b>	<ul style="list-style-type: none"> <li>• History of diarrhoea and vomiting</li> <li>• Dehydration</li> <li>• Burns</li> <li>• Pancreatitis</li> </ul>
<b>Septic</b>	<ul style="list-style-type: none"> <li>• Temperature dysregulation</li> <li>• Infective symptoms</li> <li>• Sepsis can present as “warm shock” (bounding pulse, warm hands) or “cold shock” (vasoconstriction, cold extremities)</li> </ul>
<b>Anaphylactic</b>	<ul style="list-style-type: none"> <li>• Very sudden onset angioedema and wheezing</li> <li>• Urticaria</li> <li>• New medication or known allergy</li> </ul>
<b>Cardiogenic</b>	<ul style="list-style-type: none"> <li>• Older patient</li> <li>• Known cardiac history</li> <li>• Chest pain and difficult breathing, sweaty</li> </ul>

### Less common categories and their causes

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

### History

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







### Examination

Do a focused examination to identify likely causes. Check:

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

### DDx: Shock

Diagnosis	In favour
<b>Anaphylaxis</b>	<ul style="list-style-type: none"><li>• Swollen neck or tongue</li><li>• Wheeze and stridor</li><li>• Urticaria or red rash</li><li>• Angioedema</li><li>• Exposure to food or medicine just prior to attack</li></ul>
<b>Cardiogenic</b>	
<b>Arrhythmias</b>	<ul style="list-style-type: none"><li>• Very fast or very slow pulse</li><li>• Irregular pulse</li></ul>
<b>Cardiomyopathy</b>	<ul style="list-style-type: none"><li>• History of HIV, peripartum, recent viral infection, hypertension</li><li>• Displaced maximum cardiac impulse, extra heart sounds</li></ul>
<b>Myocardial infarction</b>	<ul style="list-style-type: none"><li>• Known ischaemic heart disease</li><li>• Heavy or tight or crushing chest pain associated with nausea or sweating or radiating into arm or neck</li><li>• Risk factors (smoking, age over 50, hypertension, diabetes)</li></ul>
<b>Pericardial effusion or tamponade</b> see pericardial effusion or tamponade in Section 3.1.4 on cardiogenic shock	<ul style="list-style-type: none"><li>• Risk factors (TB, HIV, malignancy)</li><li>• Sharp sternal pain, worse lying flat</li><li>• Quiet heart sounds</li><li>• Distended neck veins</li></ul>
<b>Valve disease</b>	<ul style="list-style-type: none"><li>• History of rheumatic fever or heart disease</li><li>• Murmur</li></ul>

Haemorrhagic	
<b>Trauma with visible bleeding</b>	<ul style="list-style-type: none"> <li>• History of blunt or penetrating trauma</li> <li>• Visible bleeding</li> </ul>
<b>Trauma with internal bleeding (spleen, liver, femur or pelvic fractures)</b>	<ul style="list-style-type: none"> <li>• History of blunt or penetrating trauma</li> <li>• Major trauma and long bone fractures</li> <li>• Localized pain</li> <li>• Abdominal pain, tenderness, distension</li> </ul>
<b>Gastrointestinal bleeding (peptic ulcer, bleeding varices)</b>	<ul style="list-style-type: none"> <li>• Vomiting blood or melena</li> <li>• History of peptic ulcer disease</li> <li>• History of cirrhosis</li> <li>• Abdominal pain and tenderness</li> </ul>
<b>Ruptured ectopic pregnancy</b> 	<ul style="list-style-type: none"> <li>• Pallor</li> <li>• Vaginal bleeding – mild (usually follows abdominal pain and missed period)</li> <li>• Pelvic or adnexal tenderness</li> <li>• May have mass</li> <li>• Positive pregnancy test (may be too early to detect pregnancy clinically)</li> </ul>
<b>Incomplete or septic abortion</b> 	<ul style="list-style-type: none"> <li>• Heavy bleeding</li> <li>• Dilated cervix</li> <li>• Cramping or lower abdominal pain</li> <li>• Expulsion of products of conception</li> <li>• If septic abortion, purulent cervical discharge or foul-smelling vaginal discharge</li> </ul>
<b>Abruptio placentae</b> 	<ul style="list-style-type: none"> <li>• Late stages of pregnancy</li> <li>• Abdominal pain</li> <li>• Uterus tender and tense</li> <li>• May occur after relatively minor trauma</li> <li>• May have fetal distress or fetal death</li> </ul>
<b>Placenta previa</b> 	<ul style="list-style-type: none"> <li>• Late pregnancy</li> <li>• Fetal presenting part above the pelvis</li> <li>• May be precipitated by intercourse</li> </ul>
<b>Postpartum haemorrhage (PPH)</b> 	<ul style="list-style-type: none"> <li>• Recent childbirth and uterus not contracted (bleeding, usually immediately after childbirth)</li> <li>• Placenta may not be completely expelled</li> <li>• Secondary PPH also can occur from retained products</li> <li>• Consider traumatic PPH</li> </ul>
<b>Uterine rupture</b> 	<ul style="list-style-type: none"> <li>• Severe abdominal pain (may decrease after rupture)</li> <li>• Bleeding may be vaginal or intra-abdominal</li> <li>• Abdominal distension, free fluid</li> <li>• Decreased or absent fetal movements, fetal distress, absent fetal heart sounds</li> <li>• Prior caesarean section, prolonged labour, or induction of labour</li> </ul>
<b>Ruptured abdominal aortic aneurysm</b>	<ul style="list-style-type: none"> <li>• Sudden, severe onset abdominal pain radiating to the back</li> <li>• Pulsatile abdominal mass</li> <li>• Peritonitis</li> <li>• Asymmetry (left to right) of femoral or distal leg pulses</li> </ul>
Hypovolaemic	
<b>Severe dehydration due to diarrhoea</b>	<ul style="list-style-type: none"> <li>• Profuse watery diarrhoea</li> <li>• Known outbreak or travel to area with cholera</li> </ul>
<b>Severe dengue</b>	<ul style="list-style-type: none"> <li>• Known recent cases of dengue, endemic area</li> <li>• Fever, headache, petechiae</li> </ul>
<b>Haemorrhagic fevers</b> see WHO VHF pocket guide and Sections 11.6, 11.11, 11.39	<ul style="list-style-type: none"> <li>• Contact with known outbreak or endemic area</li> <li>• Fever, headache, dizziness</li> <li>• Bruising, bleeding from gastrointestinal or respiratory tracts</li> </ul>
<b>Poisoning</b> see Section 3.8	<ul style="list-style-type: none"> <li>• History of exposure</li> <li>• Organophosphate (pinpoint pupils, salivation, bradycardia, incontinence, anxiety, coma)</li> </ul>
<b>Burns</b> see Section 3.10	<ul style="list-style-type: none"> <li>• Severe burns</li> </ul>

<b>Pancreatitis</b>	<ul style="list-style-type: none"> <li>• Abdominal pain radiating to the back (duration more than 6 hours)</li> <li>• Vomiting</li> <li>• Known biliary stones (gallstones) or heavy alcohol use</li> <li>• Use of didanosine</li> </ul>
<b>Septic</b>	
<b>Septic shock</b>	<ul style="list-style-type: none"> <li>• Fever (temperature more than 38°C) or hypothermia (less than 36°C)</li> <li>• Warm extremities, bounding pulses (often not present) or weak, thready pulse and cold extremities when hypovolaemic from fluid shifts</li> <li>• 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)</li> </ul>
<b>Obstructive</b>	
<b>Tamponade</b> see pericardial effusion or tamponade in Section 3.1.4 on cardiogenic shock	<ul style="list-style-type: none"> <li>• Risk factors (TB, HIV, malignancy)</li> <li>• Sharp sternal pain, worse lying flat</li> <li>• Quiet heart sounds, distended neck veins</li> </ul>
<b>Pulmonary emboli</b>	<ul style="list-style-type: none"> <li>• Sudden-onset shortness of breath, difficult breathing, pleuritic chest pain</li> <li>• Unilateral leg swelling</li> <li>• Haemoptysis</li> <li>• Tachycardia</li> <li>• Risk factor (long travel, prolonged sitting, recent surgery, recent long bone fracture, malignancy, sickle-cell disease)</li> </ul>
<b>Tension pneumothorax</b>	<ul style="list-style-type: none"> <li>• Sudden-onset shortness of breath, difficult breathing, pleuritic chest pain</li> <li>• History of trauma or chronic lung disease (e.g. emphysema)</li> <li>• Increased resonance on affected side of chest</li> <li>• Decreased breath sounds on side of pneumothorax</li> <li>• Deviated trachea away from pneumothorax</li> </ul>
<b>Endocrine</b>	
<b>Hypoadrenalism (Addisonian crisis)</b>	<ul style="list-style-type: none"> <li>• Fatigue, dizziness</li> <li>• Vomiting</li> <li>• Sudden cessation of long-standing steroid medications (or herbal remedies containing steroids)</li> <li>• Recent precipitant – infection, surgery</li> <li>• Adrenal TB (fever, night sweats, loss of weight)</li> <li>• Hypoglycaemia</li> <li>• Hyponatraemia, hyperkalaemia</li> </ul>
<b>Neurogenic</b>	
<b>Acute spinal cord injury</b>	<ul style="list-style-type: none"> <li>• Acute trauma to the cervical or upper thoracic spine with paraplegia or quadriplegia</li> <li>• Slow pulse</li> <li>• Loss of muscle tone and reflexes during acute phase of the injury</li> </ul>

### General principles of managing patients with shock

- Manage airway (see Quick Check pages 15-18).
- Give oxygen (see Quick Check pages 19-22).
- Give IV fluid rapidly (see Quick Check page 25 and specific fluid recommendations by type of shock in the sections which follow).
- Treat underlying cause.
- Consider vasopressors if SBP <90 and signs of inadequate perfusion after fluid resuscitation
- Monitor – record – respond (see Section 3.0).

### Monitor – record – respond

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

- signs of inadequate perfusion
  - decreased urine output

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

## Management of specific types of shock

### 3.1.1 Manage haemorrhagic shock (see Quick Check page 33 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 15-18)
- Give oxygen for respiratory distress or SpO<sub>2</sub> <90 (see Quick Check pages 19-22)

#### 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 obstetrical guidelines

#### 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).



### Stop ongoing blood loss

- Apply direct pressure to stop obvious bleeding (see Quick Check page 33).
- Splint long bone or pelvic fracture (see Section 4.5.2 and Quick Check page 33).
- Place chest tube if suspect haemothorax (see Section 7.3.1 and Quick Check page 32).
- If vaginal bleeding,<sup>1</sup> see obstetrical guidelines.
- 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 34).

### Restore circulating blood volume

For complete information on blood transfusion, see *The Clinical Use of Blood Handbook*.<sup>2,3</sup> During Quick Check (see page 25) 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).

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### 3.1.2 Manage hypovolaemic shock

Patients with shock from severe dehydration (e.g. cholera or other severe gastroenteritis) 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 8.3).

- 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.

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<sup>1</sup> *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](http://whqlibdoc.who.int/publications/2009/9789241598514_eng.pdf)

<sup>2</sup> *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/](http://www.who.int/bloodsafety/clinical_use/en/)

<sup>3</sup> National Blood Transfusion Policy. Available at <https://drive.google.com/file/d/1ZoXCdKO8Nx9F55eiUfQxH3f3f7Ho8fZJ/view>

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 burn management, Section 3.1.5 for septic shock, and Section 8.1.11 for dengue.

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### 3.1.3 Manage anaphylactic shock

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- Give epinephrine (adrenaline) 0.5 ml 1:1000 IM (see Quick Check page 14) – 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<sub>2</sub> <90 (see Quick Check pages 15-18).
- 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 H<sub>2</sub>-antagonist (e.g. *ranitidine*) may provide additional benefit.

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### 3.1.4 Manage cardiogenic shock

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- Help the patient assume a comfortable position.
- Give oxygen for respiratory distress or if SpO<sub>2</sub> <90 (see Quick Check pages 19-22).
- If there is evidence of pericardial tamponade, the patient will need urgent drainage (refer to pericardiocentesis in Section 7.2.12).
- Do an urgent ECG or use a cardiac monitor.
  - Assess for ST segment elevation or depression suggestive of myocardial infarction and treat appropriately.
  - Treat any serious arrhythmia.
- If there is no clinical evidence of fluid overload, give fluids cautiously (250–500 ml).
- If there is clinical evidence of fluid overload, consider vasopressors. See table How to administer peripheral vasopressors (in cardiogenic or septic shock) at end of Section 3.1.

### 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, availability of antibiotics, and current data on antimicrobial resistance.
  - If no known site of infection, give ceftriaxone
  - If community-acquired pneumonia is suspected, refer to updated 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. Immediately do a malaria RDT or microscopy then start antimalarials; if not immediately available, start antimalarials while waiting the result. See Quick Check page 29 and Section 11.23
- **Antivirals:** if suspect influenza, give antiviral. See Quick Check page 29 and Section 8.2.<sup>4,5</sup>

**Consider TB especially in PLHIV:** Patients with HIV-related pulmonary and extrapulmonary TB are at high risk of rapid clinical deterioration and death.<sup>6</sup>

Perform all appropriate TB investigations and recommend HIV testing. Promptly send sputum for AFB smear<sup>7</sup> 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.

Consider disseminated TB especially if there is malnutrition and weight loss.

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.

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.

<sup>4</sup> *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](http://www.who.int/csr/resources/publications/swineflu/h1n1_use_antivirals_20090820/en/index.html)


<sup>5</sup> EDCD Interim guideline on use of Oseltamivir, 2016

<sup>6</sup> *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](http://whqlibdoc.who.int/hq/2007/WHO_HTM_TB_2007.379_eng.pdf)

<sup>7</sup> If available, obtain nationally or WHO-approved molecular testing, e.g. Xpert MTB/RIF, per national guideline recommendations.

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
<b>Dengue<sup>8</sup></b> see Section 8.1.11	<ul style="list-style-type: none"> <li>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.</li> <li>Haematocrit should be monitored frequently.</li> <li>Watch carefully for signs of fluid overload. If fluid overload develops, see Sections 3.2.5 and 8.1.11.</li> </ul> <p>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 (follow guidance in Section 8.1.10)</p>
<b>Suspect scrub or murine typhus</b> See Sections 8.1.6, 8.1.7	<ul style="list-style-type: none"> <li>Give doxycycline or azithromycin if any suspicion in severely ill patient.</li> </ul>
<b>Suspect enteric fever</b>	<ul style="list-style-type: none"> <li>See Section 8.1.9</li> </ul>
<b>Severe malaria</b> see Section 11.23 <sup>9,10</sup>	<ul style="list-style-type: none"> <li>Give antimalarials.</li> <li>Severe malaria often is associated with bacteraemic sepsis (in particular Gram-negative bacteria). Give broad-spectrum antibiotics (ampicillin plus gentamicin, or ceftriaxone).</li> <li>Fluids, other supportive care are the same. Follow flowchart on following pages.</li> <li>Watch carefully for signs of pulmonary oedema and volume overload (cough, fast respiratory rate, shortness of breath, hypoxaemia, increased JVP, rales on auscultation).</li> <li>In the calculation of 60 ml/kg total in the first 2 hours, include the fluids used to administer antimalarials.</li> <li>If pulmonary oedema develops, see Section 3.2.5. Stop fluids and use vasopressors to support circulation (dopamine is preferred).</li> </ul>
<b>Tuberculosis</b>	<ul style="list-style-type: none"> <li>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.</li> <li>Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>
<b>Severe pneumonia</b> see Sections 3.2.3 and 8.2	<ul style="list-style-type: none"> <li>Antibiotics may differ depending on suspected etiology; see Section 3.2.3.</li> <li>Influenza -specific antiviral if suspect influenza.</li> <li>If empyaema, drain.</li> <li>Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>
<b>Suspect amnionitis during pregnancy</b> see obstetrical guidelines	 <ul style="list-style-type: none"> <li>Add metronidazole to ampicillin and gentamicin.</li> <li>Fetal monitoring; consider delivery.</li> <li>Keep patient on left side.</li> <li>Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>

<sup>8</sup> *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](http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf)

<sup>9</sup> *Guidelines for the treatment of malaria, 3rd edition*. WHO, 2015

<sup>10</sup> Nepal National Malaria Treatment Protocol, 2015

<b>Postpartum sepsis or septic abortion</b>  see obstetrical and STD guidelines	<ul style="list-style-type: none"> <li>• Add metronidazole (or clindamycin) to ceftriaxone, or give ampicillin plus gentamicin.</li> <li>• Evacuate uterus if there are retained products.</li> <li>• Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>
<b>PID<sup>12</sup>, pelvic or tubo-ovarian abscess</b> see obstetrical and STD guidelines	<ul style="list-style-type: none"> <li>• Give ceftriaxone plus doxycycline; OR clindamycin plus gentamicin.</li> <li>• May need urgent surgery if suspect ruptured tubo-ovarian abscess.</li> <li>• Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>
<b>Pancreatitis, peritonitis, surgical abdomen or abscess, cholangitis, ruptured appendicitis, etc.</b> see Section 10.5a	<ul style="list-style-type: none"> <li>• Call for help from surgical consultant to possibly drain abscess or perform other surgical interventions as needed.</li> <li>• Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>
<b>Suspect CCHF</b> see Section 11.6	<ul style="list-style-type: none"> <li>• IV ribavirin may be effective against bunyaviridae- Crimean-Congo haemorrhagic fever and hantaviruses); consult with national programme and experts on its use.</li> <li>• See Section 6.13 for infection control.</li> <li>• Fluids, other supportive care are the same. Follow flowchart on following pages.</li> </ul>

<sup>12</sup> Insert Nepal current guideline reference

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

**Septic shock**

**Severe respiratory distress without shock**

<b>First 2 hours</b>	<b>Recognize</b>	<p><b>Clinical diagnosis of severe sepsis or septic shock</b></p> <ul style="list-style-type: none"> <li>• Suspected infection</li> <li>• Hypotension (systolic blood pressure &lt;90 mmHg) <b>and 1 or more of the following</b></li> <li>• Pulse &gt;100 bpm</li> <li>• Respiratory rate &gt;24</li> <li>• Abnormal temperature (&lt;36°C or &gt;38°C)</li> </ul>	<p><b>Clinical diagnosis of severe respiratory distress without shock</b></p> <ul style="list-style-type: none"> <li>• If respiratory rate &gt;30 or SpO<sub>2</sub> &lt;90, and</li> <li>• SBP &gt;90 mmHg, and</li> <li>• No heart failure, and</li> <li>• Suspected pneumonia or acute lung injury</li> </ul>
	<b>Fix the physiology</b>	<p><b>Oxygen:</b> titrate to SpO<sub>2</sub> 90</p> <p><b>Fluids:</b> 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</p>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90</p> <p><b>Fluids:</b> Give fluids at 1 ml/kg/hour or orally If wheezing, give salbutamol</p>
	<b>Treat infection</b>	<p><b>Urgent empirical antimicrobials</b></p> <ul style="list-style-type: none"> <li>• Antibiotics</li> <li>• Antimalarials</li> <li>• Influenza -specific antiviral if suspect influenza</li> </ul>	<p><b>Identify source of infection</b></p> <ul style="list-style-type: none"> <li>• Use signs or symptoms to consider source.</li> <li>• Malaria test</li> <li>• Where available, molecular testing for TB or AFB smear of sputums, if cough</li> <li>• Chest X-ray, Gram-stain sputum</li> <li>• Send blood cultures.</li> </ul>
	<b>Monitor, Record</b>	<p><b>Every 30 minutes until stable; then every 1 hour</b></p> <ul style="list-style-type: none"> <li>• SBP, pulse</li> <li>• Respiratory rate</li> <li>• SpO<sub>2</sub></li> <li>• Mental status (AVPU)</li> <li>• JVP, auscultate for crackles (rales)</li> </ul>	<p><b>Check results of emergency laboratory</b></p> <ul style="list-style-type: none"> <li>• If haemoglobin &lt;7 mg/dl (Hct &lt;20), consider transfusion.</li> <li>• If glucose &lt;3 mmol/l (54 mg/dl), then give D50 25–50 ml (see Quick Check page 27).</li> </ul>
	<b>Respond</b>	<p><b>If respiratory function declining (increasing RR, falling SpO<sub>2</sub>)</b></p> <ul style="list-style-type: none"> <li>• Check oxygen supply.</li> <li>• If JVP elevated, increasing crackles,</li> </ul> <p>Consider fluid overload.</p>	<p><b>If SBP &lt;90, switch to manage as septic shock</b></p> <ul style="list-style-type: none"> <li>• If wheezing, give salbutamol.</li> <li>• If suspect fluid overload, slow rate of fluid administration and start vasopressors if still in shock.</li> </ul>

**Septic shock**

**Severe respiratory distress without shock**

<b>2-6 hours</b>	<b>Recognize</b>	<p>Reconsider diagnosis if no change in SBP following fluid boluses.</p> <p>Establish source of infection</p>	<p>If poor response, reconsider pneumothorax, pleural effusion, heart failure, poisoning, TB, and PCP associated with HIV.</p>
	<b>Fix the physiology</b>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90.</p> <p><b>Fluids:</b></p> <ul style="list-style-type: none"> <li>If SBP &gt;90, continue fluids at 2 ml/kg/hour.</li> <li>If SBP &lt;90 at 2 hours or later, start vasopressors and continue fluids at 5-10 ml/kg/hour.</li> </ul>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90.</p> <p><b>Fluids:</b></p> <ul style="list-style-type: none"> <li>Give fluids at 1 ml/kg/hour or orally</li> <li>If wheezing, give salbutamol.</li> </ul>
	<b>Treat infection</b>	<p>Drain surgical infection if required.</p>	<p>Consider source of infection.</p> <p>Review results of investigations.</p>
	<b>Monitor, Record</b>	<p><b>Every 30 minutes until stable; then every 1 hour</b></p> <ul style="list-style-type: none"> <li>SBP, pulse</li> <li>Respiratory rate</li> <li>SpO<sub>2</sub></li> <li>Mental status (AVPU)</li> <li>JVP, auscultate for crackles (rales)</li> </ul>	<p><b>Every 6 hours</b></p> <ul style="list-style-type: none"> <li>Temperature</li> <li>Urine output</li> <li>Repeat glucose and Hb if initial values abnormal.</li> </ul>
	<b>Respond</b>	<p><b>If respiratory function declining (increasing RR, falling SpO<sub>2</sub>)</b></p> <ul style="list-style-type: none"> <li>Check oxygen supply</li> <li>If elevated JVP and increasing crackles,</li> </ul> <p>Consider fluid overload.</p>	<p><b>If SBP &lt;90, switch to manage as septic shock and give 1000 ml IV.</b></p> <p><b>If respiratory function declining (increasing breathlessness, increasing RR, or SpO<sub>2</sub> &lt;90)</b></p> <ul style="list-style-type: none"> <li>Check oxygen supply and increase flow rate if possible.</li> <li>If wheezing, give salbutamol.</li> <li>Check that antimicrobials have been given. Consider broader antimicrobial cover.</li> <li>Consider other diagnoses or infections; see above.</li> <li>If signs of fluid overload, SBP &gt;100, and shock resolved, stop IV fluids, give furosemide 20 mg IV, and raise head of bed.</li> </ul>



		<b>Septic shock</b>	<b>Severe respiratory distress without shock</b>
<b>6–24 hours</b>	<b>Recognize</b>	<p>Reconsider diagnosis if no change in SBP following fluid boluses.</p> <p>Establish source of infection.</p> <p>Consider surgical cause: is drainage required?</p>	<p><b>If poor response, reconsider</b></p> <ul style="list-style-type: none"> <li>• pneumothorax</li> <li>• pleural effusion</li> <li>• heart failure</li> <li>• poisoning</li> <li>• TB</li> <li>• PCP associated with HIV</li> </ul>
	<b>Fix the physiology</b>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90.</p> <p><b>Fluids:</b></p> <ul style="list-style-type: none"> <li>• When SBP &gt;90, continue fluids at 2 ml/kg/hour. If on vasopressors, reduce rate.</li> <li>• If SBP &lt;90, continue or increase vasopressors and continue LR or NS at 2 ml/kg/hour.</li> </ul>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90.</p> <p><b>Fluids:</b></p> <ul style="list-style-type: none"> <li>• Continue at 1 ml/kg/hour or orally.</li> <li>• If wheezing, give salbutamol.</li> </ul>
	<b>Treat infection</b>	<p><b>Continue empirical antimicrobials – next dose</b></p> <ul style="list-style-type: none"> <li>• Antibiotics</li> <li>• Antimalarials (if falciparum malaria tests are positive)</li> <li>• Antiviral if suspect influenza</li> </ul>	
	<b>Monitor, Record</b>	<p><b>Every hour if SBP &lt;90 or on vasopressors; otherwise every 2 hours</b></p> <ul style="list-style-type: none"> <li>• SBP, pulse</li> <li>• Respiratory rate</li> <li>• SpO<sub>2</sub></li> <li>• Mental status (AVPU)</li> <li>• JVP, auscultate for crackles (rales)</li> </ul>	<p><b>Every 6 hours</b></p> <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Urine output</li> <li>• Repeat glucose and Hb if initial value abnormal.</li> </ul>
	<b>Respond</b>	<p>Respond to changes as indicated for 2–6 hours on previous page.</p>	

		Septic shock	Severe respiratory distress without shock
Post-resuscitation	Recognize	<p><b>Perform full reassessment.</b></p> <p><b>Review available diagnostic data and treat underlying diagnosis.</b></p> <p>Evidence of a <u>primary</u> cardiac or pulmonary process? Switch to its specific management.</p>	<p><b>If poor response, reconsider:</b></p> <ul style="list-style-type: none"> <li>• Pneumothorax</li> <li>• Pleural effusion</li> <li>• Heart failure</li> <li>• Poisoning</li> <li>• TB</li> <li>• PCP associated with HIV</li> </ul>
	Fix the physiology	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90 and discontinue when 90 on room air.</p> <p><b>Fluids:</b> Reduce to maintenance maximum 2 ml/kg/hour and switch to oral when patient is able to take.</p>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90 and discontinue when 90 on room air.</p> <p><b>Fluids:</b> oral when able to take</p> <p>If wheezing, give salbutamol.</p>
	Treat infection	<p><b><u>Continue antimicrobials – switch to oral dose</u></b></p> <ul style="list-style-type: none"> <li>• Antibiotics</li> <li>• Antimalarials (give IV antimalarials for at least 24 hours total before switching to oral)</li> <li>• Antiviral if suspect influenza</li> </ul>	
	Nutrition	<p><b>Procedures to follow once the patient has stabilized, or after 1–2 days:</b></p> <ul style="list-style-type: none"> <li>• 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).</li> <li>• 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.</li> <li>• Consider NG feeding using pureed foods if the patient cannot swallow safely.</li> <li>• In severely ill patients give a small amount initially (e.g. 20–40 ml/hour) and monitor NG aspirates to check for absorption.</li> <li>• Increase rate of feeding as tolerated.</li> </ul>	
	Monitor, Record	<p><b><u>Every 8 hours (check SBP hourly if weaning off vasopressors); then daily</u></b></p> <ul style="list-style-type: none"> <li>• SBP, pulse</li> <li>• Respiratory rate</li> <li>• SpO<sub>2</sub></li> <li>• Mental status (AVPU)</li> </ul> <p>Respond to changes as indicated earlier.</p>	
	Respond		

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

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

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

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

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

### Stop the infusion if:

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

### How to administer and titrate vasopressors

#### 1. Does the patient have adequate perfusion?

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

#### 2. Choose a vasopressor and prepare the drip for infusion

In most settings the choice of vasopressor is determined by what is available. Become familiar with the dosing and administration of the locally available vasopressor to optimize patient safety and prevent medication errors.

Norepinephrine is the preferred vasopressor in Nepal. If it is not available, use dopamine or epinephrine. 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.

Use the tables laying out the exact drip rate

#### 3. Monitor the patient and titrate

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

### ***Norepinephrine- preferred vasopressor in Nepal***

Commonly available concentrations	1 amp = 4 mg/4 ml norepinephrine	1 amp = 4 mg/4 ml norepinephrine
Target infusion concentration	16 mcg/ml	8 mcg/ml
Mixing procedure to create target infusion concentration	4 amps in 1 litre or 2 amps in 500ml or 1 amp in 250ml D5W or NS (not LR)	2 amps in 1 litre or 1 amp in 500ml or 0.5 amp in 250ml D5W or NS
<b>How to give vasopressor by peripheral infusion</b>		
Vasopressor	<b>Peripheral norepinephrine infusion</b>	
	See the infusion rate tables at the end of this Section 3.1	

### ***Dopamine***

<i>Commonly available concentration</i>	<i>1 amp = 200 mg dopamine in 5 ml</i>	<i>1 amp = 200 mg dopamine in 5 ml</i>	<i>1 amp = 200 mg dopamine in 5 ml</i>
<i>Target infusion concentration</i>	<b>1000 micrograms per ml</b>	<b>800 micrograms per ml</b>	<b>400 micrograms per ml</b>
<i>Mixing procedure to create target infusion concentration</i>	<b>5 amps in 1 litre or 2.5 amps in 500 ml or 1 amp in 200 ml D5W, NS, or LR</b>	<b>4 amps in 1 litre or 2 amps in 500 ml or 1 amp in 250 ml D5W, NS, or LR</b>	<b>2 amps in 1 litre or 1 amp in 500 ml or 0.5 amp in 250 ml D5W, NS, or LR</b>
<i>Vasopressor</i>	<i>Peripheral dopamine infusion. Preferred for shock in severe malaria.</i>		
	See the infusion rate tables at the end of this Section 3.1		

### ***Epinephrine***

Commonly available concentrations	1 amp = 1 mg epinephrine (adrenaline) in 1 ml
Target infusion concentration	10 mcg/ml
Mixing procedure to create target infusion concentration	<b>10 amps in 1 litre or 5 amps in 500 ml or 2 amps in 200ml D5W, NS or LR</b>
Vasopressor	<b>Peripheral epinephrine infusion</b>
	See the infusion rate tables at the end of this Section 3.1

Depending on what vasopressors and drippers are available, use the appropriate vasopressor tables below to determine the administration rate for the correct dose of dopamine, norepinephrine or epinephrine 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 desired dose.

### **Drip rate tables for several vasopressors**

- Choose the vasopressor and its target infusion concentration- the choices should be consistent within a hospital.
- Then choose the row with the patient's weight
- Then choose the dose desired. This gives an infusion rate.
- Then choose the drip factor- drops per ml in your set-up. Note that an adult IV giving set usually provides 20 drops/ml. A paediatric burette usually provides 60 drops/ml.
- This then gives the drip rate in drops/minute. This should be carefully regulated.

In a hospital, there should be a standard approach to giving each vasopressor—one target infusion concentration, one drip factor. It is usually safer to use a paediatric burette.

**DOPAMINE** target infusion concentration: 1000 mcg/ml

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
<b>Target infusion concentration</b>	1000 mcg/mL	<b>How to mix:</b>	5 amp in 1 litre (D5W, NS, LR)		
<b>1 amp</b>	200 mg/ 5 mL		2.5 amps in 500 mL (D5W, NS, LR)		
			1 amp in 200 mL (D5W, NS, LR)		

**DOPAMINE** target infusion concentration: 800 mcg/ml

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	Drip factor (drops/mL)		
			10	20	60
			Drip rate (drops/min)		
30	5	11	2	4	11
	10	22	4	8	22
	15	34	6	11	34
	20	45	8	15	45
40	5	15	2	5	15
	10	30	5	10	30
	15	45	8	15	45
	20	60	10	20	60
50	5	19	3	6	19
	10	38	6	12	38
	15	56	9	19	56
	20	75	12	25	75
60	5	22	4	8	22
	10	45	8	15	45
	15	68	11	22	68
	20	90	15	30	90
70	5	26	4	9	26
	10	52	9	18	52
	15	79	13	26	79
	20	105	18	35	105
80	5	30	5	10	30
	10	60	10	20	60
	15	90	15	30	90
	20	120	20	40	120
90	5	34	6	11	34
	10	68	11	22	68
	15	101	17	34	101
	20	135	22	45	135
100	5	38	6	12	38
	10	75	12	25	75
	15	112	19	38	112
	20	150	25	50	150
<b>Target infusion concentration</b>	800 mcg/mL	<b>How to mix:</b>	4 amps in 1 litre (D5W, NS, LR)		
<b>1 amp</b>	200 mg/ 5 mL		2 amps in 500 mL (D5W, NS, LR)		
			1 amp in 250 mL (D5W, NS, LR)		

**DOPAMINE** target infusion concentration: 400 mcg/ml

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	Drip factor (drops/mL)		
			10	20	60
			Drip rate (drops/min)		
30	5	22	4	8	22
	10	45	8	15	45
	15	68	11	22	68
	20	90	15	30	90
40	5	30	5	10	30
	10	60	10	20	60
	15	90	15	30	90
	20	120	20	40	120
50	5	38	6	12	38
	10	75	12	25	75
	15	112	19	38	112
	20	150	25	50	150
60	5	45	8	15	45
	10	90	15	30	90
	15	135	22	45	135
	20	180	30	60	180
70	5	52	9	18	52
	10	105	18	35	105
	15	158	26	52	158
	20	210	35	70	210
80	5	60	10	20	60
	10	120	20	40	120
	15	180	30	60	180
	20	240	40	80	240
90	5	68	11	22	68
	10	135	22	45	135
	15	202	34	68	202
	20	270	45	90	270
100	5	75	12	25	75
	10	150	25	50	150
	15	225	38	75	225
	20	300	50	100	300
<b>Target infusion concentration</b>	400 mcg/mL	<b>How to mix:</b>	2 amps in 1 litre (D5W, NS, LR)		
<b>1 amp</b>	200 mg/ 5 mL		1 amp in 500 mL (D5W, NS, LR)		
			0.5 amps in 250 mL (D5W, NS, LR)		



**Epinephrine target infusion concentration: 10 mcg/ml**

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	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
<b>Target infusion concentration</b>	10 mcg/mL	<b>How to mix:</b>	10 amp in 1 litre (D5W, NS, RL)		
<b>1 amp</b>	1 mg/mL		5 amps in 500 mL (D5W, NS, RL)		
			2 amps in 200 mL (D5W, NS, RL)		

**Norepinephrine target infusion concentration: 16 mcg/ml**

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	Drip factor (drops/mL)		
			10	20	60
			Drip rate (drops/min)		
30	0.05	6	1	2	6
	0.1	11	2	4	11
	0.15	17	3	6	17
	0.2	22	4	8	22
	0.25	28	5	9	28
	0.3	34	6	11	34
40	0.05	8	1	2	8
	0.1	15	2	5	15
	0.15	22	4	8	22
	0.2	30	5	10	30
	0.25	38	6	12	38
	0.3	45	8	15	45
50	0.05	9	2	3	9
	0.1	19	3	6	19
	0.15	28	5	9	28
	0.2	38	6	12	38
	0.25	47	8	16	47
	0.3	56	9	19	56
60	0.05	11	2	4	11
	0.1	22	4	8	22
	0.15	34	6	11	34
	0.2	45	8	15	45
	0.25	56	9	19	56
	0.3	68	11	22	68
70	0.05	13	2	4	13
	0.1	26	4	9	26
	0.15	39	7	13	39
	0.2	52	9	18	52
	0.25	66	11	22	66
	0.3	79	13	26	79
80	0.05	15	2	5	15
	0.1	30	5	10	30
	0.15	45	8	15	45
	0.2	60	10	20	60
	0.25	75	12	25	75
	0.3	90	15	30	90
90	0.05	17	3	6	17
	0.1	34	6	11	34
	0.15	51	8	17	51
	0.2	68	11	22	68
	0.25	84	14	28	84

	0.3	101	17	34	101
100	0.05	19	3	6	19
	0.1	38	6	12	38
	0.15	56	9	19	56
	0.2	75	12	25	75
	0.25	94	16	31	94
	0.3	112	19	38	112
<b>Target infusion concentration</b>	16 mcg/mL	<b>How to mix:</b>			
<b>1 amp</b>	4 mg/ 4 mL	4 amps in 1 litre (D5W, NS) 2 amps in 500 mL (D5W, NS) 1 amp in 250 mL (D5W, NS)			

### Norepinephrine target infusion concentration: 8 mcg/ml

Patient weight (kg)	Dose (mcg/kg/min)	Infusion rate (ml/hr)	Drip factor (drops/mL)		
			10	20	60
			Drip rate (drops/min)		
30	0.05	11	2	4	11
	0.1	23	4	8	23
	0.15	34	6	11	34
	0.2	45	8	15	45
	0.25	56	9	19	56
	0.3	68	11	23	68
40	0.05	15	3	5	15
	0.1	30	5	10	30
	0.15	45	8	15	45
	0.2	60	10	20	60
	0.25	75	13	25	75
	0.3	90	15	30	90
50	0.05	19	3	6	19
	0.1	38	6	13	38
	0.15	56	9	19	56
	0.2	75	13	25	75
	0.25	94	16	31	94
	0.3	113	19	38	113
60	0.05	23	4	8	23
	0.1	45	8	15	45
	0.15	68	11	23	68
	0.2	90	15	30	90
	0.25	113	19	38	113
	0.3	135	23	45	135
70	0.05	26	4	9	26
	0.1	53	9	18	53
	0.15	79	13	26	79
	0.2	105	18	35	105
	0.25	131	22	44	131

	0.3	158	26	53	158
80	0.05	30	5	10	30
	0.1	60	10	20	60
	0.15	90	15	30	90
	0.2	120	20	40	120
	0.25	150	25	50	150
	0.3	180	30	60	180
90	0.05	34	6	11	34
	0.1	68	11	23	68
	0.15	101	17	34	101
	0.2	135	23	45	135
	0.25	169	28	56	169
	0.3	203	34	68	203
100	0.05	38	6	13	38
	0.1	75	13	25	75
	0.15	113	19	38	113
	0.2	150	25	50	150
	0.25	188	31	63	188
	0.3	225	38	75	225
<b>Target infusion concentration</b>	8 mcg/mL	<b>How to mix:</b> 2 amps in 1 litre (D5W, NS) 1 amp in 500 mL (D5W, NS) 0.5 amps in 200 mL (D5W, NS)			
<b>1 amp</b>	4 mg/ 4 mL				



## 3.2 Severely ill patient with difficulty breathing

<p>3.2.1 Approach to the severely ill patient with difficulty breathing (with DDx tables)</p> <ul style="list-style-type: none"><li>– General signs of severe respiratory distress</li><li>– Four categories of severe respiratory distress</li><li>– Differential diagnosis of respiratory distress</li><li>– DDx: upper airway obstruction</li><li>– DDx: breathing not due to upper airway obstruction</li><li>– Obtain a chest X-ray to narrow the DDx</li></ul> <p>3.2.2 Provide initial emergency management for all severely ill patients with difficulty breathing</p> <ul style="list-style-type: none"><li>– General principles of managing difficulty breathing</li><li>– Manage airway</li><li>– Give oxygen for hypoxaemia</li><li>– Assist ventilation if ineffective breathing</li><li>– Identify and treat underlying cause(s)</li><li>– Table: Key initial treatments for severely ill patients with respiratory distress</li></ul> <p>3.2.3 Manage respiratory distress in patients with suspected severe pneumonia or acute lung injury without shock</p> <ul style="list-style-type: none"><li>– When to clinically diagnosis</li><li>– General principles of management</li></ul>	<ul style="list-style-type: none"><li>– Treat underlying causes</li><li>– Conservative fluid therapy</li><li>– Monitor – record – respond</li><li>– Principles of hospital management for pneumonia</li><li>– High altitude pulmonary edema (HAPE)</li></ul> <p>3.2.4 Manage patients with severe respiratory distress from acute bronchospasm</p> <ul style="list-style-type: none"><li>– DDx: Acute wheeze</li><li>– General principles to manage acute bronchospasm</li><li>– How to give sequential bronchodilator therapy</li><li>– Investigation to help grade severity</li><li>– Monitor – record – respond</li></ul> <p>3.2.5 Manage patients with severe respiratory distress from acute pulmonary oedema or fluid overload</p> <ul style="list-style-type: none"><li>– Give diuretic therapy; check response</li><li>– Treat severe hypertension if present</li><li>– Treat precipitating cause</li><li>– Monitor – record – respond</li><li>– Respond to clinical changes</li><li>– Flowchart: Severe acute pulmonary oedema or fluid overload</li></ul> <p>3.2.6 Managing acute decompensated cardiac problems</p>
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### 3.2.1 Approach to severely ill patient with difficulty breathing

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

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

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

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

The instructions for managing the airway, giving oxygen and salbutamol are in Quick Check, pages 15–24.

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

#### General signs of severe respiratory distress

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

## For clinical purposes there are four categories of severe respiratory distress

Severe respiratory distress – consider DDX in these categories				
	Respiratory	Cardiac	Blood	Drug toxicity
<b>Common</b>	<b>Pneumonia</b> ○ bacterial ○ influenza ○ PCP <b>Pleural effusion</b> <b>COPD</b> <b>Asthma</b>	<b>Pulmonary oedema (acute heart failure)</b>	<b>Anaemia</b>	<b>Opioid</b>  <b>Organo-phosphate</b>
<b>Less common</b>	<b>Pulmonary embolism</b>  <b>*Pneumothorax</b>  <b>Acute lung injury (malaria, severe sepsis, TB)</b>	<b>*Tamponade (traumatic, malignancy, TB)</b>	<b>Acidosis (malaria, diabetic ketoacidosis)</b>	<b>ART (lactic acidosis)</b>

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

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

### History

- rapidity of onset (over days or weeks or within minutes)
- description of trouble breathing (at rest, with exertion, worse when lying down, wakens from sleep)
- associated symptoms (dry or productive cough, fever, chest pain, peripheral oedema, weight loss, night sweats)
- pre-existing diseases or medication use
  - lung problems (COPD, severe asthma, previous severe pneumonia)
  - heart problems (myocardial infarction, hypertension, cardiomyopathy, heart failure, chest pain)
  - systemic illnesses (diabetes, HIV, TB, cancer)
  - medications (ART)
  - recent opioid drug use
  - tobacco use
- if at high altitude, has the patient recently ascended?
- previous surgical or trauma history
  - recent trauma or bite
  - recent period of immobility.

### Examination

Do a focused examination to identify likely causes.

Neurological

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

Respiratory

- stridor, swollen tongue, airway oedema (suspect upper airway obstruction)
- trachea pushed or pulled to one side (suspect tension pneumothorax)
- pattern of breathing
  - prolonged expiration time (suspect asthma or COPD)

- deep, laboured breathing (suspect systemic acidosis)
- small, rapid breaths (suspect severe pneumonia, acute lung injury, muscle weakness)
- quality and distribution of breath sounds
  - decreased air entry on auscultation
  - bibasilar crackles (suspect pulmonary oedema)
  - bronchial breath sounds (suspect consolidation from pneumonia)
  - wheeze (if wheezing, classify severity – see Section 3.2.4)
- percussion
  - dullness (suspect pleural effusion)
  - hyper-resonance (suspect bullae or pneumothorax)

**Cardiovascular**

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

**Metabolic**

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

**Urgent investigations include:**

- Pulse oximetry to measure SpO<sub>2</sub>, 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<sup>1</sup> and other diagnostic assessment if suspect extrapulmonary TB. Send for culture if suspect MDR-TB.
- If wheezing, check peak flow.
- If suspect volume overload, check creatinine and potassium.
- If suspect cardiac problem, check ECG to evaluate ischaemia (ST segment elevations or depressions) or arrhythmias and perform limited echocardiography to evaluate cardiac function, mitral stenosis, or pericardial effusion.

**Differential diagnosis of respiratory distress**

**DDx: Upper airway obstruction**


Requiring urgent treatment	In favour
<b>Choking</b> see Quick Check page 13	<ul style="list-style-type: none"> <li>● Very sudden onset</li> <li>● Cyanosed</li> <li>● Grasping at neck, eating just prior to attack</li> </ul>
<b>Anaphylaxis</b> see Quick Check page 14	<ul style="list-style-type: none"> <li>● Swollen neck or tongue</li> <li>● Wheeze and stridor</li> <li>● Urticaria or red rash</li> <li>● Angioedema</li> <li>● Exposure to food or medicine just prior to attack.</li> </ul>
<b>Severe upper airway infection</b> (pharyngeal abscess, diphtheria, peritonsillar abscess, epiglottitis)	<ul style="list-style-type: none"> <li>● Gradual onset</li> <li>● History of sore throat</li> <li>● Swelling and redness visible in lower pharynx</li> <li>● Drooling</li> </ul>
<b>Upper airway trauma</b>	<ul style="list-style-type: none"> <li>● History of trauma to face or neck</li> </ul>

<sup>1</sup> Or do molecular testing with a nationally or WHO-approved technology, e.g. Xpert MTB/RIF, if available.



<b>Inhalation burns</b> see Section 3.10	<ul style="list-style-type: none"> <li>• Burns around mouth and nose</li> <li>• Singed facial or nasal hair</li> <li>• Hoarseness, rasping cough</li> <li>• Stridor</li> <li>• Soot in the sputum</li> <li>• Evidence of glottic oedema</li> </ul>
<b>Ingestion of acid or alkaline substance</b> see Section 3.8	<ul style="list-style-type: none"> <li>• Pain in mouth or throat with swallowing, drooling, vomiting blood</li> <li>• Hoarse voice, stridor</li> <li>• Upper airway obstruction, aspiration pneumonia</li> <li>• Shock, renal failure</li> </ul>
<b>Inhalation of airway irritant</b> (e.g. chlorine) see Section 3.8	<ul style="list-style-type: none"> <li>• Cough, respiratory distress, chest pain</li> <li>• Burning sensation in throat, ocular or nasal irritation</li> <li>• Upper airway oedema, laryngospasm, acute lung injury</li> </ul>

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

Requiring urgent treatment	In favour
<b>Pneumothorax</b> see Quick Check page 32	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 <sub>2</sub>
<b>Cardiac tamponade</b> 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
<b>Common causes</b>	
<b>Pneumonia (may be viral, bacterial, or opportunistic)</b> see Section 3.2.3 and 8.2	Fever, cough Suspect community-acquired pneumonia if pleuritic pain, bronchial sounds Suspect PCP if dry cough, HIV-infected, chest clear (see Section 8.2) Suspect TB if productive cough, fever, weight loss, haemoptysis
<b>Nipah</b> 	Can also cause severe pneumonia/ARDS- with or without encephalitis Initial flu-like symptoms- fever, headaches, myalgia, vomiting and sore throat Encephalitis can be acute or late onset High case fatality rate Clustering of cases in the same household Nosocomial transmission to health workers As or more common in adults than children Contact with ill pigs or drinking raw date palm sap- which may have been infected by bats which carry NiV.
<b>Lower airways obstruction (asthma, acute exacerbation of COPD)</b> 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
<b>Pulmonary oedema</b> (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
<b>High altitude pulmonary edema</b>	Person who usually lives at low altitude has just ascended rapidly to high altitude 2500 meters+ or high altitude resident returns from visit to low land Early progression from dyspnoea with exertion to dyspnea at rest Nonproductive cough progresses to pink, frothy sputum and may produce frank blood About 50% also have symptoms of acute mountain sickness SpO <sub>2</sub> at least 10 points lower than expected for the altitude Very rapid correction of the SpO <sub>2</sub> and clinical status with supplemental

	oxygen
<b>Severe malaria</b> see Section 11.23	Fever Known endemic area or travel to area with malaria Acute lung injury (non-cardiogenic pulmonary oedema) Metabolic acidosis
<b>Severe anaemia</b>	Pale (conjunctivae, palmar creases) Recent heavy blood loss AZT use Severe malaria

<b>Less common causes</b>	
<b>Pulmonary embolism</b>	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)
<b>Pleural effusion</b>	History of tuberculosis History of cancer
<b>Acute lung injury</b> (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
<b>Metabolic acidosis</b> (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)
<b>Opioid intoxication</b> see Section 3.6 and mhGAP guidelines	Depressed respiratory rate or respiratory arrest Acute lung injury Pinpoint pupils Known opioid user, track marks, or evidence of injecting equipment at the scene Slurred speech, drowsiness Unsteady gait
<b>Organophosphate poisoning</b> see Section 3.8	Pinpoint pupils Salivation, excess secretions Bronchospasm, increased respiratory secretions Coarse crackles, aspiration Sweating Bradycardia Incontinence, defecation Anxiety or coma
<b>Alcohol or sedative intoxication</b> 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
<b>Poisoning</b> 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.
<b>Disseminated Kaposi sarcoma</b>	Kaposi sarcoma lesions – purplish nodules on skin and palate
<b>Drug reaction</b> see Section 10.1	Recent initiation of new medicine, particularly antiretrovirals (abacavir, nevirapine), cotrimoxazole Skin rash

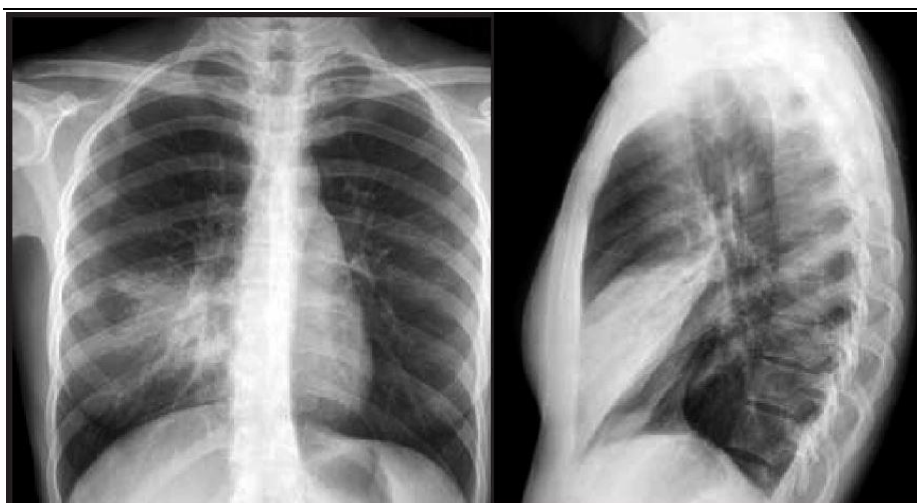
<b>Respiratory muscle weakness</b> (Guillain-Barré syndrome or botulism – see Section 10.9a, snake-bite – see Section 3.9)	Rapid, shallow breathing History of snake bites, poisoning Ascending weakness (Guillain-Barré syndrome) Decreased reflexes If weakness of facial muscles, trouble swallowing (botulism)
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**Obtain a chest X-ray to assist with narrowing the differential diagnosis**

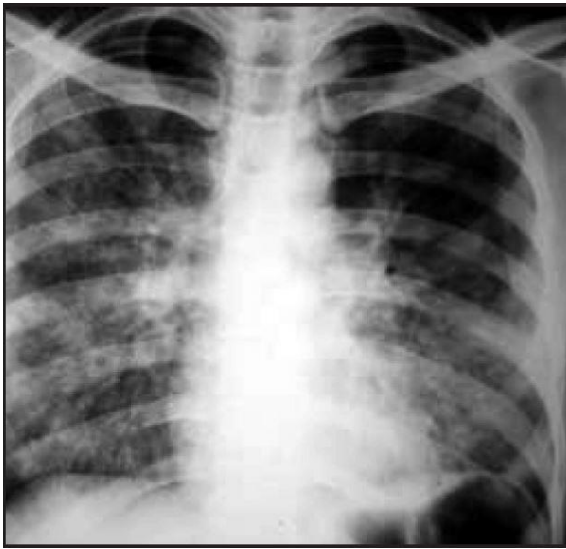
**Table: Characteristic findings on a chest X-ray for common diseases**

Diagnosis	Chest X-ray finding
<b>Pneumothorax</b>	<ul style="list-style-type: none"> <li>There is a radiolucent area with absence of lung markings and a defined edge to the collapsed lung.</li> </ul>
<b>Cardiac tamponade</b>	<ul style="list-style-type: none"> <li>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.</li> </ul>
<b>Bacterial or viral pneumonia</b>	<ul style="list-style-type: none"> <li>Segmental or lobar consolidation</li> </ul>
<b>PCP</b>	<ul style="list-style-type: none"> <li>Normal, or ground glass appearance, with nodular elements that can be confluent and consolidate.</li> </ul>
<b>Tuberculosis</b>	<ul style="list-style-type: none"> <li>Varies from bilateral upper lobe consolidation to widened mediastinum with hilar lymphadenopathy, to cavitation and miliary nodules bilaterally.</li> <li>Scarring, fibrosis, nodular opacities, pleural effusions, and collapse.</li> </ul>
<b>COPD or asthma exacerbation</b>	<ul style="list-style-type: none"> <li>Can be normal or have large-volume lungs, flattening of the diaphragms, bronchial wall thickening, more obvious bronchovascular markings</li> </ul>
<b>Pulmonary oedema (acute heart failure)*</b>	<ul style="list-style-type: none"> <li>Cardiomegaly, accumulation of fluid in the lung interstitium (diffuse fluffy opacities) progressing into consolidation, where air bronchogram can be seen.</li> <li>Upper lobe diversion (dilated pulmonary veins).</li> <li>May present with effusions bilaterally</li> </ul>
<b>Acute lung injury (non-cardiogenic)</b>	<ul style="list-style-type: none"> <li>Bilateral infiltrates, no specific distribution</li> <li>Heart size is normal.</li> </ul>
<b>Pleural effusion</b>	<ul style="list-style-type: none"> <li>Blunted costophrenic angle, curved upper margin of the meniscus</li> <li>Mediastinal shift</li> </ul>
<b>Metabolic acidosis</b>	<ul style="list-style-type: none"> <li>Normal if cause is not pulmonary in origin.</li> </ul>
<b>Pulmonary embolism</b>	<ul style="list-style-type: none"> <li>Usually normal. Some may have a wedge-shaped infarcted area that might cavitate, a pleural effusion, atelectasis, or paucity of lung markings in the vicinity of the pulmonary embolus.</li> </ul>

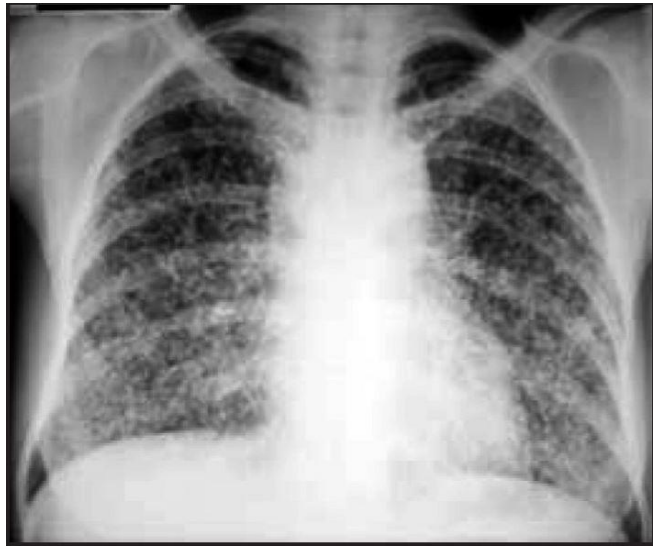
\*Chest X-ray signs of pulmonary oedema may be difficult to interpret when radiographs are of variable quality and projection is an anterior-posterior view (e.g. heart may appear misleadingly large).



Right middle lobe infiltrate pneumonia (PA and Lateral view)



Diffuse infiltrates or opacities



Multiple small nodules



Masses and nodules



Cavity



Pleural Effusion



Hilar or mediastinal lymphadenopathy



Pneumothorax



Normal

## 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 15–18
Give oxygen	Quick Check pages 19–22
If wheezing, give salbutamol	Quick Check page 23
Position patient in most comfortable position for breathing	
Identify and treat cause	
Monitor – record – respond	Section 3.0

### Manage airway (see Quick Check pages 15–18)

#### 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 41). 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<sub>2</sub> 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 19-22) 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.

Titrate SpO<sub>2</sub> to 90%, using pulse oximetry. Most patients with hypoxaemia will improve when they are given oxygen.

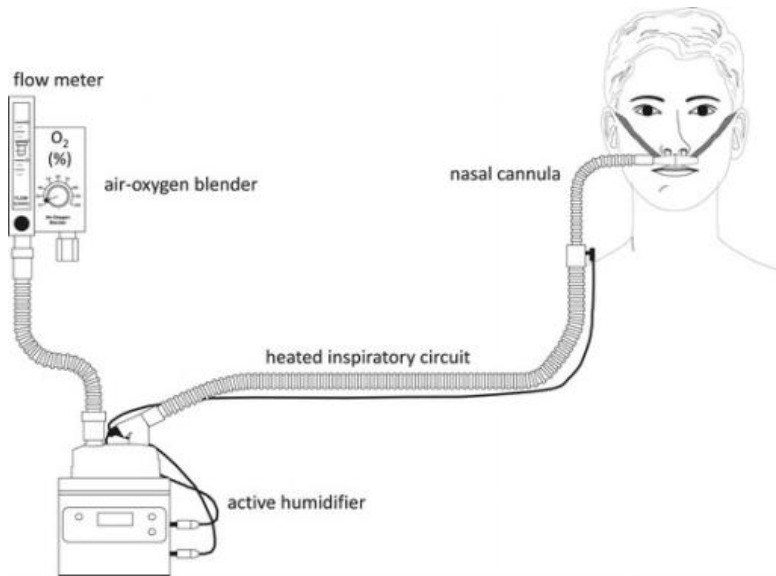
Patients not responding to oxygen therapy in increasing amounts that can be delivered by nasal prongs or face mask and who do not have cardiogenic pulmonary edema (see Section 3.2.5) should be considered to have hypoxaemic respiratory failure

– signs of severe respiratory distress

- hypoxaemia ( $SpO_2 < 90\%$ ) despite escalating oxygen therapy

These patients need more aggressive oxygen interventions, either high flow oxygen therapy or non-invasive ventilation (positive pressure ventilation delivered via high flow nasal cannula or a tight-fitting mask, if these methods and high oxygen flow are available in your hospital). If these are not successful in raising the  $SpO_2$  to  $>90\%$  or are not available, decide whether to intubate, assist ventilation with high flow oxygen, and transfer to an ICU, if this is feasible.

This illustration shows high flow oxygen via a high flow nasal cannula. This requires special apparatus and a very high flow of oxygen, which may not be available in your district hospital.



### Assist ventilation if ineffective breathing

Inadequate ventilation occurs when a patient has a low respiratory rate or inadequate breath volumes. A decreased respiratory rate can result from a central nervous system cause, such as an opioid overdose, stroke, or head trauma. Patients with weakness of the respiratory muscles, as seen with tetanus or botulism, also can develop inadequate ventilation because breaths are small. In patients with COPD and asthma, severe bronchospasm leads to inadequate ventilation because air cannot be exhaled from the lungs and the patient has to use accessory muscles to breathe.

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

For patients with inadequate ventilation, temporarily assist with BVM ventilation using high flow oxygen (see Quick Check pages 17). For certain drug overdoses or poisonings, this can be done temporarily as antidotes are administered (such as naloxone for short-acting opioid overdose or atropine for organophosphate poisoning) 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
<b>Upper airway obstruction</b>	<ul style="list-style-type: none"> <li>• Manage airway (see Quick Check pages 15-18).</li> </ul>
<b>Anaphylaxis</b>	<ul style="list-style-type: none"> <li>• Give epinephrine (see Quick Check page 14 and Section 3.1.3).</li> </ul>
<b>Pneumothorax</b>	<ul style="list-style-type: none"> <li>• If tension pneumothorax, insert needle or chest tube (see Quick Check page 32).</li> </ul>
<b>Pericardial tamponade</b>	<ul style="list-style-type: none"> <li>• Drain pericardial fluid (see Section 7.4.5).</li> </ul>
<b>Pneumonia</b>	<ul style="list-style-type: none"> <li>• Non-severe pneumonia (see Section 8.2).</li> <li>• 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.</li> <li>• If shock, see Section 3.1.5.</li> </ul>
<b>Acute bronchospasm</b>	<ul style="list-style-type: none"> <li>• Give salbutamol immediately (see Quick Check page 23 and Section 3.2.4). If suspect asthma or COPD, give hydrocortisone 100 mg IV or equivalent oral dose.</li> </ul>
<b>Acute pulmonary oedema (fluid overload condition)</b>	<ul style="list-style-type: none"> <li>• Give furosemide 20 mg IV.</li> <li>• For severe hypertension give vasodilator (see Section 3.2.5).</li> </ul>
<b>High altitude pulmonary edema (HAPE)</b>	<ul style="list-style-type: none"> <li>• Give oxygen</li> <li>• Keep patient warm and at rest</li> </ul>
<b>Acute lung injury</b>	<ul style="list-style-type: none"> <li>• Treat underlying cause (see Section 3.2.3).</li> <li>• If severe malaria, give antimalarials.</li> <li>• If severe sepsis, give empirical broad spectrum antimicrobials.</li> </ul>
<b>Anaemia</b>	See Section 10.18.
<b>Opioid overdose</b>	<ul style="list-style-type: none"> <li>• Give naloxone (see Quick Check page 26).</li> </ul>
<b>Poisoning</b>	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,<sup>2</sup> 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
- SpO<sub>2</sub> <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 or high altitude pulmonary edema, 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 15-18 and Section 3.2.1
- Give oxygen Quick Check pages 19-22 and Section 3.2.1
- Treat underlying cause(s)
- Conservative fluid management

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

#### Treat underlying causes

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

<sup>2</sup> 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](http://www.who.int/csr/resources/publications/swineflu/clinical_management/en/index.html)

Note that national or institutional recommendations may be updated based on antimicrobial resistance data. 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 azithromycin 500 mg once a day and 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 8.2) and consider tuberculosis.
- If suspect tuberculosis, send sputum for AFB smear,<sup>3</sup> X-ray chest, send sputum for culture, and perform further clinical assessment.<sup>4</sup>
- 🚫 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 8.2).<sup>5,6</sup>

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, do immediate malaria RDT (or smear) and if positive give antimalarials immediately (see Section 11.23).
- For aspiration, stop oral feedings and observe for development of aspiration pneumonia.
- For acute poisoning, see Section 3.8.
- For acute pancreatitis, see Section 10.5a.
- 🧑 For pre-eclampsia or eclampsia, give magnesium sulfate (see Quick Check page 36) and hydralazine IV (see Section 3.2.5).
- For tocolytic-associated acute lung injury, stop medication.
- For high altitude pulmonary edema, give oxygen and keep patient warm and at rest.

## Conservative fluid therapy

<sup>3</sup> Or use nationally or WHO-approved molecular testing, e.g. Xpert MTB/RIF, where available.

<sup>4</sup> *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](http://whqlibdoc.who.int/hq/2007/WHO_HTM_TB_2007.379_eng.pdf)

<sup>5</sup> *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](http://www.who.int/csr/resources/publications/swineflu/h1n1_guidelines_pharmaceutical_mngt.pdf)

<sup>6</sup> ECDC Interim guideline on use of Oseltamivir, 2016.

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
<p><b>If SBP &lt;90 give 1000 ml IV</b> (see Section 3.1).</p> <p><b>If respiratory function declining (increasing breathlessness, increasing RR or SpO<sub>2</sub> &lt;90)</b></p> <ul style="list-style-type: none"> <li>• Manage airway (see Quick Check pages 15-18).</li> <li>• Check oxygen supply and increase flow rate (see Quick Check pages 19-22).</li> <li>• Exclude pneumothorax, pleural effusion, heart failure, and poisoning.</li> <li>• If wheezing, give salbutamol.</li> <li>• Check that antimicrobials have been given (including repeat doses as indicated). Consider broader antimicrobial cover.</li> <li>• Consider TB (in all patients) and PCP in PLHIV (see Section 8.2).</li> <li>• If evidence of fluid overload and SBP &gt;100, stop IV fluids and give furosemide 20 mg IV.</li> </ul> <p><b>If respiratory function continues to decline, the prognosis is poor</b> (see Section 3.2.2 and Quick Check page 41).</p> <ul style="list-style-type: none"> <li>• Reassess patient and reconsider diagnosis and complications as above.</li> </ul> <p><b>If glucose &lt;3 mmoles (54 mg/dl), give D50 25–50 ml</b> (see Quick Check page 27).</p> <p><b>Monitor closely.</b></p> <p><b>Call for help from senior clinician.</b></p>

- 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 41-47). 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)<sup>7</sup>**

- Initiate empirical TB treatment even if sputum is negative for AFB (see TB guidelines for diagnosis of smear negative TB). 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 Section 8.2 and TB treatment guidelines).

<sup>7</sup> *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](http://whqlibdoc.who.int/hq/2007/WHO_HTM_TB_2007.379_eng.pdf)

## High altitude pulmonary edema (HAPE)<sup>8</sup>

High altitude pulmonary edema (HAPE) involves abnormal accumulation of fluid in the lungs and is life-threatening form of such illness. It is the most common cause of death from severe high altitude illness. It occurs within the first week of ascent to high altitude due to several maladaptive responses in some people to low oxygen, including poor ventilatory response, increased sympathetic tone, and pulmonary hypertension with exaggerated and uneven pulmonary vasoconstriction with overperfusion in some parts of the lung. This results in failure of the alveolar-capillary barrier and patchy pulmonary edema. It is more common in men.

### History

- Person who usually lives at low altitude has just ascended rapidly to high altitude 2500 meters+ or high altitude resident returns from a visit to lower altitude.
- About 50% also have symptoms of acute mountain sickness
- More common with cold ambient temperatures, preexisting respiratory infection, and vigorous exertion
- Begins with a subtle, nonproductive cough, shortness of breath with exertion, and difficulty walking uphill which may be mistaken for an upper respiratory tract infection or normal breathlessness at altitude or exhaustion.
- Initial symptoms typically appear two to four days after arrival at a new altitude.
- HAPE almost never develops after a week at the same altitude.
- Occasionally, HAPE develops precipitously. This occurs more often at night or after severe exertion.

### Clinical features

- Early progression from dyspnoea with exertion to dyspnea at rest
- Nonproductive cough progresses to pink, frothy sputum and may produce frank blood
- Severely restricted exercise tolerance becomes debilitating
- Severe hypoxemia may become life-threatening without prompt descent or supplemental oxygen.
- Severe hypoxemia may cause drowsiness or concomitant high altitude cerebral edema
- Typically, the patient appears better than expected given the severity of hypoxemia
- Very rapid correction of the SpO<sub>2</sub> and clinical status with supplemental oxygen

### Examination

- Tachycardia
- Tachypnea
- Inspiratory crackles- initially more prominent in the right middle lobe initially then bilateral and diffuse as HAPE progresses.
- Low-grade fever (up to 38°C) common- HAPE alone does not cause temperature > 38.3°C (101°F) (look for a co-infection if higher fever)

### Investigations

- SpO<sub>2</sub> at least 10 points lower than expected for the altitude (see Section 7.2.24)
- Chest Xray- patchy alveolar infiltrates, predominantly in the right central hemithorax, which become more confluent and bilateral as the illness progresses

**Treatment in hospital-** HAPE can be rapidly reversed with descent or administration of oxygen.

- Oxygen- high flow supplemental oxygen by nasal cannula or face mask for several hours until the patient's oxygen requirement is ≤3 L/min with the SpO<sub>2</sub> maintained at 90 percent or higher. Recheck SpO<sub>2</sub> until an ambulatory SpO<sub>2</sub> on room air is ≥90 percent, then discontinue oxygen.
- Keep patient warm
- Keep patient at rest- no exertion

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<sup>8</sup> Scott A Gallagher and Peter Hackett: High altitude pulmonary edema, in UpToDate OR replace with Wilderness Medicine reference. Permission requested

### **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 23 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<sub>2</sub>
- 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
<b>Acute bronchitis</b>	<ul style="list-style-type: none"> <li>• Diffuse wheezing or rhonchi</li> <li>• Productive cough</li> <li>• Preceded by viral upper respiratory tract infection (e.g. fever, cough, runny or stuffy nose)</li> </ul>
<b>Bacterial or viral pneumonia</b> see Section 8.2	<ul style="list-style-type: none"> <li>• More common in viral pneumonia</li> <li>• Diffuse or localized wheezing</li> <li>• Usually, acute onset fever and productive cough</li> <li>• Chest X-ray with infiltrate</li> </ul>
<b>Foreign body aspiration</b>	<ul style="list-style-type: none"> <li>• Localized wheezing</li> <li>• Acute onset; can have cough and shortness of breath</li> </ul>
<b>Asthma attack</b> see Section 8.2	<ul style="list-style-type: none"> <li>• Episodic chest tightness, shortness of breath, and diffuse wheezing</li> <li>• Night-time symptoms and cough are common</li> <li>• Precipitated by exercise, viral syndrome, strong smells</li> <li>• Personal history of asthma or allergies</li> <li>• Family history of asthma</li> </ul>
<b>COPD exacerbation</b> see Section 8.2	<ul style="list-style-type: none"> <li>• Increase in baseline breathlessness, cough, sputum quantity or purulence</li> <li>• Diffuse wheezing and rhonchi</li> <li>• Personal history of COPD or long-term exposure to tobacco smoke or indoor air pollution (e.g. open fire stoves)</li> </ul>
<b>Inhalation of airway irritants (e.g. smoke, chemicals, vapours)</b>	<ul style="list-style-type: none"> <li>• Diffuse wheezing and breathlessness</li> <li>• Immediately precipitated by inhalation of large amounts of irritating agent</li> </ul>
<b>Ingested poisons</b> see Section 3.8	<ul style="list-style-type: none"> <li>• Organophosphate poisoning (pinpoint pupils, urination, defecation, lacrimation)</li> </ul>
<b>Bronchiectasis</b>	<ul style="list-style-type: none"> <li>• Wheeze can be diffuse or localized</li> <li>• Increase in baseline or new cough productive of purulent sputum; haemoptysis is common</li> <li>• Personal history of TB infection or severe pneumonia</li> </ul>
<b>Cancer</b>	<ul style="list-style-type: none"> <li>• Localized wheeze</li> <li>• Chronic cough, haemoptysis are common</li> <li>• Associated with weight loss, anorexia</li> <li>• Personal history of exposure to tobacco smoke, exposure to indoor air pollution (e.g. indoor coal stoves)</li> </ul>
<b>Acute pulmonary oedema</b> see Section 3.2.5	<ul style="list-style-type: none"> <li>• Atypical presentation with diffuse wheezing and crackles (rales)</li> <li>• Fluid overload (elevated JVP, lower extremity oedema)</li> <li>• History of cardiomyopathy, valvular heart disease, hypertension, ischaemia, renal disease or recent ascent to high altitude</li> </ul>

### General principles to manage a patient with acute bronchospasm

- Have patient sit upright and assume comfortable position.
- Manage airway (see Quick Check pages 15-18).
- Give oxygen therapy (see Quick Check pages 19-22).
- Give inhaled salbutamol immediately (see Quick Check page 23 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 <ul style="list-style-type: none"> <li>• silent chest</li> <li>• cyanosis</li> <li>• poor respiratory effort</li> <li>• altered consciousness</li> <li>• exhaustion</li> </ul>	<b>LIFE-THREATENING WHEEZING</b>	<ul style="list-style-type: none"> <li>• Manage airway (see Quick Check pages 15-18).</li> <li>• Give oxygen (see Quick Check pages 19-22).</li> <li>• Give salbutamol by continuous nebulizer (see Quick Check page 23 for sequential bronchodilators).</li> <li>• 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).</li> <li>• Reassess immediately (do not leave patient alone).</li> <li>• If no improvement, give salbutamol continuously. Add ipratropium by nebulizer.</li> <li>• If no improvement, give intravenous magnesium sulfate (2 grams over 20 minutes) (see Quick Check page 36).</li> <li>• If fever, give IM or IV antibiotic.</li> </ul>
One or more of the following signs: <ul style="list-style-type: none"> <li>• breathless at rest</li> <li>• cannot complete sentences in one breath</li> <li>• respiratory rate <math>\geq 25</math> breaths/min</li> <li>• pulse <math>\geq 100</math></li> </ul>	<b>SEVERE WHEEZING</b>	<ul style="list-style-type: none"> <li>• Give oxygen (see Quick Check pages 19-22).</li> <li>• Give salbutamol by nebulizer (continuous or every 20 minutes) (see Quick Check page 17 for sequential bronchodilators).</li> <li>• 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).</li> <li>• Reassess immediately (15–30 minutes).</li> <li>• If not improving, give more salbutamol every 20 minutes or, if deteriorating, continuously. Add ipratropium by nebulizer.</li> <li>• If deteriorating, also give magnesium (2 grams over 20 minutes).</li> <li>• If fever, give IM or IV antibiotic.</li> </ul>
No features of severe asthma	<b>MODERATE WHEEZING</b>	<ul style="list-style-type: none"> <li>• Give oxygen.</li> <li>• Give salbutamol by primed spacer with 5 puffs; then give 2 puffs via spacer every 2 minutes.</li> <li>• If acute asthma or COPD, give steroids – oral prednisolone 40–60 mg (or equivalent).</li> <li>• If fever, give IM or IV antibiotic.</li> <li>• Reassess in 15–30 minutes.</li> </ul>

### The following investigations help grade severity

<ul style="list-style-type: none"> <li>• SpO<sub>2</sub> &lt;90 on room air</li> <li>• Peak flow &lt;33% of predicted or personal best</li> <li>• Absence of pulsus paradoxus (when respiratory arrest imminent, absence suggests muscle fatigue)</li> </ul>	<b>LIFE-THREATENING WHEEZE</b>
<ul style="list-style-type: none"> <li>• SpO<sub>2</sub> &gt;90</li> <li>• Peak flow 33–50% of predicted or personal best</li> <li>• Pulsus paradoxus &gt;25 mmHg</li> </ul>	<b>SEVERE WHEEZING</b>
<ul style="list-style-type: none"> <li>• SpO<sub>2</sub> &gt;90</li> <li>• Peak flow 50–75% of predicted or personal best</li> <li>• Pulsus paradoxus may be present (10–25 mmHg)</li> </ul>	<b>MODERATE WHEEZING</b>

**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 23)**

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 28). 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<sub>2</sub> <90 (see Quick Check pages 19-22).
- 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 41-47). 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.

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

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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), chest pain, or recent ascent to high altitude
- 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
<b>Cardiomyopathy</b>	<ul style="list-style-type: none"> <li>• HIV-infected, peripartum, long-standing hypertension</li> <li>• Displaced impulse and extra heart sounds (dilated cardiomyopathy)</li> <li>• ECG with left ventricular hypertrophy (hypertensive heart disease)</li> <li>• ECG with evidence of ischaemia (ischaemic heart disease)</li> </ul>
<b>Valvular heart disease</b>	<ul style="list-style-type: none"> <li>• Loud murmur at apex, in diastole (mitral stenosis)</li> <li>• History of rheumatic heart disease</li> </ul>
<b>Myocarditis</b> See Section 3.3	<ul style="list-style-type: none"> <li>• Syncope, ECG with arrhythmias or conduction abnormalities</li> <li>• Chest pain</li> </ul>
<b>Endocarditis</b>	<ul style="list-style-type: none"> <li>• Fever and new murmur</li> </ul>
<b>Chronic kidney disease</b>	<ul style="list-style-type: none"> <li>• Diabetes, hypertension</li> <li>• HIV-associated nephropathy</li> </ul>
<b>Acute lung injury</b>	<b>Symptoms</b>
<b>Severe malaria</b>	<ul style="list-style-type: none"> <li>• Fever, pallor, headache, jaundice</li> <li>• Cough, shortness of breath are early signs of pulmonary oedema</li> <li>• Other signs of severe malaria are altered mental status, bleeding, shock, weakness, seizures, hypoglycaemia (see sections 3.2.3 and 11.23).</li> </ul>
<b>Severe pneumonia</b>	See Section 3.2.3
<b>Severe sepsis</b>	See Section 3.1.5
<b>Poisoning</b>	See Section 3.8
<b>Acute pancreatitis</b>	<ul style="list-style-type: none"> <li>• Epigastric pain with eating, loss of appetite</li> </ul>
<b>Pregnancy-related</b>	<ul style="list-style-type: none"> <li>• Tocolytic medication, pre-eclampsia or eclampsia</li> </ul>
<b>High altitude pulmonary edema (HAPE)</b>	<ul style="list-style-type: none"> <li>• Too rapid ascent usually to above 2,500 meters by persons normally living at low altitude or re-ascent of those normally living at high altitude after a stay at low altitude</li> <li>• SpO<sub>2</sub> at least 10 points lower than expected for the altitude (values may be as low as 40- 50%).</li> <li>• Patient often appears better than expected based on severity hypoxemia</li> <li>• Clinical status and SpO<sub>2</sub> improves promptly (usually within 10 to 15 minutes) in response to supplemental oxygen- this rapid correction despite severe infiltrative lung process seen on chest Xray are pathognomonic for HAPE<sup>9</sup></li> </ul>

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
<p>Immediate diuretic and vasodilator therapy optimizes cardiac output and assists in mobilization of fluids from lungs to the kidneys for excretion.</p> <ul style="list-style-type: none"> <li>• Have patient sit upright and assume comfortable position.</li> <li>• Manage airway (see Quick Check pages 15-18).</li> <li>• Give oxygen therapy (see Quick Check pages 19-22).</li> <li>• Give diuretic therapy; check response in 30 minutes.</li> <li>• Treat severe hypertension.</li> </ul>

<sup>9</sup> Scott A Gallagher and Peter Hackett: High altitude pulmonary edema, in UpToDate OR replace with Wilderness Medicine reference

- 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 enalapril 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<sup>10</sup>, 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 labetalol*, hydralazine, *alpha methyl dopa*, or *nifedipine* based on cost, availability and experience using the medicine. For other aspects of management of pre-eclampsia or eclampsia, see obstetrical guidelines 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.

<sup>10</sup> WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia. WHO, 2011. Available at [http://whqlibdoc.who.int/publications/2011/9789241548335\\_eng.pdf](http://whqlibdoc.who.int/publications/2011/9789241548335_eng.pdf)

- 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 11.28), which can be side effects of furosemide.

#### Respond to clinical changes

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

- Double the initial furosemide dose.

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

- Check oxygen supply and increase flow rate if SpO<sub>2</sub> <90 (see Quick Check page 21).
- 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**

<b>First 2 hours</b>	<b>Recognize</b>	<p><b>Clinical diagnosis of severe acute pulmonary oedema</b></p> <ul style="list-style-type: none"> <li>• Respiratory rate &gt;30 or SpO<sub>2</sub> &lt;90 and</li> <li>• Bilateral crackles on lung exam</li> <li>• Signs of volume overload: distended neck veins, hepatomegaly, ascites, lower-extremity oedema</li> <li>• History of cardiomyopathy or kidney disease</li> </ul>
	<b>Fix the physiology</b>	<p><u>Oxygen</u>: Titrate to SpO<sub>2</sub> 90</p> <p><u>Furosemide</u>: Give furosemide 20 mg IV</p>
	<b>Treat trigger</b>	<p><u>If hypertension</u>: Isosorbide dinitrate 5 mg sublingual</p> <p><u>If ischaemia</u>: Give aspirin; other management per national guidelines</p> <p><u>If arrhythmia</u>: Treat per national guidelines</p> <p><u>If fever</u>: give empirical antimicrobials</p> <ul style="list-style-type: none"> <li>• Antibiotics</li> <li>• Antimalarials</li> <li>• Antiviral if suspect influenza</li> </ul>
	<b>Monitor, Record</b>	<p><u>Every 30 minutes until stable; then every 1 hour</u></p> <ul style="list-style-type: none"> <li>• SBP, pulse, RR, SpO<sub>2</sub>, mental status (AVPU), urine output</li> <li>• JVP, auscultate for crackles (rales)</li> <li>• Weight on admission</li> <li>• Creatinine, potassium on admission</li> </ul>
	<b>Respond</b>	<p><u>If respiratory distress fails to improve or worsens and urine output is not adequate</u></p> <ul style="list-style-type: none"> <li>• Check oxygen supply, increase oxygen flow</li> <li>• Give furosemide IV 40 mg (double dose)</li> <li>• If renal failure, call for help and consider higher doses of furosemide and additional diuretics</li> </ul>



## Acute pulmonary oedema or fluid overload

<b>2–6 hours</b>	<b>Recognize</b>	<p><b>If poor response, reconsider</b></p> <ul style="list-style-type: none"> <li>• Severe pneumonia, acute lung injury, pneumothorax, pleural effusion, poisoning, TB, PCP in PLHIV, malaria</li> </ul>
	<b>Fix the physiology</b>	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90</p> <p><b>Furosemide:</b> If urinary response not adequate (150–200 ml), give 40 mg IV furosemide. If adequate response, do not give additional dose.</p>
	<b>Treat trigger</b>	<p><b>If still hypertensive:</b> Give another dose of isosorbide dinitrate SL (5–10 mg). Can repeat every 2–3 hours.</p>
	<b>Monitor, Record</b>	<p><b>Every 30 minutes until stable; then every 1 hour</b></p> <ul style="list-style-type: none"> <li>• SBP, pulse, RR</li> <li>• Mental status (AVPU)</li> <li>• Urine output</li> <li>• JVP, auscultate for crackles (rales)</li> </ul>
	<b>Respond</b>	<p><b>If respiratory function declining</b></p> <ul style="list-style-type: none"> <li>• Check oxygen supply and increase flow rate</li> </ul> <p><b>If fluid overload unresponsive to escalating diuretic doses</b></p> <ul style="list-style-type: none"> <li>• Call for help from senior clinician to give higher dose of furosemide or add another diuretic agent</li> </ul> <p><b>If renal failure</b></p> <ul style="list-style-type: none"> <li>• Call for help from senior clinician to assist with diuretic management and consider transfer to a centre with haemodialysis</li> </ul> <p><b>If SBP &lt;90</b></p> <ul style="list-style-type: none"> <li>• Stop diuresis. Give 250 LR or NS bolus. Call for help from senior clinician; if cardiogenic shock, consider vasopressors.</li> </ul>

## Acute pulmonary oedema or fluid overload

<b>6–24 hours</b>	<b>Recognize</b>	<p><b>If poor response, reconsider</b></p> <ul style="list-style-type: none"> <li>• Severe pneumonia, acute lung injury, pneumothorax, pleural effusion, poisoning, TB, PCP if PLHIV, malaria</li> </ul>
	<b>Fix the physiology</b>	<p><b>Oxygen:</b> titrate to SpO<sub>2</sub> 90</p> <p><b>Furosemide:</b> Repeat effective diuretic dose every 6–8 hours</p>
	<b>Treat trigger</b>	<p><b>Continue to treat hypertension:</b> Start long-acting enalapril 5 mg oral if creatinine normal</p> <p><b>Continue to treat myocardial ischaemia</b> – next dose</p> <p><b>Continue to treat arrhythmia</b> – next dose</p> <p><b>Continue to treat pneumonia:</b> Empirical antimicrobials – next dose</p>
	<b>Monitor, Record</b>	<p><b>Every hour if SBP &lt;90 or on pressors; otherwise every 2 hours</b></p> <ul style="list-style-type: none"> <li>• SBP, pulse</li> <li>• Respiratory rate</li> <li>• SpO<sub>2</sub></li> <li>• Mental status (AVPU)</li> <li>• JVP, auscultate for crackles (rales)</li> </ul> <p><b>Monitor every 6 hours</b></p> <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Urine output</li> <li>• Repeat glucose and Hb if initial value abnormal</li> </ul>
	<b>Respond</b>	<p>Respond to changes as indicated on previous page for 2–6 hour period</p>

## Acute pulmonary oedema or fluid overload

Post-resuscitation	Recognize	<p>Perform full reassessment</p> <p>Review available diagnostic data and <b>treat underlying diagnosis</b></p> <p>Switch to its specific management</p>
	Fix the physiology	<p><b>Oxygen:</b> Titrate to SpO<sub>2</sub> 90; discontinue when 90 on room air</p> <p><b>Furosemide:</b> Titrate down frequency as tolerated, every 8–12 hours. Change to oral dose.</p>
	Treat trigger	<p><b><u>Continue to treat hypertension</u></b> – next dose</p> <p><b><u>Continue to treat myocardial ischaemia</u></b> – next dose</p> <p><b><u>Continue to treat arrhythmia</u></b> – next dose</p>
	Nutrition	<ul style="list-style-type: none"> <li>Begin once the patient has stabilized and in any case after 1–2 days.</li> <li>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.</li> <li>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.</li> <li>Consider NG feeding, using pureed foods, for patients who cannot swallow safely due to risk of aspiration.</li> <li>In severely ill patients give small amount initially, e.g. 20–40 ml/hour, and monitor NG aspirates to check for absorption.</li> <li>Increase rate of feeding as tolerated.</li> </ul>
	Monitor, Record	<p><b><u>Every 8 hours (check SBP hourly if weaning off pressors); then daily</u></b></p> <ul style="list-style-type: none"> <li>SBP</li> <li>Respiratory rate</li> <li>SpO<sub>2</sub></li> <li>Mental status (AVPU)</li> </ul>
	Respond	<p>Respond to changes as indicated earlier</p>

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### **3.2.6 Managing acute decompensated cardiac problems**

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

The WHO Model Formulary has guidance on many relevant treatments.



### 3.3 Approach to the patient with chest pain

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

#### DDx: Chest pain

Condition	In favour
<b>Stable angina</b>	Chest pain with exertion (crushing in nature, radiating to jaw or arm) Associated with nausea and shortness of breath Easily relieved with rest History of cardiac disease Risk factors – hypertension, diabetes, tobacco, hyperlipidaemia, family history
<b>Acute coronary syndrome (unstable angina, non-ST elevation or ST elevation myocardial infarction)</b>	Crushing chest pain (pressure, tightness) radiating to the jaw or arm at rest Clammy, sweaty Associated with nausea and shortness of breath History of cardiac disease Risk factors – hypertension, diabetes, sickle-cell anaemia, tobacco, hyperlipidaemia, family history ECG changes – Q waves, ST depression or elevation, T wave changes
<b>Pneumonia</b> see Sections 3.2.3 and 8.2	Fever and cough Pain exacerbated by breathing (pleuritic) Respiratory distress, hypoxaemia Crackles on auscultation, bronchial breath sounds Consolidation on chest X-ray
<b>Pulmonary embolus</b>	Risk factors – recent immobilization, travel, pregnancy, cancer, recent surgery, long bone or pelvic fracture Evidence of DVT – swollen leg May have fever (usually mild) Difficulty breathing Haemoptysis Tachycardia ECG – sinus tachycardia
<b>Oesophageal reflux (GERD)</b> See Section 10.5b	Burning epigastric, retrosternal pain Worse at night Worse with food Long history symptoms Relieved by antacids or acid blockers
<b>Musculoskeletal</b>	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
<b>Less common causes</b>	
<b>Oesophageal rupture</b>	Sudden onset central chest and abdominal pain During or following excessive vomiting Vomiting blood Shock
<b>Aortic dissection</b>	Tearing pain radiating to the back, abdomen or between shoulder blades Asymmetrical pulses or BP New stroke
<b>Tension pneumothorax</b> see Quick Check page 32	Difficulty breathing Elevated JVP Displaced trachea to opposite side Decreased breath sounds on affected side Hyperresonance on percussion on affected side

<b>Tuberculosis</b>	May involve lungs, pericardium, pleura Fever, cough, haemoptysis Common complication of HIV
<b>Panic attack</b> see Section 10.10	Hyperventilation History of anxiety or recent stress
<b>Pericarditis</b>	Sharp, posterior pain Relief when leaning forward Acute rheumatic fever, TB pericarditis, chest trauma ECG with diffuse ST elevation
<b>Myocarditis</b>	Chest pain Rapid heart rate or arrhythmias Shortness of breath, at rest or during physical activity Fluid retention with swelling of legs, ankles and feet Fatigue ECG: Fever, other signs and symptoms suggesting an infectious cause- such as viral infection, severe scrub typhus, Nipah, leptospirosis

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

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

<p>3.4.1 Clinical approach to the patient with altered consciousness</p> <ul style="list-style-type: none"><li>– Assessment and urgent treatments</li><li>– DDx: If a patient is unconscious or has a decreased level of consciousness or is confused or delirious</li></ul> <p>3.4.2 Manage delirium</p> <p>3.4.3 Manage acute encephalitis syndrome</p> <p>3.4.5 Manage diabetic ketoacidosis</p> <ul style="list-style-type: none"><li>– Clinical presentation of diabetic ketoacidosis</li><li>– Investigations for DKA</li><li>– Treatment of DKA</li><li>– Table: Management of DKA if K measurement or ECG is available and SBP &gt;90</li></ul> <p>3.4.6 Manage hypoglycaemia</p>	<p>3.4.7 Steroid deficiency (Addison's disease; adrenal insufficiency)</p> <p>3.4.8 Manage suspect Nipah encephalitis</p>
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### 3.4.1 Clinical approach to the patient with altered consciousness

#### Assessment and urgent treatments

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

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

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

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

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

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

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

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

A patient may be unconscious because of processes involving the brain (infection, ischaemia, epilepsy), drugs, toxins and poisons, or severe metabolic problems. Patients with pre-existing confusion, such as those with dementia, may become more acutely confused as a result of other problems, such as infection, worsening organ failure, or new medications. An altered state



of consciousness may overlap with other syndromes, such as shock or respiratory distress. Shock commonly presents with an altered state of consciousness due to reduced oxygenation of the brain. Severe respiratory distress may present as coma due to retention of carbon dioxide. This Section outlines management of patients with an altered state of consciousness identified as their primary problem after initial assessment and management.

#### **Urgent treatment is required for:**

- hypoglycaemia (blood glucose  $<3.0$  mmol/l or  $<50$  mg/dl) – give the patient a sweet drink orally (if not at risk of aspirating) or via nasogastric tube, or else 50% dextrose 25–50 ml IV over 2 minutes (see Quick Check page 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), scrub typhus;
- 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).

#### **Special IPC precautions (in addition to standard precautions) required if:**

- If suspect Nipah
- If suspect meningococcal meningitis  
See Section 6

### **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, pigs, rural areas with chiggers/scrub typhus, 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 ( $>38^{\circ}\text{C}$  or  $<36^{\circ}\text{C}$ )
- 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.
- Skin for eschar or rash

### **Differential diagnosis**

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

Condition	In favour
<b>Rapidly reversible causes</b>	
<b>Hypoglycaemia</b> see Section 3.4.2	<ul style="list-style-type: none"> <li>• Sweating</li> <li>• Seizures</li> <li>• Confusion</li> <li>• Use of hypoglycaemic agents or heavy alcohol use</li> <li>• Severe sepsis or malaria</li> <li>• Responds quickly to glucose</li> </ul>
<b>Severe dehydration</b> see Section 3.1.2	<ul style="list-style-type: none"> <li>• Signs of shock (elevated pulse, low blood pressure)</li> <li>• Decreased skin turgor</li> <li>• Impaired ability to drink fluids</li> </ul>
<b>Heat stroke</b> see Section 8.1	<ul style="list-style-type: none"> <li>• Prolonged exposure to heat and sun</li> <li>• High temperature (&gt;40.5°C)</li> </ul>
<b>Hypoxaemia</b> see Sections 3.2.2 and 8.2	<ul style="list-style-type: none"> <li>• Cyanosis (look at nail bed, lips; cyanosis may not be apparent in anaemic patients)</li> <li>• Shortness of breath</li> <li>• Low SpO<sub>2</sub></li> </ul>
<b>Infection</b>	
<b>Sepsis from various causes including pneumonia, UTI</b> see Section 3.1.5	Fever Shock Sometimes: warm extremities, endocarditis Signs of focus of the infection
<b>Cerebral malaria</b> see Section 11.23	Endemic area in season Migrant workers Fever, altered mental state Rapid malaria test positive or smear positive
<b>Meningitis</b> see Section 10.9b	Fever Neck stiffness, photophobia, headache May be uncomfortable, lethargic, or distracted by headache, but cerebral function remains normal Known epidemic of meningitis History or likely to have HIV infection
<b>Leptospirosis</b>	See Section 8.1.8
<b>Encephalitis- has many causes including several notifiable diseases- Nipah, scrub typhus, severe typhoid/enteric fever, JE; chikungunya (rare in adults)</b>	Fever Abnormalities in brain function including altered mental status or conscious state (including coma), motor or sensory deficits, altered behavior and personality changes, and speech or movement disorders Seizures common
<b>Typhoid/enteric fever</b>	See Section 8.1.9
<b>Scrub typhus</b>	See Section 8.1.6
<b>Japanese encephalitis</b>	More common in children than adults
<b>Nipah</b>	Initial flu-like symptoms- fever, headaches, myalgia, vomiting and sore throat Encephalitis can be acute or late onset Can also cause severe pneumonia/ARDS High case fatality rate Clustering of cases in the same household Nosocomial transmission to health workers As or more common in adults than children Contact with ill pigs or drinking raw date palm sap- which may have been infected by bats which carry NiV.
<b>Mumps</b>	Rarely causes encephalitis Parotitis Fever

<b>Measles</b>  see Section 8.1	Rare cause of encephalitis see Section 8.1
<b>Hand, foot and mouth disease (HFMD) caused by enterovirus 71</b>	Can cause encephalitis
<b>Chikungunya</b> see Section 8.1	Rarely causes meningitis or acute encephalitis in adults
<b>Herpes simplex virus type 1 encephalitis</b>	Sporadic cases Treatable- important to recognize early
<b>HIV encephalopathy</b> 	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
<b>Rabies</b> see Section 11.27	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
<b>Metabolic</b>	
<b>Diabetic ketoacidosis (DKA) or hyperosmolar non-ketotic (HONK) coma</b> 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)
<b>Hypertonaemia</b> see Section 5.2.1	Lethargy, weakness, irritability (early) Twitching, seizures, coma (late)
<b>Hypotonaemia</b> see Section 5.2.1	Nausea, vomiting, fatigue Apathy Coma Seizures
<b>Hyperkalaemia</b> see Section 5.2.2	Twitching, abdominal pain, paraesthesia, seizures
<b>Hypokalaemia</b> see Section 5.2.2	Lethargy, generalized weakness leading to ascending paralysis, ileus
<b>Hypercalcaemia</b> 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
<b>Hypocalcaemia</b>	Constipation, confusion, chronic generalized pain, bone pain Seizures, tetany History of thyroidectomy (look for scar)
<b>Myxoedema</b>	Hypothyroidism Deterioration in mental status Goitre, swelling of skin/soft tissue Delayed relaxation of reflexes Elderly female

<b>Toxic</b>	
<b>Poisoning</b> see Section 3.8	History of exposure Organophosphate – pinpoint pupils, salivation, bradycardia, incontinence, anxiety, coma
<b>Drug overdose, intoxication, or interactions – prescribed drugs</b>	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)

see Section 3.8	
<b>Drug overdose, intoxication – psychoactive substance use</b> see Sections 3.6, 3.7	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
<b>Neurotoxic snake bite</b> see Section 3.9	Snake bite history or bite marks in a setting with neurotoxic snakes
<b>Other causes</b>	
<b>Status epilepticus</b> see Section 3.5	Ongoing or recurrent stiffening or jerking movements of limbs Known history of seizures
<b>Post-seizure state</b>	History of recent seizure (stiffening, jerking movements) Bitten tongue, incontinence Known history of seizures Postictal improvement over minutes or hours from: confusion poor attention poor short-term memory cognitive deficits below baseline functioning
<b>Eclampsia</b>	Usually associated with hypertension, oedema Usually occurs at term, during delivery or immediately following delivery
<b>Head trauma</b> 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
<b>Intracranial mass</b>	Headache Nausea, vomiting Focal neurological signs and symptoms (unequal pupils, cranial nerve findings, limb weakness, papilloedema)
<b>Hypertensive encephalopathy</b>	BP systolic >180 Known hypertensive Papilloedema and retinal haemorrhages or exudates
<b>Cerebral vascular accident (CVA)</b>	Neurological deficit or impairment Sudden onset Lasting >24 hours (can lead to death) Presumed vascular origin
<b>Transient ischaemic attack (TIA)</b>	Focal neurological symptoms or signs Lasting <24 hours, with full recovery
<b>Hypothermia</b>	Decreased core body temperature Exposure to cold
<b>Acute liver failure or hepatic encephalopathy</b>	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, <i>foetor hepaticus</i> (musky breath) Jaundice, hypoglycaemia
<b>Uraemia</b> see Section 11.28	Asterixis – uraemic flap Peripheral oedema, ascites, uraemic frost History of renal disease Elevated creatinine and BUN
<b>Withdrawal from alcohol or other substances</b>	Chronic use of alcohol or sedative drugs, with recent discontinuation Tremulousness Confusion Seizures Visual hallucinations
<b>Wernicke-Korsakoff encephalopathy</b>	Confusion Ataxia Ophthalmoplegia (double-vision, inability to move eyes to side) Confusion

	History of hazardous alcohol consumption
<b>Some mental health problems can present as confusion; however, they do not cause a reduced level of consciousness.</b>	
<b>Psychosis, dementia, mania, severe learning disabilities</b>	See abnormal behaviour, Section 10.10 Mental health

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### 3.4.2 Manage delirium

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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 27).
- 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. If acute encephalitis syndrome, follow guidance in Section 3.4.3 which follows.
- For delirium due to alcohol withdrawal, give a benzodiazepine (diazepam) (see Section 3.7). Give parenteral thiamine and then glucose. Keep well-hydrated. If delirium persists, consider using antipsychotics such as haloperidol 2.5–5 mg orally up to 3 times daily.
- For agitation or psychosis, give the patient low doses of antipsychotic medications (see Quick Check page 29 and Section 10.10 on mental health).

The objectives of managing delirium are as follows:

- Identify the underlying aetiology of the patient's delirium and begin medical management.
- Ensure that the patient is safe and comfortable. Supervise agitated patients.
- Determine the appropriate place for the patient's treatment (home versus hospital). For cases of severe delirium, treatment should take place in a hospital or other health setting. Treatment should involve several clinicians or the equivalent, including a mental health expert. If persons with delirium have milder symptoms, they may be treated in a nursing facility or at home.
- Ensure an appropriate environment that does not worsen the delirium, confusion, and misperceptions.
- Some environmental considerations include:
  - lighting that corresponds with day and night to help reduce sleep disturbances; availability of a window may also assist in orienting the patient to time;
  - control of the noise level, making it neither over-stimulating nor too quiet;
  - ensuring that individuals who wear eyeglasses or hearing aids wear them, to help lessen confusion and disorientation;
  - provision of a clock and calendar in the room to help keep patients oriented to the time and the day of the week.

Determine whether management with psychotropic medication is appropriate. If symptoms do not abate, despite addressing medical problems and providing environmental support, consider very low-dose antipsychotics (see Quick Check page 29). If withdrawing from alcohol, see Section 3.7 Acute alcohol withdrawal.

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### 3.4.3 Manage acute encephalitis syndrome (AES)

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A broad range of conditions which can cause acute encephalitis, as indicated in the DDX table above. The WHO AES case definition is very broad and includes viral encephalitis, bacterial meningitis, tubercular meningitis, cerebral malaria and acute disseminated encephalomyelitis. CNS tuberculosis often presents as acute to subacute meningitis with symptoms of less than

two weeks duration and may be labelled as AES; identifying *M. tuberculosis* is important for initiating specific treatment in these patients, who would otherwise have higher chances of mortality and poor outcome (see Tuberculosis guidelines). For most AES, including JES, there is no specific treatment so careful supportive care is important and can reduce the case fatality rate. Supportive care, therefore, should focus on:

- airway management
- seizure control
- decreasing cerebral edema
- fluids and nutrition
- fever control
- managing secondary infections

Good clinical management is important to reduce the risk of disability or death from encephalitis. Good clinical management includes using the ABCDE approach of the Quick Check and provision emergency treatments (Section 2) and managing the severely ill patient apply. Manage airway and breathing including airway management, positioning, suctioning, oxygen, BVM ventilation as needed; manage shock; testing for and correcting low blood sugar; control of convulsions (Section 2 and 3.5) as well as interventions to control elevated intracranial pressure if found (using mannitol and other interventions for cerebral edema), control of high temperature (see 8.1), and close monitoring (see 3.11). If ventilatory support is required, refer to hospital with ICU. A summary from India observed that the main cause of high mortality is transporting patient over long distances without proper initial medical care at the nearest hospital in the hope of getting best treatment in the tertiary care hospital. Irreversible brain injury can occur during transport.<sup>1</sup>

#### **Report:**

Although the attack rate is higher in young children, AES in a person of any age should be reported. All AES should be reported – “a person of any age, in any geographical region, at any time of year with the acute onset of fever and a change in mental status (including symptoms such as confusion, disorientation, coma, or inability to talk) AND/OR new onset of seizures (excluding simple febrile seizures).” (Surveillance identifies patients with AES—amongst these, lab test for JE infection)

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<sup>1</sup> GOVERNMENT OF INDIA Directorate of National Vector Borne Disease Control Programme, Directorate General of Health Services, Ministry of Health & Family Welfare: GUIDELINES CLINICAL MANAGEMENT OF ACUTE ENCEPHALITIS SYNDROME INCLUDING JAPANESE ENCEPHALITIS, Delhi, 2009.

### 3.4.4 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 [ $\beta$ OHB] and acetoacetate) in serum more than 3 mmol/l;*
- *acidosis with blood pH <7.3 or serum bicarbonate <15 mEq/l;*
- hyperosmolar dehydration with *serum osmolarity >320 mmol/l.*

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

#### DKA may cause

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

#### Usual presentations

- nausea, vomiting, abdominal pain
- polyuria, polydipsia, and weight loss are often early indicators of hyperglycaemia
- lethargy
- a 2–3 day history of deterioration that may be precipitated by infection
- apparent shortness of breath (hyperventilation with deep breaths, sighing breaths due to acidosis)
- shock (due to dehydration or to sepsis)
- coma
- characteristic ketotic (sweet-smelling) breath
- signs suggestive of a source of infection (pneumonia, urinary tract infection).

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

#### Investigations for DKA

Confirm the diagnosis

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

If blood glucose is not available, the following investigations should be done:

- Urine dipstick with 3+ or 4+ glucose with ketones.
- Check electrolytes, creatinine, and, if available, bicarbonate. Calculate anion gap (serum sodium – (serum chloride + serum bicarbonate)). An anion gap of more than 12 mEq/l is abnormal; suspect acidosis.
- If available (not required), check *arterial blood gas* if urine ketones or anion gap is elevated. *Blood pH <7.3 confirms acidosis (if venous, then +0.03 less than arterial).*
- Check an ECG (see Monitoring, below).



- Consider precipitating cause for DKA
  - urine dipstick and microscopy (for urinary tract infection)
  - blood culture (if fever)
  - chest X-ray (for pneumonia)
  - ECG for chest pain (myocardial infarction).

### Treatment of DKA

Principles of management include giving IV fluids and insulin, correction of electrolyte abnormalities (K), and treatment of precipitating cause. Use Quick Check pages 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.

If the patient is in shock, insert IV line.

- Manage fluids
  - Administer 1 litre normal saline immediately – **do not** add K to this litre.
  - Infuse normal saline as quickly as possible.
  - If the patient is haemodynamically stable, infusion rate is 10–15 ml/kg body weight per hour in first few hours (maximum 50 ml/kg in first 4 hours) – generally 1 litre per hour in an average-size person.
  - Fluid replacement should be more cautious in elderly or pregnant patients or in heart or renal failure.
- Manage potassium (see .5.2.2)
  - Rapid hydration with normal saline and early initiation of insulin can result in dangerously low K levels. When insulin is given, K moves rapidly into the cells, which can cause a drop in serum K. This is associated with a risk of heart arrhythmias.
  - It is important to monitor serum K or ECG hourly for first 3 hours if possible (then every 2 hours) and to carefully replace K to avoid hypokalaemia. It is also important to give K by infusion over an hour, never by bolus.
  - Potassium chloride supplementation – maintain the K level between 4–5 mEq/l.
  - Do not begin replacement until the level is  $<5.3$  and there is adequate urine output (more than 50 ml/h).
  - Add 20 mmol to each subsequent litre of saline – unless hyperkalaemia or hypokalaemia is present (see Monitoring below). A litre of normal saline with added K should be infused over 1 hour.
  - Hyperkalaemia – if the level is  $\geq 5.3$  or there are tall, pointed T waves and a widened QRS complex, then continue NS or Ringer's solution without K and check the level every 2 hours, or repeat ECG.
  - Hypokalaemia – if the level is  $<3.3$ , or there are small or absent T waves and a large U wave following the T wave on the ECG, give 20–30 mmol K/hour until the level is higher than 3.3.
  - If there is no capacity to measure K and no ECG, consider slowing the rehydration rate and giving empirical K supplementation starting from the second hour (20 mmol K in each litre of fluid). Do not give K supplementation empirically until the patient has produced urine.

Manage glucose with insulin

- Administer soluble (short-acting) insulin IV or IM as soon as you have initiated fluid resuscitation (see the table below). Be aware that children and adolescents younger than 18 years are at increased risk of cerebral oedema, and it is better to wait until fluids have been given for 1–2 hours before starting insulin.
- Continue to monitor blood glucose and adjust insulin according to the table.

**Table: Management of DKA if K measurement or ECG is available and SBP >90**

(If in shock with SBP&lt;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
<b>First hour</b> from time of initiation of IV fluids	Give 1 litre NS IV over 1 hour	<b>Rapid repletion K:</b> add 40 mEq/l K to one-half NS; run over 1 hour. <b>No insulin</b> therapy until K >3.3 mEq/l.	<b>Do not add K.</b> <b>Give short-acting insulin</b> 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	<b>Do not add K.</b> <b>Give insulin as in box to left.</b>
<b>2<sup>nd</sup> and 3<sup>rd</sup> hours</b>	Give NS 1 litre/hour (average-size person)	<b>Rapid repletion K:</b> add 40 mEq/l K to 1/2 NS; run over 1 hour. <b>No insulin</b> therapy until K >3.3 mEq/l.	<b>20 mmol K in each litre fluid</b> <b>Continue insulin and adjust according to decrease in blood glucose.</b> 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.	<b>Do not add K.</b> <b>Continue insulin as above.</b>
<b>Over next 4 hours</b>	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.	<b>Continue K repletion as above.</b> <b>Delay or reduce rate of insulin therapy</b> until K >3.3 mEq/l.	<b>20 mmol K in each litre fluid</b> <b>Continue insulin</b> and decrease the rate to 0.05 U/kg/hr when blood glucose <14 mmol/l or <250 mg/dl.	<b>Do not add K.</b> <b>Continue insulin</b> and decrease the rate to 0.05 U/kg/hour when blood glucose <14 mmol/l or <250 mg/dl.

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

### Monitoring DKA

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

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

Assess for signs of infection and initiate antibiotics as indicated.

### 3.4.5 Manage hypoglycaemia

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

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

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

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

If hypoglycaemia is suspected, perform a finger-prick test or carry out laboratory testing immediately to either confirm or rule it out, and urgently give 25–50 ml of 50% dextrose slowly. If glucose testing is unavailable or a delay in obtaining results is expected, treat with glucose empirically.

#### Some causes of hypoglycaemia

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

#### Treatment of hypoglycaemia

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

- Mild to moderate hypoglycaemia is usually treated with food, oral glucose powder or tablets, or sucrose solutions. The guide is to administer 15–20 g glucose, to raise blood glucose by about 3 mmol/l (65 mg/dl). If the patient is conscious, give sweet drinks (not diabetic or sugar-free), e.g. cola, juice, sweet water.
- After the administration of the first 15–20 g glucose, patients should wait 15 minutes for symptoms to subside. Administration of glucose can be repeated after that time if the symptoms persist or if the blood glucose level is checked and is still low.
- In case of loss of consciousness, give glucose (see Quick Check page 27). The treatment is 20–30 g dextrose IV as 200–300 ml 10% dextrose or 25–50 ml D50 (50% dextrose) slowly, followed by a saline flush to avoid damage to the vein.
- When the patient recovers consciousness, food should be provided as soon as the patient can ingest food safely. He or she will need sugary drinks, followed by a long-acting carbohydrate (e.g. bread, rice, maize) to prevent recurrence of symptoms.

- Monitor blood sugar every 1–2 hours. A continuous infusion of dextrose (1 litre over 8 hours) may be required if blood sugar falls to <3.1 mmol/l.
- Look for and treat the underlying cause.

If there is a possibility of alcohol withdrawal or if the patient is malnourished, also give parenteral thiamine 100 mg X 5 days<sup>2</sup>.

### 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 neuroglycopenia.
- 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 infections.

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

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

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

#### Investigations

- electrolytes
- glucose (finger-prick or laboratory)
- Low Na, high K, and hypoglycaemia support the diagnosis; high calcium may also be present.
- chest X-ray (look for TB)
- abdominal X-ray (look for adrenal calcification)
- blood and urine cultures (can help indicate underlying cause)
- ECG, especially if electrolyte imbalances are detected

<sup>2</sup> WHO. mhGAP Intervention Guide for mental, neurological and substance use disorders in non-specialized health settings: Version 2.0. 2016

## 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 27). Commence urgent steroids. Give 100 mg hydrocortisone IV or 8 mg dexamethasone IV immediately then repeat every 8 hours. If neither is available, give 50 mg oral prednisolone once daily. This is a less effective alternative. See dose equivalents of different corticosteroids in Section 8.2.
- Consider general supportive measures, including oxygen and broad-spectrum IV antibiotics for underlying infection, and a Foley catheter to monitor fluid balance.
- Regularly monitor pulse and blood pressure, as well as ECG, electrolytes, and glucose as possible.
- Investigate and treat the underlying cause.

## Ongoing care

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

## Gradual dose reduction after chronic steroid use

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

## 3.5 Approach to the patient with seizures or status epilepticus<sup>3</sup>

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).

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<sup>3</sup> mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings. WHO and mhGAP Evidence Resource Centre, 2016. Available at: [https://www.who.int/mental\\_health/mhgap/mhGAP\\_intervention\\_guide\\_02/en/](https://www.who.int/mental_health/mhgap/mhGAP_intervention_guide_02/en/) [http://www.who.int/mental\\_health/evidence/mhGAP\\_intervention\\_guide/en/index.html](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.

## 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.

### DDx: Seizures

Condition	In favour
<b>Cysticercosis</b>	<ul style="list-style-type: none"><li>• Endemic area for <i>Taenia solium</i>- in pigs and humans</li><li>• History of recurrent seizures</li><li>• May or may not have focal neurological signs</li></ul>
<b>Pregnancy</b>	<ul style="list-style-type: none"><li>• Eclampsia, usually associated with hypertension, oedema</li><li>• Usually occurs at term, during delivery, or immediately following delivery</li></ul>
<b>Epilepsy</b>	<ul style="list-style-type: none"><li>• Tendency to recurrent seizures, including where the cause is not known</li></ul>
<b>Hypoglycaemia</b>	<ul style="list-style-type: none"><li>• Diabetic patient on treatment</li><li>• Responds to glucose</li></ul>
<b>Alcohol or sedative drug withdrawal</b> see Sections 3.6 and 3.7	<ul style="list-style-type: none"><li>• History of hazardous alcohol use or use of sedative-hypnotic drugs, with recent cessation or markedly lower level of use</li></ul>
<b>CNS infection (meningitis, cerebral malaria)</b>	<ul style="list-style-type: none"><li>• Fever</li><li>• Signs of meningitis (neck stiffness, photophobia)</li><li>• Signs of encephalitis (confusion)</li><li>• Signs of brain abscess (focal neurological signs or septic emboli)</li></ul>
<b>HIV-related</b> 	<ul style="list-style-type: none"><li>• Toxoplasmosis, tuberculosis, cerebral lymphoma – all presenting with focal signs</li><li>• If chest X-ray suggestive of tuberculosis, treat for TB (see Section 15).</li><li>• If chest X-ray not suggestive of TB, treat for toxoplasmosis (see Section 11.40).</li><li>• Electrolyte abnormalities (calcium, sodium, potassium)</li></ul>
<b>Poisoning</b> see Section 3.8	<ul style="list-style-type: none"><li>• Pesticides, antidepressants, amphetamines</li></ul>

### 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 or midazolam buccally 5-10 mg.

- 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 (if no history of epilepsy, second half of pregnancy or up to 1 week post partum)) may be caused by severe eclampsia.

- For eclampsia, give magnesium sulfate (see Quick Check page 36); consider delivery and anti-hypertensives.

### Management of ongoing seizures (status epilepticus)

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

This is associated with high mortality.

- Give glucose – D50 IV 25–50 ml IV slowly.
- Give a repeat dose of diazepam 10 mg IV or rectally. Monitor the patient's respiratory rate closely.
- Give phenytoin 15–20 mg/kg IV (up to max dose of 1 g) in normal saline over a 1-hour period through a **different IV line** from the diazepam.
- Monitor the pulse (preferably via an ECG) and respiratory rate every 15 minutes.
- If the patient is already on phenytoin or it is not available, give phenobarbital 15–20 mg/kg IV over 15 minutes (up to max dose of 1 g, over 100mg/min; if no IV access, can use IM phenobarbital (same dose as IV)) or may give valproic acid 20 mg/kg IV once (up to max dose of 1 g, over 30 min)
- 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 41), 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 10.9c)

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 and toxoplasmosis (see Section 11.40).

## 3.6 Manage intoxication or overdose, or withdrawal from injecting or other use of opioids, amphetamine-type stimulants, or cocaine<sup>1,2</sup>

3.6.1 Opioid intoxication or overdose – Treatment of opioid intoxication or overdose	3.6.3 Manage stimulant intoxication and overdose – – Standard stimulant intoxication
3.6.2 Manage opioid withdrawal – The effects of acute opioid withdrawal – Manage acute opioid withdrawal	– 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<sub>2</sub> <90.

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

<sup>2</sup> *mhGAP Intervention Guide for mental, neurological and substance use disorders in non-specialized health settings-Version 2.0*. WHO, 2016. Available at [https://www.who.int/mental\\_health/mhgap/mhGAP\\_intervention\\_guide\\_02/en/](https://www.who.int/mental_health/mhgap/mhGAP_intervention_guide_02/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-acting and wears off within 2–3 hours. This is long enough to reverse the effects of short-acting opioids such as heroin. If a person has used long-acting opioids (such as methadone or oral slow-release morphine formulations), they may develop the signs of overdose again when the naloxone wears off. It is therefore important to establish whether the person has used short- or long-acting opioids. An adequate supply of naloxone should be available in district hospitals and staff should be trained in administering it properly.

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

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

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### 3.6.2 Manage opioid withdrawal

#### The effects of acute opioid withdrawal

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

Signs and symptoms of acute opioid withdrawal:

- tremors, shivers
- tear formation, rhinorrhoea, yawning
- muscle cramps
- restlessness
- gooseflesh
- disturbed sleep or inability to sleep
- diarrhoea
- extreme anxiety
- nausea and vomiting
- tachycardia.

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

## Manage acute opioid withdrawal

The management of acute opioid withdrawal depends on the medications available. Buprenorphine (a partial opioid agonist) and methadone (a full agonist)<sup>3</sup> are the most effective for relieving symptoms and ensuring that patients can complete a detoxification schedule.

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

If the patient has:

- muscle cramps and pain ⇒ give ibuprofen or other NSAIDs
- nausea and vomiting ⇒ give anti-emetics (see Section 10.5c)
- restlessness or sleep disorder ⇒ give mild sedatives such as a sedating antihistamine
- diarrhoea ⇒ see Section 8.3. Consider giving *loperamide*.

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

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### 3.6.3 Manage stimulant intoxication and overdose

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

#### Standard stimulant intoxication

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

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

#### Complicated stimulant intoxication

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

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

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<sup>3</sup> 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) or an opioid e.g. morphine 10–20mg initially, with 10mg extra dose if needed. The exact dose depends on body weight, severity of withdrawal, and the patient’s response. Continue for 4–7 days. See Adaptation Guide.*

- seizures
- uncontrolled hypertension.

### **Amphetamine and cocaine acute intoxication – initial management**

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

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

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

- Provide a non-stimulating environment, with support and reassurance.
- Prevent the person from harming themselves or others (provide a safe space to “chill out”).
- Avoid confrontation.
- Encourage support from family or sober friends.

### **Special features of cocaine intoxication or overdose**

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

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## **3.6.4 Manage stimulant withdrawal**

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Characteristics of psychostimulant withdrawal syndrome include:

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

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

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

### **Symptomatic management of withdrawal**

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

### **Non-pharmacological management of withdrawal**

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

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



## 3.7 Acute alcohol withdrawal and intoxication<sup>4</sup>

### 3.7.1 Acute alcohol withdrawal

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

#### **To make a diagnosis of alcohol withdrawal**

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

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

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

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

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

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

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

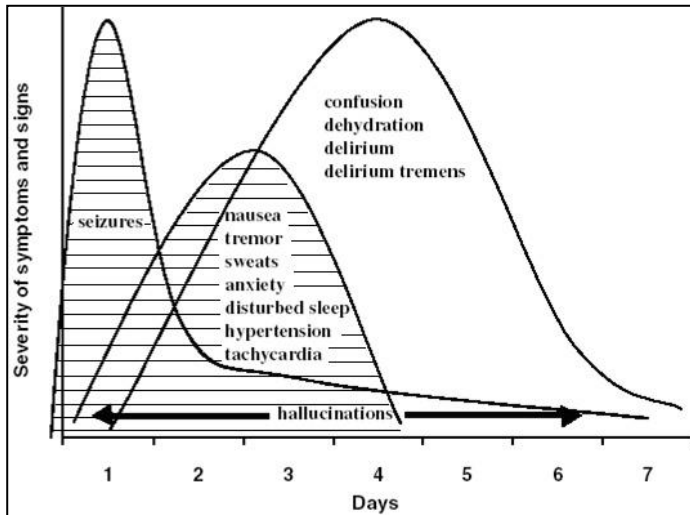
Sedation with benzodiazepines reduces the severity of delirium and hallucinations due to alcohol withdrawal. However, it must be recognized that other causes of delirium and hallucinations may be present, which will require specific, additional forms of treatment.

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<sup>4</sup>*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](http://mental_health/mhgap/evidence/en/index.html). The mhGAP Guidelines and the mhGAP-IG will be reviewed and updated in 5 years. Any revision and update before that will be made to the online version of the document.

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

### Progression of the alcohol withdrawal syndrome



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

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

It is important to consider and treat these other medical problems. Use the Quick Check, then the acute care Sections 8 or 10 for each main symptom.

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

#### Delirium tremens

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

#### Clinical features of delirium tremens

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

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

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

## Treatment of alcohol withdrawal syndrome

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

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

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

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

### 1. Sedation

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

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

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

Patients can have a tendency to abuse benzodiazepines; therefore, they should not be prescribed for more than 1 week. The diazepam regime for a simple withdrawal should be finished within a week to avoid risk of benzodiazepine dependence. Following delirium tremens, up to 10 days of sedation reduction may be required. Patients should **not** be discharged with a prescription for benzodiazepines.

### 2. Antipsychotic medication

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

### 3. Thiamine and multivitamin supplements

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

### 4. Oral or intravenous fluids

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



## 5. Potassium

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

## 6. Magnesium

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

## 7. Supportive care

If patient has hypoglycaemia, give glucose (see Quick Check page 27) but only **after** the patient has received thiamine 100 mg IV or IM.

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

## 8. Skilled nursing

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

## 9. Close monitoring

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

### If the patient has a seizure

- Use Quick Check and Section 3.5.
- Ensure a responsible person remains with the patient at all times.
- Place the patient in a quiet room without bright lights.
- Every 30–60 minutes monitor BP, pulse, temperature, respiratory rate, and record the alcohol withdrawal score.
- If recovery of consciousness is slow, ensure adequate IV fluids.

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

### If the patient has alcohol withdrawal delirium

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

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

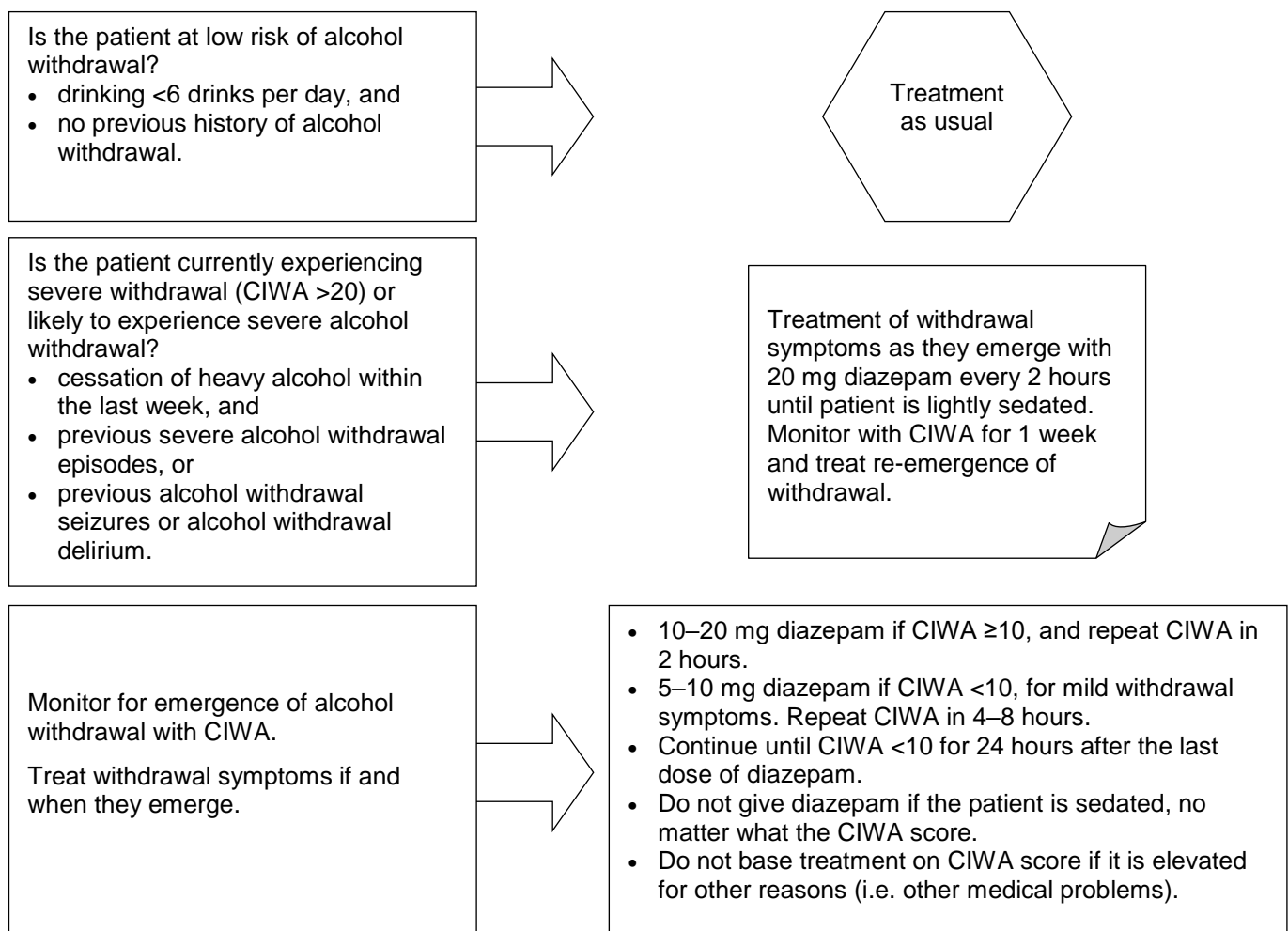
## Precautions in patients who have complicating medical disorders

**If patients have chronic airflow limitation without respiratory failure**, the dose of diazepam should be reduced and carefully titrated. Monitor SpO<sub>2</sub> before and after each dose of diazepam.

**If there is respiratory failure**, DO NOT sedate. Use Quick Check airway management instructions (Quick Check page 15 to 18) 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**.<sup>5</sup> 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.



<sup>5</sup> 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.

<p><b>Nausea and vomiting</b> Ask "Do you feel sick to your stomach? Have you vomited?"</p> <p>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</p>	<p><b>Tactile disturbances</b> Ask "Have you any itching, pins and needles sensations, any burning, any numbness, or do you feel bugs crawling under your skin?"</p> <p>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</p>
<p><b>Tremor</b> Observe patient's arms extended and fingers spread apart.</p> <p>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</p>	<p><b>Auditory hallucinations</b> 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?"</p> <p>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</p>
<p><b>Paroxysmal sweats</b> Record observations.</p> <p>0 No sweat visible 1 Barely perceptible sweating, palms moist 2 3 4 Beads of sweat obvious on forehead 5 6 7 Drenching sweats</p>	<p><b>Visual disturbances</b> 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?"</p> <p>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</p>
<p><b>Anxiety</b> Ask "Do you feel nervous?"</p> <p>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</p>	<p><b>Headaches, fullness in head</b> 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.</p> <p>0 Not present 1 Very mild 2 Mild 3 Moderate 4 Moderately severe 5 Severe 6 Very severe 7 Extremely severe</p>
<p><b>Agitation</b></p> <p>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</p>	<p><b>Orientation and clouding of sensorium</b> Ask: "What day is this? Where are you? Who am I?"</p> <p>0 Orientated and can do serial additions 1 Cannot do serial additions or is uncertain about date 2 Disorientated for date by no &gt;2 calendar dates 3 Disorientated for date by &gt;2 calendar dates 4 Disorientated for place or person</p>

Estimated date and time of last drink \_\_\_\_\_

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

<b>Vital signs:</b>														
Temperature														
Pulse														
Respiratory rate														
BP														

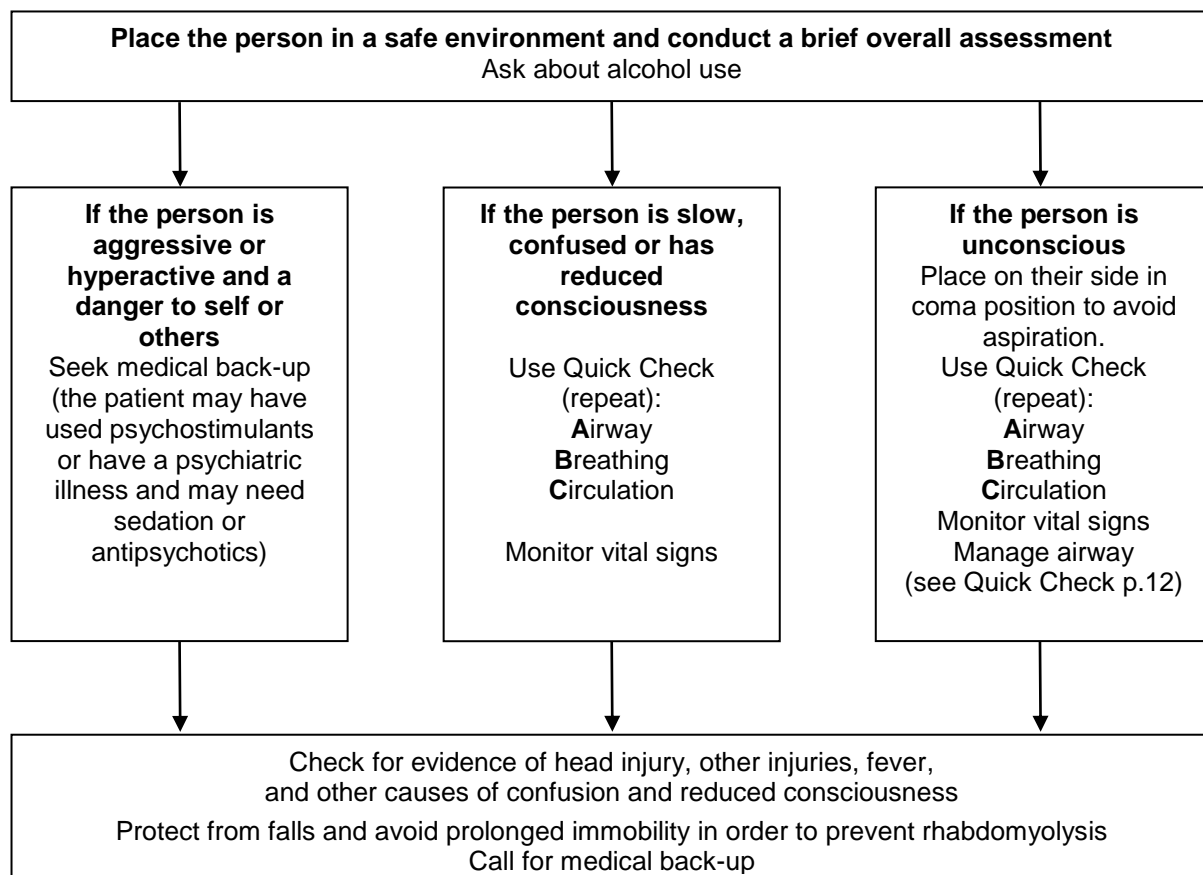
### 3.7.2 Acute alcohol intoxication

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

<p>3.8.1 Ingested poisons or overdose of medicines</p> <ul style="list-style-type: none"><li>– Prevent aspiration of gastric contents</li><li>– Assess airway and breathing</li><li>– Assess circulation</li><li>– Assess neurological impairment</li><li>– Assess the need for antidotes</li><li>– Risk assessment</li><li>– Common agents</li><li>– Management principles for ingested poisons</li><li>– Important considerations in resuscitation and stabilization that may differ from management of non-poisoned patients</li><li>– Differences with standard guidelines for management of arrhythmias and advanced cardiac life support</li><li>– Criteria for inpatient hospital admission</li><li>– Removal of the poison from the gastrointestinal tract (gut decontamination)</li><li>– Induction of vomiting (emesis) to treat poisoning should usually not be used</li><li>– Very limited role for gastric lavage</li><li>– Activated charcoal may be useful in the first 1–2 hours after ingestion for some poisons</li><li>– Very limited role for whole bowel irrigation (WBI) for gut decontamination</li><li>- Management of organophosphate poisoning</li><li>- Management of mushroom poisoning</li><li>– Management of other specific poisons</li><li>– Table: Poisons or toxins, symptoms of toxicity in overdose, and brief guidance on specific management</li></ul>	<p>3.8.2 Inhaled poisons</p> <ul style="list-style-type: none"><li>– Table: Inhaled poisons or toxins, symptoms of toxicity, and brief guidance on specific management</li></ul> <p>3.8.3 Chemicals on the skin or in the eye</p> <ul style="list-style-type: none"><li>– Health worker protection</li><li>– Manage chemicals in the eye</li><li>– Manage chemicals on the skin</li><li>– Manage organophosphates or carbamate on skin</li><li>– Manage exposure to tear gas (e.g. CN or CS gas)</li></ul>
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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<sub>2</sub> <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 serotonergic 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.<sup>1</sup>

### Common agents

- **Medicines:** pain killers (e.g. paracetamol [acetaminophen], opioids, salicylates), antidepressants, anticonvulsants, sedatives, antimalarials, iron salts, antihypertensives, hypoglycaemic agents, bronchodilators, and drugs of abuse.
- **Plants:** e.g. *Datura stramonium* (thorn apple, jimson weed), *datura merel* (angel's trumpet), *ricinus communis* (castor bean), *thevetia peruviana* (yellow oleander), *atropa belladonna* (deadly nightshade), *gloriosa superba* (glory lily).  
**Fungi:** e.g. *Amanita phalloides*, *gyromitra* species. Mushroom poisoning occurs regularly in Nepal and is immediately reportable (as a type of food poisoning). See section below.  
**Herbal preparations:** e.g. pennyroyal, bitter melon, arnica, aristolochia.

<sup>1</sup> Medicine interaction information can be found in the *Nepal National Formulary, 2018*.



- **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). Organophosphate poisoning is common in Nepal—see section on this below.
- **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<sub>2</sub>) 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).

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<sub>2</sub>.

- 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<sub>2</sub> <90, give oxygen (see Quick Check pages 14–16).
- If wheezing, give salbutamol (see Quick Check pages 23–24).
- Is there an indication for advanced airway management with tracheal intubation (see Quick Check pages 42 to 48)?
  - 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 41 to 48 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 27).
- If consciousness is reduced, place in the recovery position.
- Manage seizures with diazepam *or* lorazepam (see Quick Check page 27 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 27 and Section 3.4). Avoid haloperidol and chlorpromazine, especially in haemodynamically unstable patients.
- Few patients require active removal of the poison or the use of antidotes.
- Frequently monitor vital signs, neurological and respiratory status (see Section 3.0 on the general principles for caring for severely ill patients).

#### **Important considerations in resuscitation and stabilization in clinical toxicology that may differ from management of non-poisoned patients**

- Caustic ingestion may lead to severe upper airway injury (mucosal inflammation and necrosis), stridor, and obstruction, and requires advanced airway management (see Section 3.2.2). Call for help from a senior clinician immediately as progression to complete obstruction can happen rapidly. This type of injury can make tracheal intubation very difficult. Ensure an experienced senior clinician is present and be prepared for surgical airway management, if necessary. If the airway is already obstructed, proceed to emergency cricothyroidotomy (see Quick Check page 48) 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. 36).
- 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 50), 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. The details for the Nepal Drug and Poison Information Center are given below. If not available, these services can also be obtained by telephoning a poison centre in another country.<sup>2</sup> A directory of poisons centres can be found at.

### 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.

<sup>2</sup> Nepal Drug and Poison Information Center, 75 Abhiyan Marg, Shamakushi, Kathmandu, 977. +977 1435 3877. lohanis@gmail.com

The prerequisites for gastric lavage are:

- patient consent
- the patient is conscious and able to protect the airway, or is intubated
- the patient has been adequately resuscitated and has a stable cardiovascular status.

The contraindications to gastric lavage are:

- a patient with an unprotected airway, such as a patient with a depressed level of consciousness and without endotracheal intubation;
- a patient who has ingested corrosives (likely to increase the risk of injury to the oesophagus and stomach during gastric lavage);
- if its use increases the risk and severity of aspiration (e.g. a patient who has ingested a hydrocarbon with high aspiration potential);
- a patient at risk of haemorrhage or gastrointestinal perforation due to pathology, recent surgery, or other medical conditions.

Gastric lavage should be performed by a qualified and experienced clinician and the procedure **MUST** be explained to the patient. The patient's pulse and blood pressure should be monitored throughout the procedure. Never use force to introduce the tube. Place the patient in the left lateral position, with the head tilted down. Insert a orogastric tube (36 to 40 French gauge or 30 English gauge in adults, with an external diameter of 12 to 13.3 mm; and 24 to 28 French gauge in children, external diameter 7.8 to 9.3 mm). Introduce 200 to 300 ml (10 ml/kg in children) of normal saline or water (preferably warmed to 38°C – avoid water in children to prevent hyponatraemia). Remove the volume introduced before giving further fluid. If the patient becomes restless or if the blood pressure drops, abandon the procedure. Give a dose of activated charcoal (50 g) to an adult and 1 g/kg to a child after the lavage (see below).

#### **Activated charcoal may be useful in the first 1–2 hours after ingestion for some poisons**

Activated charcoal acts by **adsorbing** the poison and preventing it from being absorbed by the patient.

- It is ineffective in poisoning due to alkalis, acids, heavy metals, iron, lithium, toxic alcohols, glycols, and hydrocarbons such as kerosene.

Activated charcoal is contraindicated:

- if the patient has an unprotected airway, such as in a patient with a depressed level of consciousness and without endotracheal intubation;
- if its use increases the risk and severity of aspiration (e.g. a hydrocarbon with a high aspiration potential);
- in patients who are at risk of gastrointestinal haemorrhage or perforation due to pathology, recent surgery, or medical conditions that could further be compromised by single dose of activated charcoal.

#### **How to prepare activated charcoal**

Activated charcoal should be mixed with water according to manufacturer's instructions and well-shaken.

- For adolescents and adults: give 50–100 g as a single dose (children 1–12 years: give 1 g/kg, maximum 50 g).
- The solution can be administered via a nasogastric tube if the airway is protected and the patient is compliant.

The presence of activated charcoal in the gastrointestinal tract may obscure endoscopic visualization. However, a corrosive is not a contraindication when charcoal is used for co-ingested agents that are systemic toxins.

#### **There is a very limited role for whole bowel irrigation (WBI) for gut decontamination**

This aims to clear the entire gastro-intestinal tract using an **osmotically balanced** polyethylene glycol-electrolyte solution.

NB: WBI should only be performed using this solution, which is carefully formulated to prevent development of electrolyte and fluid imbalance.

- The indications for WBI are potentially toxic ingestion of sustained-release or enteric-coated drugs, iron, and packets of illicit drugs.
- WBI is contraindicated in the presence of ileus, bowel obstruction, bowel perforation, clinically significant gastrointestinal haemorrhage, haemodynamic instability, uncontrollable intractable vomiting, and an unprotected, compromised airway.

A 12 French nasogastric tube is passed into the stomach (gastric location should be confirmed by auscultation during air injection). The tube is then attached to a reservoir bag of irrigation solution that is hung from an elevated site. The patient should be seated or the head of the bed elevated to at least 45°. The irrigation fluid is given at a rate of 1500–2000 ml/h for adults and adolescents. The patient should be placed on a commode or similar receptacle to collect the effluent. WBI should be continued at least until the rectal effluent is clear.

## Management of organophosphate poisoning

Suspected case of poisoning

History suggestive of organophosphate intoxication and typical features\*

NO

Observe and monitor the features of organophosphate poisoning\*

YES

Use Quick Check to evaluate and manage ABCDE emergency signs

### \*TYPICAL FEATURES

Muscarinic effects: DUMBBELS (defecation, urination, miosis, bronchospasm, bronchorrhea, emesis, lacrimation, salivation)  
 Nicotinic effects: weakness, fasciculation, paralysis, mydriasis  
 Other: agitation, confusion, lethargy, convulsions, coma

### SPECIFIC ANTIDOTE TREATMENT

#### Atropine

Initial dose 0.05 mg/kg, e.g. 5 ampoules for a 60 kg patient  
 Monitor and repeat doses

Pralidoxime (START ONLY after Atropine)

- Loading dose: 30 mg/kg (Slowly over 30 mins)
- Infuse @ 8mg/kg/hr

#### General management

- Decontamination
  - PPE
  - Gastric aspiration if patient presents within 1 hour.
- \*\*CAUTION for gastric decontamination:**
- unconsciousness or depressed sensorium with unprotected airway
  - ingestion of corrosive substances • ingestion of hydrocarbons, unless a more toxic substance is combined with the hydrocarbon, such as pesticide
  - presence of frank convulsions
  - patient at risk of haemorrhage or gastrointestinal perforation
  - an uncooperative patient (the tube can injure the gastrointestinal tract).

Use OP Poisoning Observation Chart (below) to MONITOR:

Heart rate, BP, Pupils, Auscultate lungs, Feel axilla and oral mucosa

Every 5 minutes

Lungs clear and oral mucosa dry?

NO

Double/increase the dose of Atropine

YES

Infuse Atropine @ 20% of atropinisation dose per hour



## Mushroom poisoning

There are over 10,000 species of mushrooms worldwide, but of these, only 50 to 100 are potentially toxic.<sup>3</sup> At least 228 edible mushroom species are collected in Nepal for consumption.<sup>4</sup> “The wild edible species in Nepal are collected from the lower plains to the highlands, but it is difficult to differentiate between the edible mushrooms and poisonous ones because there are no hard and fast rules to define toxic and edible mushrooms.... There is no general rule for the identification of poisonous and non-poisonous mushrooms in the world. There are many traditional methods for testing these fungi but they are not reliable (for example, false beliefs include only bright coloured mushrooms or with warty cap/texture are poisonous; poisonous mushrooms can be detoxified by boiling in water with or without salt or vinegar; all mushrooms with smooth caps are edible.)<sup>5</sup>

“The collection of mushrooms was found to be most important in high-altitude forest areas where almost all the households collect mushrooms and where wild edible mushrooms form an important part of the diet and provide cash income. Locally, it was assumed that the popularity of mushrooms in high-altitude areas was related to a lack of poisonous mushrooms.” This ethnobotany study” did not entirely confirm this, but the frequency of poisonous mushrooms was very low in the *Pinus wallichiana* forest compared to the forest types at lower altitudes. And notably, there are no known poisonous mushrooms looking like the commonly eaten ones in the high-altitude forests. Several poisonous mushrooms occur, for example *Amanita virosa* and *A. phalloides*, which are difficult to distinguish from commonly-eaten species such as *Amanita caesarea*, *A. chepangiana*, and *A. hemibapha*). Every year lethal poisoning caused by fungi is reported.”<sup>5</sup>

Serious toxicity from mushrooms is uncommon. Usually the specific species is not known- if possible, samples of all ingested mushrooms should be obtained for potential identification by a trained mycologist. Whole mushrooms are preferred, but identification can be made on parts of the mushroom, especially the cap. Further storage is facilitated by wrapping the mushrooms in wax paper, placing it in a paper bag, and refrigerating the sample. Storage in plastic bags should be avoided.<sup>3</sup>

When serious mushroom poisoning does occur, it often results from misidentification.

Classification of poisoning based upon clinical presentation helps achieve a working diagnosis and guides treatment. Defining which clinical syndrome predominates, initiating general supportive care, and administering any specific treatments for that syndrome are the key steps in the recognition and management of mushroom poisoning. The timing of the development of symptoms is important so careful history should be done. See the table which follows, adapted for Nepal from UpToDate.<sup>3</sup>

Supportive care of airway, breathing, and circulation are important (see earlier Section on managing severely ill patients. Aggressive IV fluid resuscitation is often necessary for patients with severe vomiting and diarrhoea. Anticipate the possibility of liver or renal failure, seizures, hemolytic anemia, methemoglobinemia, and/or rhabdomyolysis.

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<sup>3</sup> Wiegand TJ, Clinical manifestations and evaluation of mushroom poisoning in UpToDate, last updated July 16, 2018.

<sup>4</sup> Christensen M, Devkota S, Bhattarai S, Larsen HO: Collection and use of wild edible fungi in Nepa. *Economic Botany* 62(1), May 2008.

<sup>5</sup> Shiva Devkota: Edibility of Wild Mushrooms in the Context of Nepal: an appraisal of Indigenous and Local Knowledge, chapter in *Knowing our Lands and Resources Indigenous and Local Knowledge and Practices related to Biodiversity and Ecosystem Services in Asia*, editors Karki M, Hill R, Xue D, Alangui W, Ichikawa K and Bridgewater P; 2016.



**Mushroom poisoning syndromes: Symptoms, toxicity, and treatment- adapted from UpToDate<sup>3</sup>**

Mushroom poisoning syndrome	Toxins	Onset of symptoms	Sites of toxicity	Specific mushroom examples- adapt to only include those in Nepal- may allow deletion rows	Treatment*	Mortality
Acute gastroenteritis without liver failure	GI irritants	<6 hours (most within 3 hours)	GI tract	<i>Chlorophyllum molybdites</i> <i>Clitocybe nebularis</i> <i>Omphalates illudens</i>	Supportive care: IV fluid repletion as needed	Mortality rare, symptoms typically resolve within 6 hours
Hallucinogenic	Psilocybin, psilocin	30 minutes-2 hours	CNS (hallucinogenic effects)	<i>Psilocybe cubensis</i> <i>P. mexicana</i> <i>Conocybe cyanopus</i> <i>Gymnopilus aeruginosa</i> <i>Panaeolousfoenisecil</i>	Benzodiazepines for agitation  Supportive care	Mortality rare, symptoms typically resolve within 12 hours
CNS excitation and depression (stupor, coma, delirium, agitation, hallucinations, and, in children, seizures)	Ibotenic acid, muscimol	30 minutes-2 hours	CNS (depressant and excitatory effects)	<i>Amanita muscaria</i> <i>A. pantherina</i> <i>A. gemmata</i>	Benzodiazepines (eg, lorazepam 0.05 mg/kg, maximum dose 2-4 mg) for agitation  Supportive care	Mortality rare, symptoms typically resolve within 6-24 hours
Cholinergic excess (vomiting, diarrhea, bradycardia, bronchorrhea, bronchospasm, salivation, tearing)	Muscarine	30 minutes-2 hours	Autonomic nervous system (muscarinic receptors)	<i>Clitocybe dealbata</i> <i>C. illudens</i> <i>Inocybe fastigiata</i> <i>Boletus calopus</i>	Atropine (0.02 mg/kg IV, minimum dose 0.1 mg, maximum dose 1 mg) OR  Glycopyrrolate (10 mcg/kg, maximum dose 0.2 mg)  Repeat anticholinergic agent as needed until bronchial secretions have dried  Supportive care: IV fluid resuscitation of vomiting and diarrhea, inhaled albuterol and ipratropium bromide for bronchospasm	Mortality rare, symptoms typically resolve within 12 hours
Disulfuram-like reaction (flushing, headache,	Coprine	30 minutes-2 hours	Inhibition of aldehyde-dehydrogenase	<i>Coprinus atramentarius</i>	Supportive care	Mortality rare, symptoms typically resolve within 6 hours

tachycardia, chest pain, anxiety)			se enzyme leading to increased blood aldehyde	<i>Clitocybe clavipes</i>		
Gastroenteritis and delayed onset renal failure	Allenic norleucine	30 minutes-3 hours (GI toxicity) 12-24 hours (renal toxicity)	Kidney GI tract	<i>Amanita smithiana</i>	Supportive care: As for renal insufficiency Hemodialysis	Mortality rare, full recovery of renal function in most patients
Delayed liver toxicity and delayed gastroenteritis	Cyclopeptides: • Amatoxins • Phallotoxins	6-24 hours <sup>¶</sup>	GI tract Liver Kidney	<i>Amanita phalloides</i> <i>A. virosa</i> <i>A. verna</i> <i>A. bisporigera</i> <i>Galerina autumnalis</i> <i>G. marginata</i> <i>G. venenata</i> <i>Lepiota helveola</i>	Multiple dose activated charcoal IV Silibinin <sup>Δ</sup> IV N-acetylcysteine <sup>Δ</sup> IV cimetidine <sup>Δ</sup> IV vitamin C <sup>Δ</sup> Supportive care: IV fluid resuscitation for hypovolemia; supportive treatment of liver failure and hepatorenal syndrome <sup>◊</sup> Liver transplant	2-30%
Seizures, delayed gastroenteritis and liver toxicity	Gyromitrin	4-10 hours	GI tract Central nervous system Liver Blood	<i>Gyromitra esculenta</i> <i>G. infula</i> <i>Sarcosphaera coronaria</i> <i>Cyathipodia macropus</i>	Seizures: Benzodiazepines and pyridoxine (70 mg/kg IV, maximum dose: 5 grams) Methemoglobinemia: Methylene blue (1-2 mg/kg IV, slowly over 5 minutes for symptoms or methemoglobin level >20%) Supportive care: IV fluid resuscitation for delayed vomiting and diarrhea	0-10%

Delayed renal failure	Orellanine, orellanine, cortinarin	3-20 days	Kidney	<i>Cortinarius orellanus</i> <i>C. speciosissinus</i> <i>Mycena pura</i> <i>Omphalatus orarius</i>	Supportive care: As for renal insufficiency Hemodialysis Renal transplant	Rare, end-stage renal failure 11%, renal transplant 13%
Delayed rhabdomyolysis	Unknown	24-72 hours	Muscle	<i>Tricholoma equestre</i>	Supportive care: IV fluid repletion and correction of hyperkalemia Hemodialysis	25%
Erythromelalgia (burning extremity pain with erythema and edema, severe tactile pain)	Acromelic acid	>24 hours	Peripheral nerves Skin	<i>Clitocybe acromelalga</i>	Supportive care: Pain management	Mortality rare, symptoms may last for months
Delayed encephalopathy						
Patients with renal failure	Unknown	>24 hours to days	Encephalopathy	<i>Pleurocybella porrigens</i> <sup>s</sup>	Supportive care	27%
Normal healthy patients	Polyporic acid (causes violet colored urine)	>12 hours	Encephalopathy, liver and renal toxicity	<i>Hapalopilus rustilans</i>	Supportive care	Rare
Immune-mediate hemolytic anemia	Antibodies to <i>Paxillus involutus</i>	Repeated ingestion of cooked mushroom	Blood	<i>Paxillus involutus</i>	Supportive care: As for autoimmune hemolytic anemia. Renal insufficiency may occur.	Rare
Shiitake dermatitis	Lentinan	2 hours to 5 days after consumption of raw or undercooked shiitake mushrooms	Skin	<i>Lentinula edodes</i>	For severe cases, antihistamines and systemic corticosteroids	None
Allergic bronchioalveolitis	Allergic reaction to spores of <i>Lycoperdon</i> species	<6 hours	Lungs	<i>Lycoperdon</i> species	Corticosteroids Antifungal agents (eg, amphotericin B)	Rare

GI: gastrointestinal; CNS: central nervous system; IV: intravenous.

\*

¶ Gastroenteritis may occur as early as six hours after consumption of mushrooms containing cyclopeptide toxins. Gastroenteritis may appear under six hours in patients who ingest other mushrooms along with cyclopeptide-containing species. Liver toxicity typically becomes apparent within 24-36 hours after ingestion.

Δ Although frequently recommended, these treatments are of uncertain benefit. If IV silibinin is not available, administration of high-dose IV penicillin G and oral silymarin or similar milk thistle product is suggested. Refer to UpToDate topics on management of amatoxin-containing mushroom poisoning.

◇ For example, lactulose for encephalopathy, vitamin K and fresh frozen plasma for coagulopathy. Bridging liver therapies such as molecular absorbent regenerating system, fractionated plasma separation and adsorption system, or therapeutic plasma exchange should be determined by a liver transplant service.

§ Mushroom commonly served in Japanese miso soup.

Data derived from:

1. Goldfrank LR. Mushrooms. In: Goldfrank's Toxicologic Emergencies, 9th, Nelson LS, Lewin NA, Howland MA, et al (Eds), McGraw-Hill, New York 2011. p.1522.
2. Brent J, Palmer RB. Mushrooms. In: Haddad and Winchester's Clinical Management of Poisoning and Drug Overdose, 4th edition, Shannon MW, Borron SW, Burns MJ (Eds), Saunders Elsevier, Philadelphia, PA 2007. p.455.

## Management of other specific poisons

Brief guidance on the management of specific poisonings is given in the table on the next page: Poisons and agents, symptoms of toxicity in overdose, and brief guidance on specific management. This does not cover all aspects of management or complications, and the reader is advised to consult additional sources. Some agrochemicals and medicines do not lead to serious adverse clinical outcomes and should only be treated with supportive care (see Table: Agrochemicals and pharmaceuticals that are unlikely to lead to adverse clinical outcomes).

**Table: Poisons or toxins, symptoms of toxicity in overdose, and brief guidance on specific management**

Poison or toxin	Symptoms	Management
<b>Drugs</b>		
<p><b>Aspirin</b> (acetylsalicylic acid)</p> <p>Toxic dose: &gt;150 mg/kg or 6.5 g aspirin equivalent (whichever is less)</p> <p>Ingestion of &gt;4 ml of oil of wintergreen (98% methyl salicylate) or more than a lick or taste for &lt;6 years of age</p>	<p>Vomiting, deafness, tinnitus, confusion, hyperventilation, fast pulse, low SBP, dehydration, hypoglycaemia, coma</p> <p>Prolonged or delayed absorption possible</p>	<ul style="list-style-type: none"> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1). Target adequate urine output.</li> <li>• Give activated charcoal, followed by a second dose 4 hours later.</li> <li>• Monitor electrolytes and bicarbonate 2 hourly.</li> <li>• Correct hypokalaemia. Maintain serum K between 4 and 4.5 mmol/l.</li> <li>• Check and monitor the serum salicylate concentration.</li> <li>• <i>Correct metabolic acidosis with sodium bicarbonate 1–2 mmol/kg as IV bolus, followed by maintenance infusion.</i></li> <li>• If salicylate level is &gt;500 mg/l, give sodium bicarbonate to alkalinize the urine (pH&gt;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 alkalisation should only be done if there are facilities to monitor plasma bicarbonate and urine pH.</li> <li>• Regular monitoring of urine pH, serum bicarbonate, and potassium.</li> <li>• Refer for haemodialysis if salicylate concentration &gt;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.</li> </ul>
<p><b>Beta-blockers</b></p> <p>Toxic dose: variable response to overdose</p>	<p>Hypotension and bradycardia, AV block, electromechanical dissociation, intraventricular conduction delays and asystole CNS depression and seizures with propranolol</p>	<ul style="list-style-type: none"> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease.</li> <li>• Give activated charcoal if within 2 hours of ingestion, provided patient is stable.</li> <li>• For sustained-release preparations, give multiple doses of activated charcoal <i>and consider the use of whole bowel irrigation.</i></li> <li>• <i>Cardiac monitoring</i> 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).</li> <li>• 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.</li> <li>• If shock is unresponsive to fluids, give vasopressors, starting with dopamine followed by epinephrine (see Section 3.1.4) and titrate up as needed.</li> <li>• <i>For unresponsive bradycardia with hypotension, give isoprenaline (1 mcg/minute).</i></li> <li>• 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.<sup>6</sup></li> </ul>

<sup>6</sup> Calcium chloride 10% – 0.2 ml/kg to a maximum of 10 ml over 5 minutes.

		<ul style="list-style-type: none"> <li>• <i>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.</i></li> <li>• 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</li> <li>• 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.</li> <li>• Treat seizures with diazepam (see Quick Check page 27 and Section 3.5). Avoid the use of phenytoin in propranolol overdose.</li> </ul>
<p><b>Calcium-channel blockers</b></p> <p>Toxic dose: any overdose is potentially serious</p>	<p>Hypotension and bradycardia, cardiogenic shock</p> <p>Reflex tachycardia with nifedipine</p>	<ul style="list-style-type: none"> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease.</li> <li>• Give activated charcoal if patient presents within 2 hours and is stable.</li> <li>• For sustained-release preparations, give multiple doses of activated charcoal and <i>consider the use of whole bowel irrigation.</i></li> <li>• <i>Cardiac monitoring</i> and perform 12-lead ECG.</li> <li>• 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.</li> <li>• 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.</li> <li>• Monitor calcium, <i>arterial blood gases</i>, glucose, and potassium.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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).</li> </ul>
<p><b>Carbamazepine</b></p> <p>Toxic dose: &gt;20 mg/kg</p>	<p>Nystagmus, dilated pupils, ataxia, slurred speech, fluctuating level of consciousness, hypotension, tachycardia, urinary retention</p> <p>In severe poisoning: seizures, coma, respiratory depression,</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18 and 41).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1). Be cautious for signs of fluid overload in patients with cardiac disease.</li> <li>• Give repeat dose of activated charcoal provided that bowel sounds are present and the airway is protected.</li> <li>• <i>Cardiac monitoring</i> and perform 12-lead ECG.</li> <li>• If still in shock after fluid resuscitation, give vasopressors</li> </ul>

	and arrhythmias	<p>(see Section 3.1.4).</p> <ul style="list-style-type: none"> <li>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).</li> <li>For a patient who develops seizures, give diazepam as a first-line treatment, followed by phenobarbital if necessary (see Quick Check page 27 and Section 3.5). Do not give phenytoin.</li> </ul>
<p><b>Tricyclic antidepressants, e.g. amitriptyline, imipramine</b></p> <p>Toxic dose: despiramine, trimipramine, and nortriptyline &gt;2.5 mg/kg</p> <p>Protriptyline &gt;1 mg/kg</p> <p>All others &gt;5 mg/kg</p>	<p><b>Cardiovascular:</b> hypotension, dysrhythmias, cardiac arrest</p> <p><b>Central nervous system:</b> excitation, restlessness, myoclonus, hyperreflexia, disorientation, confusion, hallucination, coma, seizures</p> <p><b>Anticholinergic:</b> hyperthermia, urinary retention, paralytic ileus, mydriasis, dry mouth, flushing of skin</p>	<ul style="list-style-type: none"> <li>Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>Give activated charcoal if patient presents within 2 hours after ingestion, provided airway is protected.</li> <li>Monitor blood gases, correct hypoxia.</li> <li><i>Cardiac monitoring</i> and perform 12-lead ECG, measure the QRS width.</li> <li>If shock persists, give vasopressors (see Section 3.1.4) – <i>norepinephrine is preferred</i> or give epinephrine.</li> <li>Correct acidosis if can measure bicarbonate.</li> <li>Sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg) should be given to all patients with QRS prolongation (&gt;120 millisecond) or arrhythmias. <i>Give repeated boluses of sodium bicarbonate to keep QRS at &lt;120 millisecond and arterial pH between 7.45–7.55.</i></li> <li>Seizures should be treated with diazepam (see Quick Check page 27 and Section 3.5). Avoid the use of phenytoin.</li> <li>Following seizures, a dose of bicarbonate is suggested to correct acidosis and reduce risk of further toxicity.</li> </ul>
<p><b>Chloroquine</b></p> <p>Toxic dose: &gt;20 mg/kg is toxic</p>	<p>Nausea, vomiting, diarrhoea, and abdominal pain, dizziness, convulsions, coma, hypotension, arrhythmias, sudden cardiac arrest</p>	<ul style="list-style-type: none"> <li>Manage airway and assist ventilation, as needed (see Quick Check pages 15-18).</li> <li>If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>If shock persists, give vasopressors (see Section 3.1) – epinephrine is preferred.</li> <li>Give activated charcoal if airway is protected and within 1 hour of ingestion.</li> <li>Observe for a minimum of 12 hours, monitor vital signs.</li> <li>Monitor blood glucose, urea, electrolytes, blood gases.</li> <li><i>Cardiac monitoring</i> and perform 12-lead ECG, and measure the QRS width. If &gt;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 &lt;120 millisecond and arterial pH between 7.45–7.55.</li> <li>Correct hypokalaemia if &lt;3 to no more than 3.5 (beware of rebound increase in potassium).</li> <li>Seizures should be treated with diazepam (see Quick Check page 27 and Section 3.5). Avoid barbiturates as these may precipitate cardiac arrest. Avoid phenytoin.</li> </ul>
<p><b>Quinine</b></p> <p>Toxic dose: &gt;15 mg/kg could be toxic</p>	<p>Tinnitus, deafness, abdominal pain, visual changes, blindness, ataxia, coma, convulsions, arrhythmia, torsade de pointes, hypoglycaemia</p>	<ul style="list-style-type: none"> <li>Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>Give activated charcoal if airway is protected.</li> <li>In severe cases, provided airway is protected, give repeat doses of activated charcoal.</li> <li>Monitor urea, electrolytes, blood glucose, blood gases.</li> <li><i>Cardiac monitoring</i> and perform 12-lead ECG and measure</li> </ul>

		<p>the QRS width – if &gt;120 milliseconds there is a risk of cardiac arrhythmias.</p> <ul style="list-style-type: none"> <li>• If shock persists, give vasopressors to treat hypotension (see Section 3.1).</li> <li>• 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 &lt;120 millisecond and <i>arterial pH between 7.45–7.55</i>.</li> <li>• Treat torsade de pointes with magnesium sulfate 1–2 grams IV.</li> <li>• Seizures should be treated with diazepam (see Quick Check page 27 and Section 3.5). Avoid barbiturates and phenytoin.</li> </ul>
<p><b>Digoxin, oleander (<i>Thevetia peruviana</i>, <i>Nerium oleander</i>, <i>Digitalis</i> spp)</b></p> <p>Toxic dose digoxin: ≥3 mg (produces toxic level in adults). Note: ≥10 mg is often lethal.</p> <p>Patients on digoxin therapy are more susceptible in overdose.</p>	<p>Nausea, vomiting, abdominal pain, visual changes, headache, fatigue, coma, Heart block and tachy – or brady– arrhythmias</p>	<ul style="list-style-type: none"> <li>• Give a dose of activated charcoal if presenting within 1 hour.</li> <li>• Multiple doses of activated charcoal (every 4 hours for 24 hours) may be considered in the absence of digoxin antibodies.</li> <li>• Monitor ECG.</li> <li>• Monitor electrolytes at least every 6 hours and correct if necessary (particularly potassium).</li> <li>• <i>Monitor blood gases and pH and correct metabolic acidosis with sodium bicarbonate.</i></li> <li>• <i>Digoxin antibodies</i> should be given, if available, for the following indications: <ul style="list-style-type: none"> <li>○ serum potassium &gt;6 mmol/l</li> <li>○ bradycardia or heart block with hypotension</li> <li>○ tachyarrhythmia with hypotension.</li> </ul> </li> <li>• Treat hyperkalaemia: if K &gt;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.</li> <li>• Give atropine for bradycardia or heart block associated with hypotension.</li> <li>• 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.</li> <li>• Ventricular tachyarrhythmia – give magnesium sulfate 2 g IV over 20 minutes in an adult initially. If no response consider lidocaine.</li> </ul>



<p><b>Antidiabetic agents: hypoglycaemic agents</b> (if metformin see separate entry)</p> <p>Toxic dose: for sulphonylurea and insulin, more than the usual recommended dose</p>	<p>Sweating, agitation, giddiness, confusion, coma. Delayed onset of hypoglycaemia possible, also recurrent hypoglycaemia</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• 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 &lt;3 mmol/l (see Section 3.4.2).</li> <li>• 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.</li> <li>• Give activated charcoal if airway is protected and it is within 1 hour of ingestion of an oral hypoglycaemic.</li> <li>• Check blood sugar and monitor every 1 to 2 hours.</li> <li>• Continue monitoring for at least 24 hours.</li> <li>• Monitor level of consciousness using AVPU.</li> <li>• 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).</li> <li>• Do not give prophylactic dextrose without symptoms or a low blood glucose.</li> <li>• <i>Octreotide</i>, if available, could be given to patients whose blood sugar does not normalise after above measures.</li> </ul>
<p><b>Antidiabetic agents: metformin</b></p> <p>Toxic dose: variable response</p>	<p>Lactic acidosis (does not cause hypoglycaemia)</p>	<ul style="list-style-type: none"> <li>• Give activated charcoal if airway is protected and it is within 2 hours of ingestion.</li> <li>• <i>Monitor blood gases and lactate.</i></li> <li>• <i>If acidotic, ensure that patient is adequately ventilated and perfused and give IV sodium bicarbonate.</i></li> </ul>
<p><b>Opioids</b> e.g. morphine, diamorphine (heroin), raw opium, codeine, methadone, dextropropoxyphene, oxycodone, tramadol</p> <p>Toxic dose: variable</p>	<p>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</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• Give naloxone (see Quick Check page 26 and Section 3.6).</li> <li>• Give activated charcoal if within 2 hours of ingestion and airway is protected.</li> <li>• <i>Cardiac monitoring and perform 12-lead ECG if dextropropoxyphene taken. If QRS &gt;120 millisecond, give sodium bicarbonate (50 ml of 8.4% or 1–2 mmol/kg).</i></li> <li>• For serotonin syndrome, see SSRIs.</li> </ul>
<p><b>Paracetamol (acetaminophen)</b> Note: Risk of toxicity is increased in patients taking enzyme-inducing drugs, e.g. carbamazepine, phenobarbital, phenytoin, primidone, rifampicin.</p>	<p>Vomiting, right upper quadrant abdominal pain, hepatic encephalopathy</p>	<ul style="list-style-type: none"> <li>• Give activated charcoal if less than 2 hours after ingestion.</li> <li>• Obtain blood level if possible; however, the sample should be taken at 4 hours or more after the ingestion.</li> <li>• 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.</li> <li>• See paracetamol nomogram below.</li> <li>• If paracetamol level not available, base treatment on ingested dose: <ul style="list-style-type: none"> <li>○ 75 mg/kg if high risk (nutritionally deficient, acute starvation, AIDS, alcoholic, on enzyme-inducing drugs);</li> <li>○ 150 mg/kg if not high risk.</li> </ul> </li> <li>• Give acetylcysteine IV or orally: <ul style="list-style-type: none"> <li>○ 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.</li> <li>○ 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,</li> </ul> </li> </ul>

		<p>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.</p> <ul style="list-style-type: none"> <li>○ Check liver function tests, INR (prothrombin time), creatinine and BUN, and electrolytes.</li> </ul>
<p><b>Selective serotonin reuptake inhibitors (SSRI) e.g. fluoxetine, paroxetine, sertraline</b></p> <p>Toxic dose: variable</p>	<p>Nausea, vomiting, dry mouth, tachycardia, drowsiness, coma</p> <p>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</p>	<ul style="list-style-type: none"> <li>• Give activated charcoal within 2 hours of ingestion.</li> <li>• Perform 12-lead ECG.</li> <li>• Manage serotonin syndrome: <ul style="list-style-type: none"> <li>○ Monitor urea, electrolytes, CK, and renal function.</li> <li>○ <i>Cardiac monitoring</i> and perform 12-lead ECG.</li> <li>○ Give IV fluids to maintain good urine output. If in shock, give rapidly (see Quick Check page 18).</li> <li>○ If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>○ Sedate with diazepam if agitated or if having seizures (see Quick Check page 27).</li> <li>○ Hyperthermia (&gt;40.5°C) should be treated with rapid cooling (see Section 8.1).</li> <li>○ <i>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.</i></li> <li>○ In cases of severe hyperthermia (&gt;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.</li> </ul> </li> </ul>
<p><b>Monoamine oxidase inhibitors (MAOI), e.g. phenelzine, tranylcypromine</b></p> <p>Toxic dose: In adults &gt;5 tablets of any preparation can be toxic.</p>	<p>Anxiety, vomiting, restlessness, confusion, flushing, sweating, hypertension, hyperthermia, seizures</p> <p>Note: MAOIs interact with a wide range of drugs and some foods to cause severe hypertension. They have a life-threatening interaction with pethidine.</p> <p>Serotonin syndrome may occur.</p>	<ul style="list-style-type: none"> <li>• Give activated charcoal if airway is protected and within 2 hours of ingestion.</li> <li>• If symptomatic, monitor pulse, blood pressure, temperature, respiratory rate, and AVPU every 30 minutes.</li> <li>• Check urea and electrolytes and full blood count.</li> <li>• Check creatine kinase activity in all symptomatic patients.</li> <li>• 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.</li> <li>• Give diazepam for agitation or seizures (see Quick Check pages 29 and 19).</li> <li>• Hyperthermia (&gt;40.5°C) should be treated with rapid cooling (see Section 8.1).</li> <li>• In cases of severe hyperthermia (&gt;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 <i>transfer to a hospital with mechanical ventilator.</i></li> <li>• If convulsions unresponsive to first- and second-line antiepileptics (see Quick Check page 27 and Section 3.5), and advanced airway management is feasible, consider anaesthetic (e.g. thiopental or propofol).</li> <li>• See also management of serotonin syndrome under SSRIs.</li> </ul>
<p><b>Iron (ferrous salts)</b></p> <p>Toxic dose: &gt;40 mg/kg elemental iron, or if there is persistent vomiting or diarrhoea</p> <p>Approximate elemental iron content of ferrous salts is:</p>	<p>Vomiting and diarrhoea – often bloody; drowsiness, lethargy, coma, shock, convulsions, liver failure Delayed pyloric stenosis.</p> <p>Note: Initial symptoms may be followed by apparent recovery, then a relapse. Therefore all symptomatic patients should be observed for</p>	<ul style="list-style-type: none"> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>• If more than 40 mg/kg body weight of elemental iron ingested then: <ul style="list-style-type: none"> <li>○ 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.)</li> </ul> </li> <li>• If within 4 hours of ingestion, initiate whole bowel irrigation with osmotically balanced polyethylene glycol-electrolyte solution (2 litres per hour for adults and 0.5 litres/hour in children – see above).</li> <li>• If WBI is not available, give gastric lavage (with a wide-bore</li> </ul>

<ul style="list-style-type: none"> <li>ferrous fumarate 210 mg (68 mg iron)</li> <li>ferrous gluconate 300 mg (35 mg iron)</li> <li>ferrous succinate 100 mg (35 mg iron)</li> <li>ferrous sulfate 300 mg (60 mg iron)</li> <li>dried ferrous sulfate 200 mg (65 mg iron)</li> </ul> <p>Note: Check label to make sure.</p>	<p>minimum of 12 hours.</p>	<p>tube) within 1 hour of ingestion or if radiography reveals tablets in the stomach.</p> <ul style="list-style-type: none"> <li>Monitor urea and electrolytes, WBC, blood glucose, LFTs, whole blood clotting time, renal function, and blood gases.</li> <li>If possible, check iron level 4 hours post-ingestion and give deferoxamine if the serum iron level is over 90 µmol/l.</li> <li>If iron levels are not available, give deferoxamine if patient has: <ul style="list-style-type: none"> <li>taken 60 mg/kg elemental iron (see table of elemental iron content or check label), or</li> <li>any of the following: metabolic acidosis, hypotension, shock, coma, convulsions.</li> </ul> </li> <li>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.</li> </ul>
<p><b>Lithium</b></p> <p>Toxic dose: Acute overdose is &gt;2 g in adults Note: Acute overdose is usually well-tolerated.</p> <p>Acute-on-chronic: any amount more than the usual daily dose could be toxic</p>	<p>Mild toxicity: nausea, vomiting, diarrhoea, fine tremor</p> <p>Moderate toxicity: confusion, fasciculation, and hyperreflexia</p> <p>Severe toxicity: coma, convulsions and cardiac arrhythmias</p>	<ul style="list-style-type: none"> <li>Acute overdose with normal renal function – no gut decontamination is needed.</li> <li>Overdose in patient on lithium therapy (taking sustained-release) or with impaired renal function – consider the use of whole bowel irrigation.</li> </ul> <p><b>All:</b></p> <ul style="list-style-type: none"> <li>If hypotension or shock, give rapid IV fluids (see Quick Check page 25 and Section 3.1) – NS preferred. Titrate to ensure good urine output.</li> <li>Cardiac monitoring and perform 12-lead ECG.</li> <li>Monitor renal function.</li> <li>Monitor and correct electrolyte imbalance.</li> <li>Seizures should be treated with diazepam (see Quick Check page 27 and Section 3.5).</li> <li>Haemodialysis for patients with coma, convulsions, respiratory failure, or acute renal failure.</li> </ul>
<p><b>Phenobarbital</b></p> <p>Toxic dose: variable response</p>	<p>Drowsiness, lethargy, slurred speech, nystagmus, coma, respiratory depression, hypotension, tachycardia, hypothermia</p>	<ul style="list-style-type: none"> <li>Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>If hypotension or shock, give IV fluids rapidly (see Quick Check page 18 and Section 3.1).</li> <li>If symptomatic, give repeat doses of activated charcoal provided bowel sounds are present and airway is protected.</li> <li>Manage hypothermia.</li> <li>Give supportive care.</li> <li>Monitor pulse, respiratory rate, BP, temperature, AVPU.</li> <li>Haemodialysis if ileus, failure to respond to supportive care.</li> </ul>
<p><b>Theophylline</b></p> <p>Toxic dose &gt;20 mg/kg</p>	<p>Vomiting (may be protracted), haematemesis, agitation, tachycardia, hypertension, hypotension, hyperventilation, cardiac dysrhythmias, seizures, acid-base disturbance, hypokalaemia, rhabdomyolysis, respiratory arrest</p>	<ul style="list-style-type: none"> <li>Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>Give multiple dose activated charcoal.</li> <li>Give antiemetic such as metoclopramide (may need large dose) or ondansetron.</li> <li>Monitor electrolytes and cautiously correct hypokalaemia if &lt;3 to no more than 3.5 (beware of rebound increase in potassium).</li> <li>Monitor vital signs.</li> <li>Cardiac monitoring and perform 12-lead ECG.</li> <li>Treat SVT if it is causing haemodynamic compromise. Give a beta-blocker (preferably beta-1 selective blockers, such as esmolol, metoprolol, but beware of bronchospasm in asthmatics and those with COPD – in these cases consider verapamil or adenosine).</li> </ul>

		<ul style="list-style-type: none"> <li>• For ventricular arrhythmias causing haemodynamic compromise, use magnesium or lidocaine. If severe, treat with DC cardioversion.</li> <li>• Diazepam for seizures (see Quick Check page 27). 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.</li> <li>• Refer for haemodialysis for life-threatening toxicity.</li> </ul>
<b>Warfarin</b>	See anticoagulant pesticides further down.	
<b>Pesticides</b>		
<b>Aluminium or zinc phosphide</b>	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	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>• If shock persists after fluid resuscitation, start vasopressors (see Section 3.1).</li> <li>• <i>Cardiac monitoring</i> and perform 12-lead ECG.</li> <li>• Monitor for and correct hypoglycaemia.</li> <li>• Monitor for and correct electrolyte imbalance.</li> <li>• <i>Give sodium bicarbonate (1–2 mmol/kg) for metabolic acidosis.</i></li> <li>• Magnesium sulfate may improve cardiac output – give 1 g 6 hourly.</li> <li>• Other supportive care as required.</li> <li>• Monitor renal and hepatic function.</li> </ul>
<b>Anticoagulant rodenticides (rat and mouse killers) or anticoagulant therapy (warfarin)</b>	Bleeding: spontaneous bruising, haematomas, haematuria, rectal bleeding and haemorrhage into any internal organ  Delayed onset and may be prolonged	<ul style="list-style-type: none"> <li>• Monitor INR at 24 and 48 hours.</li> <li>• If poisoning and INR mild to moderately elevated without major bleeding, give oral vitamin K 10–20 mg.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• In case of long-acting anticoagulant rodenticides, vitamin K therapy may be needed for several weeks. The dose should be titrated to response.</li> </ul>
<b>Chlorophenoxy herbicides</b> e.g. MCPA, 2, 4-D	Burning pain in the mouth and epigastrium. Muscle pain and rigidity, muscle twitching, agitation, seizures, hyperpyrexia, rhabdomyolysis leading to renal failure. Metabolic acidosis, hyperventilation, tachycardia, hypotension, ECG abnormalities, prolonged coma	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1). Titrate to maintain adequate urine output.</li> <li>• Monitor <i>blood gases</i>, renal and liver function, <i>creatinine kinase</i>.</li> <li>• Look for dark-coloured urine (<i>check for myoglobin</i>).</li> <li>• <i>Cardiac monitoring</i> and perform 12-lead ECG.</li> <li>• In symptomatic cases, alkalinise the urine to pH&gt;7.5 with IV sodium bicarbonate. Suggested regimen: sodium bicarbonate 225 mmol (225 ml of an 8.4% solution)</li> </ul>

		<p>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.</p> <ul style="list-style-type: none"> <li>• Treat rhabdomyolysis with fluid replacement to maintain good renal output together with urinary alkalinisation.</li> <li>• In severe poisoning, refer for haemodialysis, if available.</li> </ul>
<b>Paraquat</b>	<p>Early stages (hours to a few days): burning pain of the mouth, lips, and tongue. Gastrointestinal corrosion leading to painful swallowing (odynophagia), nausea, vomiting, abdominal pain. Following large ingestions: coma convulsions, cardiovascular collapse, and shortness of breath. Burning sensation of the skin.</p> <p>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.</p> <p>Later (weeks). Chronic hypoxia due to progressive lung fibrosis. Renal failure.</p>	<ul style="list-style-type: none"> <li>• If shock, give rapid IV fluids (see Quick Check page 25 and Section 3.1). Titrate to maintain adequate urine output.</li> <li>• Avoid giving supplemental oxygen if possible as this worsens lung injury. Oxygen may be needed in late stage as fibrosis develops.</li> <li>• Give activated charcoal or Fullers earth for patients presenting within 2 hours.</li> <li>• Insert a nasogastric tube as early as possible to facilitate feeding.</li> <li>• <i>Confirm systemic absorption with urine dithionite test, if available.</i></li> <li>• Assess baseline electrolytes, creatinine, FBC, and blood gases, and correct all reversible abnormalities.</li> <li>• Screen and treat for sepsis – monitor temperature, check WBC, blood cultures when indicated. Start empirical antibiotics (see Section 3.1.5).</li> <li>• Give IV fluids to maintain good renal output.</li> <li>• Liberal pain relief and sedation with opioids and benzodiazepines as needed.</li> </ul>
<b>Propanil</b>	<p>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.</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25).</li> <li>• Give activated charcoal.</li> <li>• Monitor blood gases with <i>co-oximeter</i> (Note: A pulse oximeter will give a misleading result in the presence of methaemoglobin).</li> <li>• <i>Cardiac monitoring</i> until patients maintain stable cardiovascular status.</li> <li>• Check haemoglobin level to detect anaemia due to haemolysis.</li> <li>• Patients who present with depressed level of consciousness tend to have poor prognosis. These patients should be closely observed.</li> <li>• <i>Check methaemoglobin concentration, if possible.</i></li> <li>• 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.</li> <li>• If the patient <i>has a methaemoglobin level of &gt;20–30%</i> or is symptomatic (confusion, tachycardia, hypotension, chest pain, cyanosis) in the absence of methaemoglobin level, treat with methylthionium chloride (methylene blue). <ul style="list-style-type: none"> <li>○ Give a loading dose of methylthionium 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</li> </ul> </li> </ul>

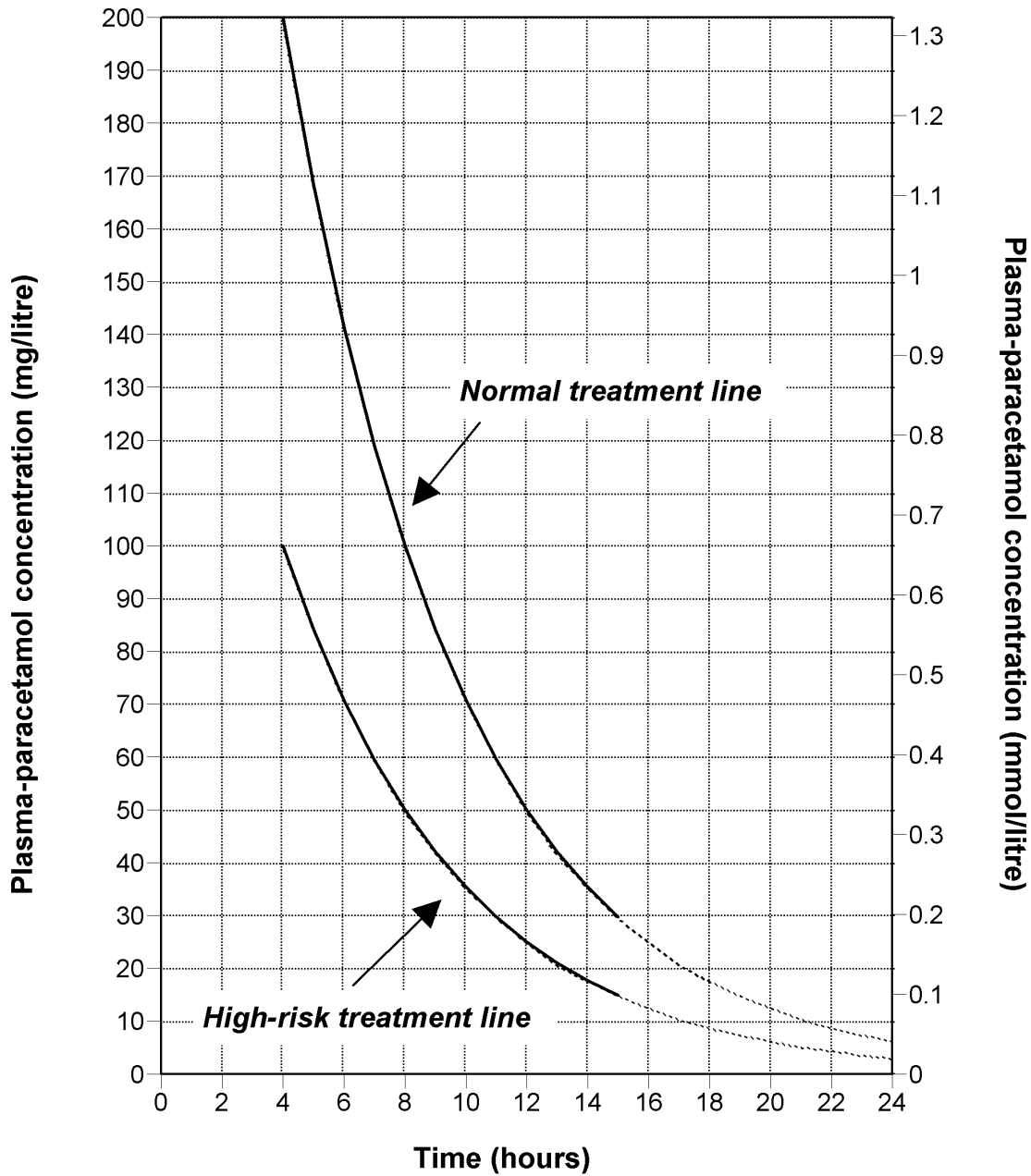
		<p>further treatment with methylthionium chloride.</p> <ul style="list-style-type: none"> <li>○ After 6 hours <i>recheck methaemoglobin level</i>, clinical status, and blood gases. Then, if necessary repeat the dose of 1 mg/kg. Continue to repeat 6 hourly while patient is symptomatic <i>or methaemoglobin level remains &gt;30%</i>.</li> <li>○ May need methylthionium chloride for 2–3 days.</li> <li>○ If patient is deteriorating on this therapy, consider possibility of G6PD deficiency or haemolysis.</li> <li>○ If methylthionium chloride is not available or patient has G6PDD, give IV or oral ascorbic acid 500 mg every 12 hours.</li> <li>○ If patient continues to deteriorate consider exchange transfusion.</li> </ul>
<b>Other chemicals</b>		
<b>Corrosive substances</b>	<p>Pain in mouth, throat, epigastrium, or abdomen. Dysphagia, hypersalivation (drooling), hoarse voice, and stridor. Gastrointestinal bleeding and haematemesis. Perforation, shock. Aspiration pneumonia, airway obstruction.</p> <p><b>Acids</b> cause coagulation necrosis. Strong acetic acid also causes haemolysis and renal failure.</p> <p><b>Alkalis</b> cause liquefaction necrosis, which may result in extensive penetration of tissue.</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If stridor, consider advanced airway management (see Quick Check pages 41-48) and surgical airway (see Quick Check page 36 and Section 3.2.2).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 14–16).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 48 and Section 3.1).</li> <li>• Do NOT induce vomiting or give gastric lavage or activated charcoal.</li> <li>• Do NOT attempt neutralization.</li> <li>• Give adequate pain relief with IV opioids.</li> <li>• <i>Refer all patients for assessment of gastrointestinal injury by cautious endoscopy between 6–24 hours of ingestion.</i></li> <li>• If grade III injury, put nasojejunal tube under endoscopy or perform feeding jejunostomy.</li> <li>• Monitor pH, fluid, and electrolyte status, haemoglobin and clotting time.</li> <li>• If possible perform abdominal and chest X-ray to assess for aspiration and perforation.</li> <li>• Patients with acid ingestion: <i>correct metabolic acidosis with sodium bicarbonate.</i></li> <li>• Consider surgical intervention for any signs of perforation.</li> </ul>
<b>Ethylene glycol</b>	<p>Drunken-state, nausea, vomiting, metabolic acidosis, renal failure, calcium oxalate crystals in urine, hypocalcaemia, seizures, coma, tetany</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1) and titrate to maintain good urine output.</li> <li>• 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.</li> <li>• Continue oral administration of alcohol drink as follows.</li> <li>• Maintenance dose: <ul style="list-style-type: none"> <li>○ 0.2 ml/kg/hour (non-drinker)</li> <li>○ 0.46 ml/kg/hour (heavy alcohol user).</li> </ul> </li> <li>• Maintenance dose during dialysis: <ul style="list-style-type: none"> <li>○ 0.5 ml/kg/hour (non-drinker)</li> <li>○ 0.77 ml/kg/hour (heavy alcohol user).</li> </ul> </li> <li>• May need to give alcohol for 2–3 days.</li> <li>• Correct metabolic acidosis with sodium bicarbonate (may need high doses) and fluid replacement. Important to monitor electrolytes for hypernatraemia and</li> </ul>

		<p>hypokalaemia.</p> <ul style="list-style-type: none"> <li>• To confirm diagnosis, if possible, check osmolar gap, anion gap, and serum ethanol. In the early stages a gap of &gt;19 mOsm/kgH<sub>2</sub>O may be indicative of ethylene glycol poisoning if serum ethanol is 0 (if not, subtract 24 mOsm/kgH<sub>2</sub>O per 100 mg/dl of ethanol). Later a raised anion-gap metabolic acidosis develops.</li> <li>• <i>Haemodialysis if there is a severe metabolic acidosis (pH &lt;7.25 or base deficit &gt;15 mm despite buffer) or renal failure.</i> Consider peritoneal dialysis if haemodialysis is not available.</li> <li>• <i>Fomepizole</i> 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.</li> <li>• If hypocalcaemia – cautious correction with calcium gluconate.</li> <li>• 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.</li> </ul>
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<p><b>Methanol</b></p>	<p>Non-specific features: GI symptoms (nausea, vomiting, abdominal pain), chest pain, dyspnoea.</p> <p>More specific features: metabolic acidosis, visual disturbances of all kinds leading to blindness, coma.</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1) and titrate to maintain good urine output.</li> <li>• 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.</li> <li>• Continue oral administration of alcohol drink as follows.</li> <li>• Maintenance dose: <ul style="list-style-type: none"> <li>○ 0.2 ml/kg/hour (non-drinker)</li> <li>○ 0.46 ml/kg/hour (heavy alcohol user).</li> </ul> </li> <li>• Maintenance dose during dialysis: <ul style="list-style-type: none"> <li>○ 0.5 ml/kg/hour (non-drinker)</li> <li>○ 0.77 ml/kg/hour (heavy alcohol user).</li> </ul> </li> <li>• May need to give alcohol for 2–3 days.</li> <li>• Correct metabolic acidosis with sodium bicarbonate and fluid replacement.</li> <li>• To confirm diagnosis, if possible, check osmolar gap, anion gap and serum ethanol). In the early stages a gap of &gt;19 mOsm/kgH<sub>2</sub>O may be indicative of ethylene glycol poisoning if serum ethanol is 0 (if not subtract 24 mOsm/kgH<sub>2</sub>O per 100 mg/dl of ethanol). Later a raised anion-gap metabolic acidosis develops.</li> <li>• Refer for haemodialysis if there is a severe metabolic acidosis (pH &lt;7.25 or base deficit &gt;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.</li> <li>• Folinic acid 50 mg IV every 4 hours for 6 doses.</li> </ul>
<p><b>Petrol, kerosene and other volatile hydrocarbons – ingestion</b></p>	<p>Nausea, vomiting, abdominal pain, haematemesis, coughing, shortness of breath, tachypnoea, pulmonary oedema, coma.</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen (see Quick Check pages 19-22).</li> <li>• If hypotension or shock, give IV fluids rapidly (see Quick Check page 25 and Section 3.1).</li> <li>• Do NOT induce vomiting, attempt gastric lavage, or give activated charcoal.</li> <li>• If acute lung injury, see Section 3.2.</li> <li>• Observe for at least 6 hours for respiratory symptoms. If asymptomatic, discharge.</li> <li>• Immediate chest X-ray if symptomatic.</li> </ul>



## Paracetamol nomogram<sup>7</sup>



<sup>7</sup> 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
<ul style="list-style-type: none"> <li>• acephate</li> <li>• acetamiprid</li> <li>• azadirachtin</li> <li>• beta-cyfluthrin</li> <li>• bispribac</li> <li>• carbendazim</li> <li>• chlorfluazuron</li> <li>• chlorothalonil</li> <li>• cyhalothrin</li> <li>• cypermethrin</li> <li>• deltamethrin</li> <li>• d-trans allethrin</li> <li>• edifenphos</li> <li>• etofenprox</li> <li>• fenoxaprop-ethyl</li> </ul>	<ul style="list-style-type: none"> <li>• fenvalerate</li> <li>• hexaconazole</li> <li>• imidacloprid</li> <li>• mancozeb</li> <li>• permethrin</li> <li>• propiconazole</li> <li>• propineb</li> <li>• pyrethroids (others)</li> <li>• tebuconazole</li> <li>• tebufenozide</li> <li>• thiophanate</li> <li>• thiram</li> </ul>	<ul style="list-style-type: none"> <li>• antibiotics</li> <li>• diuretics and ACE inhibitors</li> <li>• oral contraceptive pills</li> <li>• nonsteroidal anti-inflammatory agents (excluding salicylates and mefenamic acid)</li> <li>• acid suppressants (proton pump inhibitors, H<sub>2</sub> receptor blockers)</li> <li>• lipid-lowering agents</li> </ul>

### 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
<b>Carbon monoxide</b>	<p>Mild to moderate toxicity: dizziness, headache, nausea, vomiting, weakness, and confusion.</p> <p>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.</p> <p>There may be delayed neuropsychiatric complications.</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 12–13 and 31).</li> <li>• 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.</li> <li>• <i>Cardiac monitoring</i> and perform 12-lead ECG.</li> <li>• Monitor urea, electrolytes and renal function, <i>blood gases, and pH</i>.</li> <li>• <i>Measure carboxyhaemoglobin level, if possible</i>.</li> <li>• Treat seizures (see Section 3.5).</li> <li>• Give supportive care.</li> <li>• If cerebral oedema is suspected, consider advanced airway management for hyperventilation (see Quick Check page 31).</li> <li>• The benefits of hyperbaric oxygen therapy in preventing neurological complications are uncertain.</li> <li>• Check if there are other victims.</li> </ul>
<b>Chlorine</b>	<p>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.</p> <p>Severe poisoning: upper airway oedema, laryngospasm, severe non-cardiogenic pulmonary oedema, pneumonia, persistent hypoxemia, respiratory failure, acute lung injury.</p>	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• Consider early intubation if stridor is present.</li> <li>• If severe respiratory distress or SpO<sub>2</sub> &lt;90, give oxygen.</li> <li>• Give salbutamol for wheezing (see Quick Check pages 23-24).</li> <li>• Irrigate the eyes.</li> <li>• Check peak flow.</li> <li>• Do chest X-ray if symptomatic.</li> <li>• Monitor SpO<sub>2</sub> and electrolytes.</li> <li>• Treat non-cardiogenic pulmonary oedema (see Section 3.2.3).</li> </ul>

<b>Cyanide</b>	Headache, dyspnoea, confusion, coma, convulsions, cardiovascular collapse, metabolic acidosis	<ul style="list-style-type: none"> <li>• Manage airway and assist ventilation as needed (see Quick Check pages 15-18).</li> <li>• Give high-flow oxygen aiming at 100% (see Quick Check pages 19-22 and Section 3). Give regardless of oxygen saturation and do not titrate.</li> <li>• Measure lactate.</li> <li>• <i>Correct persistent metabolic acidosis with sodium bicarbonate.</i></li> <li>• Severe toxicity (comatose patients):             <ul style="list-style-type: none"> <li>◦ Give sodium nitrite: 300 mg (10 ml of 3% solution) by slow IV injection over 5–20 minutes.</li> <li>◦ Then give sodium thiosulphate: 12.5 g (50 ml of 25% solution) by slow IV injection over 10 minutes.</li> <li>◦ If no response after 30 minutes, give further dose of sodium nitrite 150 mg followed by sodium thiosulphate 12.5 g.</li> </ul> </li> <li>• Alternatively, hydroxocobalamin 5 grams IV over 15 minutes can be given, if available.</li> <li>• Moderate toxicity (recovered from a period of unconsciousness, convulsions, cyanosis), smoke inhalation victim, or a presumed cyanide poisoning:             <ul style="list-style-type: none"> <li>◦ give sodium thiosulphate 12.5 g (83 ml of 15% solution) by slow IV injection over 10 minutes.</li> </ul> </li> </ul>
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### 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.<sup>8</sup> Soothing lotions such as calamine can be applied to irritated skin once decontamination has been done.

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<sup>8</sup> *Public health response to biological and chemical weapons*. WHO Guidance, 2004. Available at <http://www.who.int/csr/deliberatedemics/biochemguide/en/>



## 3.9 Snake-bite<sup>1,2,3</sup>

<p>3.9.1 Snake-bite assessment</p> <ul style="list-style-type: none"><li>– Establish the circumstances of the bite</li><li>– Clinical features and diagnosis</li><li>– Table: Some snakes of medical importance and major features of envenomation</li></ul>	<p>3.9.2 Snake-bite treatment</p> <ul style="list-style-type: none"><li>– Treatment of systemic envenomation</li><li>– Manage complications</li><li>– Manage local necrosis and compartment syndrome</li><li>– Manage green (HAREU SARPA) and mountain (ADHO SARPA) pit viper envenomation</li><li>– Manage muscle weakness (neurotoxicity)</li><li>– Manage bleeding from clotting factor defects</li><li>– Important myths</li></ul>
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Snake venoms vary considerably in their effect, ranging from venoms that produce no effects or minimal effects to venoms that are potentially life-threatening. Usually, there is a history of snake-bite, but snake-bite should also be considered in any patient with severe pain or swelling of a limb of unknown origin and when a patient with any unexplained illness presents with bleeding or abnormal neurological signs.

Seventeen of the 89 species of snakes found in Nepal are venomous<sup>4</sup> (7 pit viper species, 6 krait species, 2 cobra species and 1 each coral and Russel's viper species). Around 15,000 snake bite cases occur annually of which about 10 percent are poisonous bites. The mortality rate is about 10 percent among poisonous bite cases. The 26 Tarai districts are highly affected. In the last eight years between 1 and 131 deaths have been reported from poisonous snake bites each year. The free distribution of anti-snake venom serum (ASVS) began in 1999/2000. Indian quadrivalent ASVS is provided.<sup>5</sup>

The highest recorded focal incidence, for Nepal (and for the whole world<sup>3</sup>), was 162 snakebite deaths/100 000/year, determined in the Eastern Terai.<sup>6</sup> In this community-based study, only 20% of the deaths occurred in hospitals. Increased risk of fatality was associated with being bitten inside the house while resting between midnight and 6 AM, suggesting bites by the common krait (*Bungarus caeruleus*). Other risk factors were an initial visit to a traditional healer and delayed transport to hospital.

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### 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 Nepal, <10% of the suspected snakebite develops features suggestive of envenomation. Even, in the case of venomous snakebite, venom may not be necessarily injected and may result in dry bite (i.e. insufficient venom was injected to cause clinical effects). The exact proportion of drybite is not known in Nepal.

<sup>1</sup> *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>

<sup>2</sup> *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](http://www.searo.who.int/LinkFiles/BCT_snake_bite_guidelines.pdf)

<sup>3</sup> *Guidelines for the management of snake-bites*. 2<sup>nd</sup> edition, WHO Regional Office for South-East Asia, 2016.

<sup>4</sup> Sharma SK, Pandey DP, Shah KB, Tillack F, Chappuis F, Thapa CL, Alirol E, Kuch U. *Venomous snakes of Nepal: a photographic guide*. Kathmandu, Nepal: B. P. Koirala Institute of Health Sciences, P. 78 [English edition], ISBN 978-9937-2-6003-9.

<sup>5</sup> Nepal Annual Report 2016-2017

<sup>6</sup> Sharma SK, Chappuis F, Jha N, Bovier PA, Loutan L, Koirala S. Impact of snakebites and determinants of fatal outcomes in southeastern Nepal. *Am J Trop Med Hyg*. 2004 Aug;71(2):234-8.

If there is any doubt, observe the patient closely.

**If a bite occurred, consider the following:**

- time since the bite
- Can the snake be identified?  
Local knowledge is important to help identify the correct species. Also, some snakes change considerably in appearance during their life cycle. If there is any doubt, treat the bite as if it is from an unknown species.
- Are there any obvious symptoms of envenoming?  
Particular species are associated with characteristic clinical syndromes (see Table: Some snakes of medical importance and major features of envenomation).

**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 2–4).
- Examine the site of the bite for signs such as fang marks, local necrosis, blister formation, or bleeding.
- Regional lymph nodes may be tender or enlarged.
- Local swelling may gradually extend up the bitten limb. This may lead to a compartment syndrome.
- Non-specific symptoms of systemic envenomation include nausea, vomiting, abdominal pain, dizziness, and headache.
- Assess for bleeding
  - external, from gums, wounds, or ulcers, needle puncture sites;
  - internal, especially intracranial, haematuria, and a prolonged whole blood clotting time. The 20-minute whole blood clotting time test (see below) should be performed routinely. Also see Sections 7.2.15 and 10.15.
- Assess for signs of neurotoxicity, including:
  - ophthalmoplegia (ptosis), double vision, difficulty swallowing (bulbar palsy) and talking, muscle weakness, difficulty breathing, and flaccid paralysis with respiratory failure.
- Assess for signs of muscle breakdown, including muscle pains and black urine (a urine dipstick test positive for blood is indicative of muscle breakdown resulting in myoglobinuria).

It is difficult to give advice that can be generalized to all regions and situations, and local knowledge and adaptation of the management plan are important.<sup>7</sup>

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.

<sup>7</sup> Updated snake distributions maps are available at <http://apps.who.int/bloodproducts/snakeantivenoms/database/>

**Table: Some Nepal venomous snakes of medical importance and major features of envenomation<sup>8,9</sup>**

	Local effects	Clotting disorders	Weakness	Muscle break-down	Low BP	Renal failure	Quadri-valent antivenom effective?
<i>Bungarus bungaroides</i> (Himalayan Krait; Northeastern hill Krait)							
<i>Bungarus caeruleus</i> (Common Krait) Common name: KRAIT SARPA. Common in flat land.							Yes
<i>Bungarus fasciatus</i> (Banded Krait)							?no- need banded krait antivenim or neuro-polyvalent antivenom from Thailand
<i>Bugarus lividu</i> (Lesser Black Krait)							No
<i>Bungarus niger</i> (Greater Black Krait)							No
<i>Bungarus walli</i> (Wall's Krait)							No
<i>Naja naja</i> (Common Cobra; Indian Cobra). Common name: GOMAN SARPA. Common in flat land.	+++		+++		++		Yes
<i>Naja Kaouthia</i> (Monocled Cobra)	+++		+++		++		Yes
<i>Ophiophagus Hannah</i> (King Cobra)							No- need King Cobra antivenin or neuro-polyvalent snake antivenom from Thailand
<i>Sinomicrurus macclellandi univirgatus</i> (Macclelland's Coral Snake)							
<i>Daboia russelii</i> (Russel's Viper) Common name: <b>BAGHE SARPA</b> . Found in hilly areas but no common.	++	+++	±	+++	++(+)	++(+)	Yes
<i>Gloydius himalayanus</i> (Himalayan Pit Viper)							No
<i>Himalayophis tibetanus</i> (Tibetan Pit Viper)							No
<i>Ovophis monticola</i> (Mountain Pit Viper) Common name: AADHO SARPA. Common in mountainous areas.							No
<i>Protobothrops sp.</i> (Himalayan Habu Pit Viper; Jerdon's pitviper)							No
<i>Trimeresurus cf. albolabris</i> (White-lipped Pit Viper)							
<i>Cryptelytrops septentrionalis</i> (previous species name: <i>Trimeresurus macrops</i> or <i>septentrionalis</i> or <i>albolabris septentrionalis</i> ) (Green Pit Viper). Common name: HAREU SARPA. Common in hilly areas.		+++					No
<i>Trimeresurus septentrionalis</i> (Kramer's Pit Viper)							
<i>Rhabdophis subminiatus</i> (Red-necked Keelback)							

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

<sup>8</sup> Adapted from Meier J, White J. *Clinical toxicity of animal venoms and poisons*, 1995. CRC Press. Boca Raton FL. and <http://www.toxinology.com/>

<sup>9</sup> *Venomous Snakes of Nepal a Photographic Guide*, 2013. B.P. Koirala Institute of Health Science. Dharan Nepal.



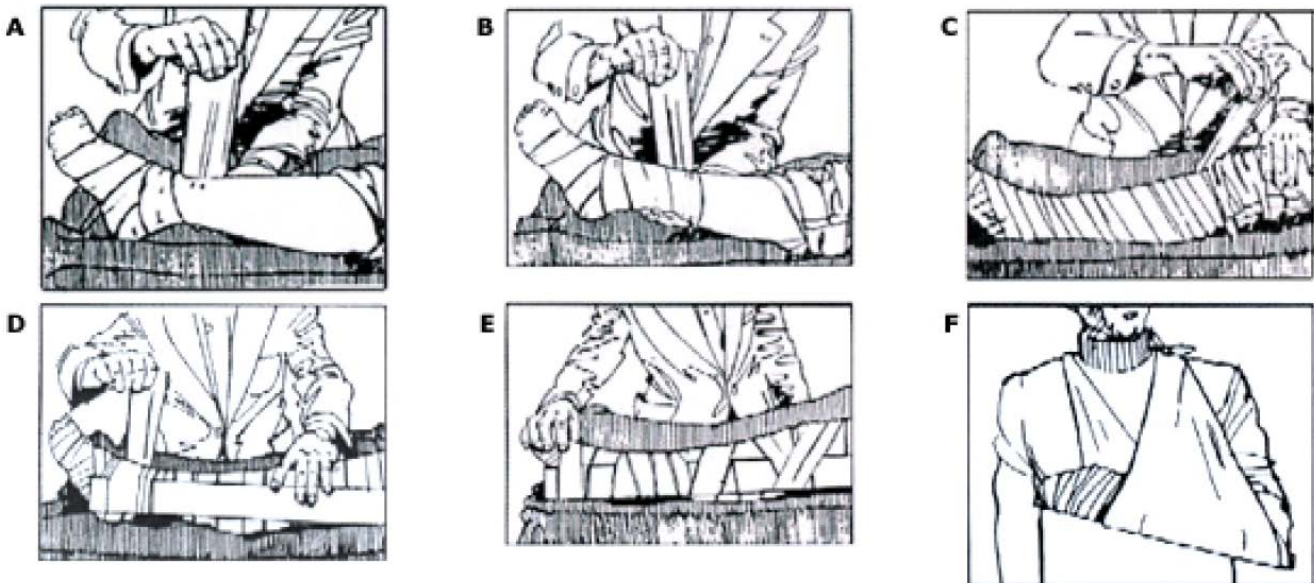
### 3.9.2 Snake-bite treatment

Snake-bite victims are generally extremely anxious and restless. First aid measures include reassurance of the victim, immobilization of the bitten limb with compression by wrapping, and rapid transport to a medical facility.

#### Pressure bandage plus immobilization- method for first aid of snake bite including during referral from district hospital

Ideally, an elasticated bandage, approximately 10 – 15 cm wide and at least 4.5 metres long should be used. If that is not available, any long strips of material can be used. The bandage is bound firmly around the entire bitten limb, starting distally around the fingers or toes and moving proximally. The bandage is bound firmly (at a pressure of 50-70 mmHg), but not so tightly that the peripheral pulse (radial, posterior tibial, dorsalis pedis) is occluded or that the patient develops severe (ischaemic) pain in the limb.<sup>3</sup>

Illustration with step by step instructions:<sup>11</sup>



#### Bites to the lower limb:

- A. Apply a broad pressure bandage over the bite as soon as possible.
  - Wide crepe bandages are idea, but any fabric may be used; clothing or towels may be torn into wide strips. Pantyhose has been successfully used.
  - Do not take off clothing, as the movement of doing so will promote the movement of venom into the blood stream.
  - Bandage upwards from the lower portion of the bitten limb. Even though a little venom may be squeezed upwards, the bandage will be more comfortable, and therefore can be left in place for longer if required.
- B. The bandage should be as tight as you would apply to a sprained ankle.
  - You should be able to slip a few fingers under the bandage.
- C. Extend the bandage as high as possible up the limb.
- D. Apply a splint to the leg.
  - Any rigid object may be used as a splint, such as a spade, a piece of wood, tree branch or rolled up newspapers
- E. Bind the splint firmly to as much of the leg as possible

#### Bites to the hand or forearm:

- F. Keep the patient still. Lie the patient down to prevent walking or moving around.
  - Bandage as much of the arm as possible, starting at the fingers.
  - Use a splint to the elbow.
  - Use a sling to immobilize the arm.

<sup>11</sup> From UpToDate Snake Bite figure- which was reproduced with permission from: Ken Winkel, MD. First aid for snake bites: Pressure-Immobilization Method. Australian Venom Research Unit. Copyright Dr. Ken Winkel, Australian Venom Research Unit- permission requested.

**Bites to the trunk:**

- If possible, apply firm pressure over the bitten area. Do not restrict chest movement. Keep the patient still.

**Bites to the head or neck:**

- No first aid for bitten area. Keep the patient still.

Research stresses the importance of keeping the patient still.

This includes all the limbs. Bring transport to the patient if possible.

- DO NOT cut or excise the bitten area
- DO NOT apply an arterial tourniquet; they cut off the circulation to the limb and are potentially dangerous.
- DO NOT wash the bitten area.
- Do not apply locally available treatment including green paste of leaves.

Some snake-bites lead to rapid onset of respiratory failure and cardiovascular collapse. Use Quick Check pages 4–6 for regular assessment of airway, breathing, and circulation. It is important to remove rings and bangles, as the swelling of limbs may worsen. Once the patient is in a medical facility, the most important aspect of management is to determine the need for antivenom and, if indicated, to administer it as soon as possible.

**Treatment of systemic envenomation**

Antivenom is required if there is evidence of systemic envenomation (clinical or biochemical) from a venomous snake. Such evidence may include:

- neurotoxicity
- clotting disorder (spontaneous bleeding or a positive 20-minute whole blood clotting time)
- muscle breakdown – muscle pains or black urine or a 3+ result for blood on a urinary dipstick (rare in Nepal)
- hypotension, shock, arrhythmia that persists

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 the effective antivenom is not available, consider transferring the patient to a facility where antivenom is available (see Quick Check page 49). In the interim fluid replacement, *administration of fresh frozen plasma* or *initiation of dialysis* should be considered in such situations. If the patient is in severe respiratory distress, see Quick Check pages 15-18 and consider advanced airway management (see Quick Check pages 41–48).

**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. Children are very vulnerable and more likely to die, so do not underdose the antivenom.
- 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 14 and Section 3.1.3.
- Antivenoms are more effective if given early (within hours of envenomation). However, improvement is possible even days after envenomation from some snakes.
- Only the quadrivalent antivenom from India is available. Only use this if it is the subset of Nepali snakes that it is effective against. (There is not sufficient data for benefit from quadrivalent antivenom to common snake found in hilly region ie Green pit viper and the mountain pit viper. This quadrivalent

antivenom is unlikely to be helpful yet can cause hypersensitivity reaction.

#### **Expected response to an antivenom**

- Systemic symptoms usually improve over hours.
- Clotting usually corrects itself over a number of hours (depending on the type of snake). Repeat a 20-minute whole blood clotting test after 3–6 hours.
- Weakness tends to stop worsening, but may not immediately get better.
- Local necrosis will not be reversed but should not progress.
- Muscle breakdown may stop progressing, but kidney failure may still occur.

#### **Reasons for a patient's failure to respond to an antivenom**

- It could be the wrong type of antivenom (particularly if monospecific).
- The antivenom could be inactive or not efficient.
- There was an insufficient dose.
- There was an excessive delay after envenomation in administration of the antivenom.

### **Manage complications**

All patients with snake-bite envenomation should be monitored for development of complications. This requires regular clinical examination (respiratory rate, breath volumes by observation or with *spirometry*, pulse and blood pressure; signs of compartment syndrome and gangrene), review of charts (urine output and urine colour, temperature) and biochemical investigations (serum potassium, creatinine, and clotting profile).

Prevention of renal failure requires adequate fluid intake. A deteriorating level of consciousness may be an indicator of intracerebral haemorrhage.

### **Manage local necrosis and compartment syndrome**

The degree of local necrosis depends on the type of venom. Early administration of antivenom is the best way to prevent muscle damage. Compartment syndrome is rare and is difficult to distinguish from local tissue necrosis.

- Give analgesia for pain.
- It is important to involve a surgeon if there is significant swelling of digits or a limb.
- Fasciotomy should be considered only if:
  - there is clinical evidence of compartment syndrome (disproportionately severe pain, weakness of intracompartmental muscles, pain on passive stretching of intracompartmental muscles, hypoaesthesia of areas of skin supplied by nerves running through the compartment, and obvious tenseness of the compartment on palpation); and
  - the intracompartmental pressure has been measured and is >40 mmHg (in adults); and
  - clotting disorders have been corrected with antivenom.
- Infection is uncommon
  - Antibiotics should be given only if there is a necrotic wound or signs of an established infection (e.g. local area is red, hot, swollen, and fluctuant).
- Tetanus toxoid vaccine should be given routinely to unvaccinated patients.

### **Manage green (HAREU SARPA) and mountain (ADHO SARPA) pit viper envenomation**

- Rest
- Avoid sharp instruments
- Check 20 minute whole blood clotting time (MWBCT) daily
- If available give specific antsnake venom (Indian quadrivalent venom does not work)
- If available do clotting time, PT, APPT for reference
- Watch carefully for bleeding (visible or concealed ie intraperitoneal, intrathoracic, intracranial)
- **If bleeding:**

- Do haematocrit/ hemoglobin
- Give whole blood or fresh frozen plasma
- If intrathoracic bleeding, may need chest tube insertion

Usually blood clotting factor normalises in 8-12 days

### Manage muscle weakness (neurotoxicity)

The use of polyvalent antivenom usually will not prevent the progression of neurotoxic effects in the acute phase, in particular respiratory paralysis, and the patient will not survive without life support. Late administration of antivenom may reverse weakness after envenomation by some snakes. If antivenom is not available, respiratory failure should be managed with assisted ventilation until spontaneous recovery occurs.

Monitor the patient closely for signs of progressive muscle weakness

- Early signs of neurotoxicity include droopy eyelids, double vision, difficulty swallowing, and drooling of saliva. These may indicate impending respiratory paralysis.
- Late signs of neurotoxicity include generalized weakness and weakness of the respiratory muscles. As the respiratory muscles become weak, the patient will breathe at a faster rate, take small shallow, and eventually use accessory muscles to breathe.
- Hypoxaemia is an ominous sign; usually, it is due to inadequate ventilation or oxygenation (see Section 3.2.1). When SpO<sub>2</sub> is <90, give oxygen (see Quick Check pages 19-22). 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 15-18). For cases that are easily reversible, BVM can continue until antivenom takes effect. In neurotoxic snake-bite, anticipate a prolonged course of weakness and consider advanced airway management with tracheal intubation (see Quick Check pages 41–47) 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 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 10.15 Abnormal bleeding and bruising)

- Spontaneous systemic bleeding usually stops within 15–30 minutes, and blood coagulation is restored within about 6 hours if an adequate dose of antivenom has been given. The 20-minute whole blood clotting test should be used to monitor the dose of antivenom in

patients with coagulopathy. If the blood remains uncoagulated 6 hours after the first dose, the dose should be repeated every 6 hours until blood coagulation is restored.

- If the patient starts bleeding excessively, correct with *fresh frozen plasma, platelets or cryoprecipitates* in addition to antivenom. If these blood products are not available, use fresh whole blood.
- Heparin should **not** be given.
- Central venous lines and surgery should **not** be attempted unless clotting has been corrected with antivenom.

### Manage muscle breakdown (rhabdomyolysis)

- An early sign includes muscle pain and a positive urine dipstick test for blood (cross-reacting with myoglobin from muscle).
- Late signs include dark urine and renal failure.
- Give IV LR or NS fluids (more than 3 litres per day). Keep patient very well hydrated by maintaining the JVP (visually) to be slightly higher than normal, and use furosemide when appropriate.
- Urine output should be monitored, and the rate of fluid administration adjusted accordingly.
- Correct acidosis and electrolyte disturbances.
- *Haemodialysis* may be required to treat acute renal failure and associated complications such as hyperkalaemia and acidosis. Refer to a zonal/provincial hospital, medical college or tertiary center able to provide this if possible.

### Important myths to counter

1. “Any antivenom will do” – FALSE.  
Antivenoms are very specific to the type of snake. However, many antivenoms are polyvalent. This means that the venoms of more than one snake are used in their preparation. The quadrivalent venom from India is only effective for cobra and krait (see Table: Some Nepal venomous snakes of medical importance and major features of envenomation).
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 and supportive care are 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. These often cause infection of the site and may result in delay in seeking hospital care, with worse outcome.

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. A study in Nepal<sup>12</sup> found many preclinical students had inadequate knowledge of first aid of snake bite and would choose ineffective and even harmful methods of treatment.

<sup>12</sup> Subedi et al. Knowledge of first aid methods and attitude about snake bite among medical students: a cross sectional observational study. *Journal of Occupational Medicine and Toxicology* (2018) 13:26

## 3.10 Burns<sup>1, 2</sup>

<p>3.10.1 Initial management and stabilization of burns using Quick Check</p> <ul style="list-style-type: none"><li>– Airway and breathing</li><li>– Circulation</li><li>– Remove all burned clothing, and cool skin with water.</li><li>– Manage associated trauma.</li><li>– Cover the burn to reduce pain, and provide appropriate analgesia.</li></ul>	<p>3.10.2 Assess and classify the burn</p> <ul style="list-style-type: none"><li>– Determine the degree of the burn</li><li>– Estimate the extent of the burn</li><li>– Types of burns</li><li>– Classify the burn to decide how to manage it</li></ul> <p>3.10.3 Burn management</p> <ul style="list-style-type: none"><li>– Manage inhalation injury</li><li>– Fluid resuscitation in patients with severe burns</li><li>– Burn skin care</li></ul>
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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<sub>2</sub> <90, or suspicion of carbon monoxide poisoning (smoke inhalation, fire in enclosed space).

#### Circulation

- Insert IV. Calculate amount of fluids according to the Parkland formula for patients with severe burns and Quick Check emergency signs.

Parkland formula  
calculates the amount of fluid to be administered over the first 24 hours post-burn;  
4 ml x body weight in kg x percentage burns per TBSA

#### 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.

<sup>1</sup> *Surgical care at the district hospital*. WHO, 2003. Available at [www.who.int/child\\_adolescent\\_health/documents/9241545755/en/index.html](http://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](http://www.who.int/surgery/publications/imeesc/en/index.html)

<sup>2</sup> Nepal Emergency Trauma Guidelines

### 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.

1 <sup>st</sup> degree	superficial	red or pink, painful, skin intact, no blisters
2 <sup>nd</sup> degree	superficial or deep partial thickness	red, blisters, wet, painful, blanches
3 <sup>rd</sup> degree	full thickness	white or black/leathery, no sensation, dry

Experienced burn doctors often reserve judgement on the definitive classification of the burn until they have examined the wounds at 72 hours after the injury.

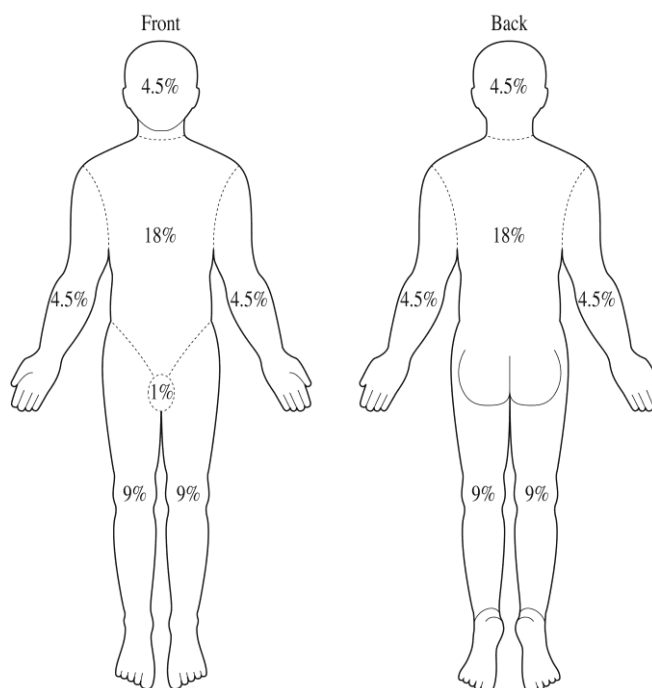
- First-degree burns usually will heal with minimal sequelae, even without treatment.
- Second-degree burns will heal, but often with significant scarring and contractures.
- Third-degree burns will heal (if at all) by contracture and cause severe scarring and disability. Third-degree burns also may include injury to the muscles or tendons.

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

#### Estimate the extent of the burn (relative to TBSA)

- Determine the percentage of area burned using the “rule of 9s”, whereby the body is divided into 9 areas or parts.
- If the burns do not fully cover a body part or cover more than one part, the percentage can be calculated by using the patient’s palm as approximately equal to 1% of the TBSA.
- If a second- or third-degree burn involves the face, neck, hands, feet, or perineum or is circumferential (encircles a limb), it should be treated as a severe burn, and surgical referral is indicated, even if the TBSA is small.

#### Estimating the burned surface area in adults The rule of 9s



## Types of burns

**Flame burns** are the most common. A history of a flame burn in an enclosed space suggests inhalation injury. Look for soot in the mouth and burned hairs in the nose. Strongly consider airway protection before laryngeal swelling makes intubation too difficult. Flame burns often are deep, with feathered edges of partial-thickness burn. Clean off soot and loose skin with soap and water.

**Scald burns.** It can be very difficult to assess the full depth of a scald burn in the first few hours. It may not be apparent until the third day.

**Contact burns** usually are small but very deep, down to muscle, and likely to require excision and grafting.

**Grease burns.** Cooking oil is usually very hot. These are typically deep, partial-thickness or full-thickness wounds.

**Electrical flash burns.** These occur when a screwdriver or other conductive tool is inserted into a live electrical box. There is an extremely hot flash, but electricity does not travel through the body. Such burns typically involve the face and hands. Examine the patient's eyes with fluorescein and blue light for corneal damage. If corneal damage is present, treat with antibiotic eye drops or ointment. Even if there is no smoke involved, electrical flash burns can cause laryngeal swelling, and airway protection needs to be considered. Otherwise, treat as a thermal burn.

**Electrical conduction burns.** These result from conduction of high voltage electricity through the body. If the patient is conscious, there may be a history of the "can't let go" phenomenon: The patient was unable to let go of the electric wire or other source. On the surface, burns are typically only small entrance and exit wounds, but suspect massive underlying tissue injury. Look for cardiac arrhythmias and fractures. Destruction of muscle leads to myoglobinuria and renal failure (see Section 11.28). In all cases insert a urinary catheter. If the urine is dark, raise the pH of the urine by giving large volumes of 5% dextrose with 150 mEq sodium bicarbonate per litre. (Putting bicarbonate in normal saline will yield a very hypertonic solution.) Give mannitol boluses and furosemide. Assess compartment pressures in the affected limbs and perform early fasciectomy. Remember that compartment pressures will rise with fluid resuscitation, and so re-examine the patient frequently.

**Chemical burns.** While caused by a wide variety of chemicals, acid and alkali burns are the most common. Always protect staff first! First, dust off any dry chemical, then wash the whole body for 40 minutes or more in running water to dilute the chemical. Irrigate the eyes thoroughly.



## Classify the burn to decide how to manage it

SIGNS:	CLASSIFY AS:	TREATMENTS:
<ul style="list-style-type: none"> <li>• Any full-thickness burn</li> <li>• Partial-thickness burn               <ul style="list-style-type: none"> <li>◦ ≥15% TBSA in adults</li> <li>◦ ≥10% TBSA in children</li> <li>◦ Special regions (hands, face, feet, perineum)</li> </ul> </li> <li>• Any circumferential burn</li> <li>• Inhalation injury</li> <li>• Significant associated trauma OR</li> <li>• Any burn in the very young or elderly OR</li> <li>• Significant pre-burn illness (diabetes, HIV)</li> </ul>	<b>SEVERE BURN</b>	<ul style="list-style-type: none"> <li>• Protect airway (consider laryngeal oedema with or without inhalation injury).</li> <li>• Cool burn if acute.</li> <li>• Fluid resuscitation               <ul style="list-style-type: none"> <li>◦ Give fluid according to Parkland formula, and insert urinary catheter to monitor urine output.</li> </ul> </li> <li>• Consider escharotomy for circumferential burns.</li> <li>• Give tetanus toxoid.</li> <li>• Burn skin care (see below)</li> <li>• Prophylactic antibiotics are not recommended. Reserve antibiotics for clinical indications of infection.</li> <li>• Manage acute pain (see Section 20).</li> <li>• Place a nasogastric tube for feeding and give medication for gastric acid suppression (H2 blocker or proton pump inhibitor).</li> <li>• Admit to hospital.</li> </ul>
<p>Second degree burns</p> <ul style="list-style-type: none"> <li>• &lt;15% of body (adults)</li> </ul> <p>First degree burns</p> <ul style="list-style-type: none"> <li>• &gt;50%</li> </ul>	<b>MODERATE BURNS</b>	<ul style="list-style-type: none"> <li>• Burn skin care (see below)</li> <li>• Give tetanus toxoid.</li> <li>• Some will require admission for pain control and dressings. Others may be managed at home with close follow-up.               <ul style="list-style-type: none"> <li>◦ Change dressing daily.</li> <li>◦ Mobilize joint twice daily and especially at each dressing change (move through range of motion).</li> <li>◦ Manage acute pain: pre-medicate for dressing changes</li> </ul> </li> <li>• 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.</li> </ul>
<p>Small burns of non-critical areas</p>	<b>MILD BURN</b>	<ul style="list-style-type: none"> <li>• Burn skin care (see below)</li> <li>• Give tetanus toxoid.</li> <li>• Manage acute pain.</li> <li>• Patient can be managed at home.</li> <li>• Advise to return if fever, purulent drainage, or increased pain or redness.</li> </ul>

### 3.10.3 Burn management

#### Manage inhalation injury

Suspect airway injury in all those who were burned in an enclosed space. Look for facial burns, soot in the mouth, and singed nasal hairs. Airway oedema may progress rapidly in the first hours to days after injury; frequent re-assessment is required for any patient with suspected airway injury.

There are 3 components to consider in inhalation injury.

1. Laryngeal oedema may be caused by inhalation of hot gas or by any burn involving the face, anterior neck, and upper chest, including scald and electrical flash burns. Burns larger than 30% TBSA, so called “metabolic burns”, will likely swell; it is prudent to protect the airway.
  2. Carbon monoxide poisoning should be suspected in anyone who lost consciousness in a fire. Intubate and provide 100% oxygen where possible if patient is confused or unconscious.
  3. True smoke inhalation causes a pneumonitis that may not become apparent on chest X-ray until 72 hours after the injury.
- Protect the airway before stridor develops. Stridor is a very late sign of life-threatening airway oedema. Where there is no capacity to manage the patient on a ventilator, consider early tracheotomy. Call for help if not skilled in airway management.

**WARNING SIGNS: face and neck burns, black sputum, wheezing, hoarse voice, burned hair in the nose.**

#### Fluid resuscitation in patients with severe burns

Patients with significant burns will require intravenous hydration.

- Place a large-bore IV X 2 in an area away from the burned skin.
- Use lactated Ringer’s solution or normal saline.
- Consider using a bladder catheter to follow urine output.
- Use the Parkland formula to estimate fluid needs:
  - half in the first 8 hours and remainder in the next 16 hours (starting from the time of the burn, not the time at which fluid resuscitation is begun)
- Monitor urine output in all burn patients and adjust intravenous fluids to ensure adequate urine output (0.5–1 cc/kg/hour). Do not over-resuscitate.

#### Example: Parkland calculation using 4 ml

60 kg adult with 30% partial-thickness burns.  
 $\text{ml} \times \text{kg} \times \% = \text{ml fluid required}$   
 $4 \times 60 \times 30 = 7200 \text{ ml (7.2 litres)}$

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.

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<sup>3</sup>;
- 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 range the joints twice a day, with adequate analgesia.

**Blisters.** Small blisters may be left intact, but those that are large, flaccid, blood- or pus-filled, and those restricting joint movement should be un-roofed and the base covered with a dressing.

**Bathing.** It is helpful to thoroughly wash the patient with soap and water at the time of admission. Showering is a good way to help remove debris from the wound. However, the routine immersion of burn patients in non-sterile bathtubs is unhelpful and spreads infection.

**Face burns.** It is difficult to keep dressings on the face. Open, uncovered treatment is preferred, with frequent, gentle cleaning and the application of topical antibiotic ointment. Shave facial hair every 2 days to prevent accumulation of exudate and infection. Examine eyes with fluorescein and, if keratitis or corneal ulceration is found, apply antibiotic eye ointment frequently. Eyelid contractures expose the surface of the eye; early surgical referral should be made for grafting of the lids. Keep the eye well protected with ointment. Blepharoplasty (suturing together the lids) is seldom indicated, as the sutures pull out, compounding the problem.

**Circumferential, partial-, and full-thickness burns.** Burned skin does not stretch and, thus, as the underlying tissue swells, pressure may cut off circulation to the extremity. This may not be apparent at the time of presentation; the swelling will increase as fluid is given, however. Escharotomy is performed by cutting through the burned skin in the mid-lateral and mid-medial axes of the extremity. A full-thickness burn has no sensation, but the edges of the burn may have exquisitely tender partial-thickness burn, so a local anaesthetic is helpful. Cut through the burn down to fat, and you will see the skin spread apart. Put a little “T” at the end of the incision

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<sup>3</sup> Ranitidine is an alternative.

where burn meets normal skin to allow more expansion. Never cut un-burned skin. Cover with dressings.

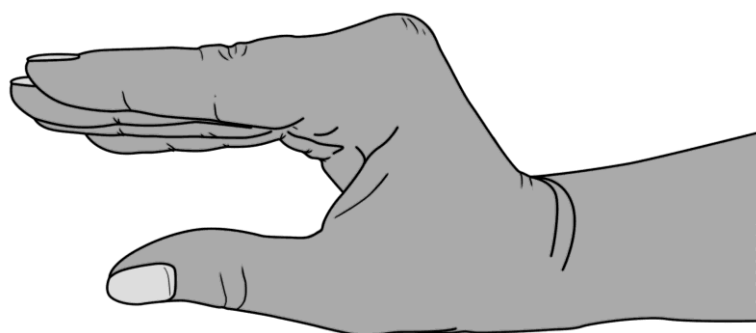
**Surgical referral.** All significant burns should be evaluated by a surgeon. Burns heal by a combination of re-epithelialization and contraction. The appearance of white epithelial pearls in the wound indicates re-epithelialization from nests of un-burned epithelium at the bottom of hair follicles and sweat glands. Red granulation tissue, however, clean as it may be, is granulating dermis and fat; if it ever heals, it will be by wound contraction. Any burn that does not heal by 3 weeks needs a skin graft.

**Nutrition.** Patients with a major burn may require more than twice their normal protein and calorie intake. Large amounts of protein are lost through the burn, and healing requires a lot of protein as well. The metabolic rate is elevated, and carbohydrate requirements are elevated as well. Because of pain and associated illness, few burn patients feel hungry. The best strategy is to insert a nasogastric feeding tube and give enteral feeds. Standard feeding solutions are good but expensive. Perfectly adequate solutions can be made from commonly available local foods and administered by the patient's relatives. In limited-resource settings good nutrition may be the most important intervention that can help a burn patient survive and heal. Oral rehydration solution (ORS) may be given by nasogastric tube instead of IV fluid resuscitation where IV access is difficult. ORS should be given freely to patients who are able to tolerate oral intake.

**Analgesia.** Burns are exceedingly painful, and so adequate analgesia is very important. Use a multimodal approach with different classes of analgesic. Paracetamol and morphine provide good basal analgesia but should be supplemented with short-acting agents for dressing changes and daily physiotherapy.

**Splinting and positioning.** It is vitally important to splint burned hands in a position with the wrist dorsiflexed, the metacarpophalangeal (MCP) joints flexed at  $90^\circ$ , 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  $90^\circ$ . 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. 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<sub>2</sub>
  - systolic BP in mmHg
  - pulse
  - respiratory rate per minute
  - consciousness level – use AVPU scale: **A**lert – **R**esponds to **V**oice – **R**esponds 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 column corresponding to time since arrival:
    - temperature in degrees Celsius
    - urine output\*\* in ml per hour. Record volume if Foley catheter used. If not, just enter checkmark (✓) if noted.
    - Repeat glucose and haemoglobin if initial values abnormal.
  8. Record results of glucose, haemoglobin.
  9. Exam – record findings of patient examination.
  10. Assess – record clinical assessment of major problems plus likely or differential diagnosis.
  11. Response – indicate which treatment was given and at what time.
  12. Initials – always write your initials after recording patient information.
  13. Any additional notes – document any additional information about clinical history, examination, interventions, and response as necessary to communicate clinical course to other health workers.
  14. Benchmarks achieved – these are a targeted list of interventions that should be completed within certain time frames. They serve as markers of delivering high-quality care to severely ill patients. For example, a patient with septic shock should be given empiric antimicrobials within 1 hour. Using a checklist like this can help health workers to deliver high-quality care.

### Severe illness monitoring form (first 6 hours)

Name: _____		Patient No.: _____		Birth date: ___/___/___		Age: _____		Sex: M / F		Admission date: _____		Admission time: _____			
Diagnosis:		<i>Circle if test sent and record result:</i>		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 <sub>2</sub>														
	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: _____						<i>Circle if sent and record result:</i>		Electrolytes _____		Urine dipstick _____				Malaria _____ AFB _____ Blood culture _____ Gram stain _____																									
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 <sub>2</sub>																																					
		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			
<p><b>If severe respiratory distress, suspect pneumonia, or acute lung injury, within 30 minutes:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Oxygen started</li> <li><input type="checkbox"/> SpO<sub>2</sub> measured</li> <li><input type="checkbox"/> IV started</li> <li><input type="checkbox"/> If wheezing, salbutamol given</li> <li><input type="checkbox"/> Appropriate infection control</li> </ul> <p><b>Within 1 hour:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Broad-spectrum antibiotics</li> <li><input type="checkbox"/> If malaria possible, antimalarial given</li> <li><input type="checkbox"/> If influenza possible, antiviral given</li> </ul>	<p><b>If acute pulmonary oedema, within 30 minutes:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Oxygen started</li> <li><input type="checkbox"/> SpO<sub>2</sub> measured</li> <li><input type="checkbox"/> Furosemide 20 mg IV given</li> <li><input type="checkbox"/> If hypertensive, isosorbide dinitrate given</li> <li><input type="checkbox"/> If ischaemia (chest pain), aspirin given</li> </ul> <p><b>If wheezing, within 30 minutes:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Salbutamol given</li> <li><input type="checkbox"/> If asthma/COPD, steroid given</li> </ul>	<p><b>If shock, within 30 minutes:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> IV line and rapid fluids started</li> <li><input type="checkbox"/> 1000 ml fluid bolus given</li> </ul> <p><b>Within 1 hour, if fever or suspect septic shock:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Antibiotics given</li> <li><input type="checkbox"/> If malaria possible, antimalarial given</li> <li><input type="checkbox"/> If influenza possible, antiviral given</li> </ul> <p><b>Within first 2 hours:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> 3 litres IV fluids given</li> </ul>	<p><b>If altered level of consciousness/convulsing:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Oxygen started</li> <li><input type="checkbox"/> Oxygen saturation measured</li> <li><input type="checkbox"/> Recovery position</li> <li><input type="checkbox"/> Glucose checked and given</li> <li><input type="checkbox"/> If convulsing, diazepam given</li> <li><input type="checkbox"/> If convulsing and pregnant, magnesium sulphate given</li> </ul> <p><b>If trauma, within 30 minutes:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Oxygen started</li> <li><input type="checkbox"/> Oxygen saturation measured</li> <li><input type="checkbox"/> Spine immobilized until clear</li> <li><input type="checkbox"/> If shock, IV line and rapid fluid bolus</li> <li><input type="checkbox"/> If shock, surgical consult</li> <li><input type="checkbox"/> Hb and type and cross sent</li> </ul>

## 4. Trauma: approach to the acutely injured patient

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## 4. Trauma: approach to the acutely injured patient<sup>1</sup>

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.

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### 4.0 General principles of trauma care

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Correct management of the trauma patient in the first few hours is critical. Many deaths can be prevented if rapid care is given, including treatment of pneumothorax, abdominal haemorrhage, and pelvic and long bone injuries. Early identification and treatment of injuries can prevent late complications and death from infection or multiple organ failure. Hospitals with limited resources face additional challenges when caring for the trauma patient. Patients often must travel long distances to reach the hospital, and delays in presentation can lead to increased morbidity from untreated wounds, abdominal injuries, and fractures. Other challenges include a lack of trauma care specialists, equipment, and supplies. In addition, prolonged transport times may undermine safe transfer to a higher level of care.<sup>1,2</sup>

Despite these obstacles, an organized team approach will greatly improve the care of trauma patients in resource-limited settings. Practice frequently using the team system during routine care, and during scheduled training drills. Use the Quick Check to identify and treat patients with immediately life-threatening injuries leading to emergency signs. Early priorities for the trauma patient include managing airway emergencies, stabilizing the spine, controlling haemorrhage, and treating shock. Trauma patients identified using Quick Check emergency signs (airway and breathing, circulation, altered consciousness or convulsions) are seriously ill and may rapidly deteriorate. Any trauma patient with abnormal vital signs (SBP <90, pulse >110, SpO<sub>2</sub> <90) is considered unstable. Common mechanisms causing serious trauma include motor vehicle accidents, falls from a significant height, and gunshot or stab wounds. As with all seriously ill patients, frequent monitoring, recording, and responding to clinical changes is of vital importance.

#### When caring for the seriously ill trauma patient:

- Identify and immediately treat airway obstruction, tension pneumothorax, or haemorrhagic shock.
- Immediately immobilize the cervical spine. Only move the patient using the log roll technique until a spinal injury is excluded clinically or by X-ray. See page 21 Quick Check.
- Stop any visible haemorrhage with manual pressure or a compression dressing.
- Insert at least 2 large bore IVs (14 or 16 gauge), and send blood for haemoglobin and type and cross-match. Blood may be needed quickly and in large quantities for some trauma patients.
- Only use isotonic crystalloid fluid (normal saline (NS) or Lactated Ringer's solution (LR)) for resuscitation in the trauma patient. If possible, warm IV fluids are preferred.
- If significant haemorrhage is ongoing, or there is a risk of significant haemorrhage, give tranexamic acid.<sup>3</sup> Administer an intravenous loading dose of 1 g of tranexamic acid over

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<sup>1</sup> Adapted from *Surgical Care at the District Hospital*. WHO, 2003. Available at

[http://www.who.int/surgery/publications/scdh\\_manual/en/index.html](http://www.who.int/surgery/publications/scdh_manual/en/index.html) with updates based on the evidence review

<sup>2</sup> 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>

<sup>3</sup> 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](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-*

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.<sup>4</sup>

- 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<sub>2</sub>) and mental status (both Glasgow Coma Scale (GCS) and AVPU) on arrival, and at least every 15 minutes for the first hour. Continue to check Glasgow Coma Scale for patients with head injury. For other patients with major trauma, recheck the GCS until stable, then use AVPU.
- If the patient deteriorates, repeat Quick Check and perform a thorough examination to identify any missed injuries. If the patient is in shock (SBP <90 mm Hg) and no visible bleeding is present, assume the patient has internal bleeding.
- Treat pain as soon as possible.
- If the patient requires referral for specialized care, and if the patient has been stabilized to the extent possible within the local capabilities for safe transfer, transport the patient without delay.

Note the special considerations in Quick Check for trauma patients. Knowledge of the mechanism of injury can help identify at risk patients who require immediate assessment and treatment. In addition to the presence of obvious visible trauma or emergency signs, triage patients as a Quick Check emergency if there is a high-risk mechanism of injury or specific injury patterns present that indicate the patient was injured by a considerable force. Patients who initially appear uninjured may have life-threatening occult injuries, such as internal bleeding. Monitor trauma patients 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.

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controlled trial. *Lancet*. 2010;376(9734):23-32. Available at [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(10\)60835-5/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)60835-5/abstract)

<sup>4</sup> The CRASH-2 collaborators. *CRASH-2: tranexamic acid and trauma patients*. *Lancet*, 2011. Available at <http://www.thelancet.com/crash-2>

High-risk mechanism of injury
Fall more than 3 metres Road traffic accident at speed more than 30 km/hour or with significant damage to vehicle Thrown from a vehicle or trapped in a vehicle Pedestrian or cyclist hit by a car Motorcycle crash with separation of rider from bike Death of another person in the same accident Injury from a high- or low-velocity weapon

High-risk injuries
Penetrating injuries to head, neck, torso, and extremities proximal to elbow and knee Flail chest Combination of trauma with burns Two or more proximal long-bone fractures Pelvic fractures Limb paralysis Amputation proximal to wrist or ankle

Patients with chronic medical conditions or at the extremes of age are at increased risk for complications from traumatic injuries. Have a high index of suspicion for occult injury in patients with high-risk co-morbid conditions. These patients often will require admission for observation, even in the absence of significant obvious injuries.

High-risk co-morbid conditions
Age <5 years or >55 years Cardiac or respiratory disease Insulin-dependent diabetes Cirrhosis Morbid obesity Pregnancy Immunosuppression Known bleeding disorder or on anticoagulants

## 4.1 Working as a clinical team to care for the trauma patient

### Preparation

It is important to check that the resuscitation area is ready at all times, before a trauma patient arrives.

- Emergency trolley in the resuscitation area with necessary emergency medications and equipment (Quick Check page 38)
- Adequate supply of resuscitation fluid (LR or NS) and safe blood for transfusion
- Equipment to stabilize the cervical spine and a spinal board to move the patient, if necessary
- A plan and equipment to transport the patient to the operating theatre, if required.

### Assign responsibilities within the clinical team

Caring for a critically injured trauma patient requires multiple tasks to occur simultaneously, such as protecting the airway and cervical spine, completely undressing the patient, checking vital signs, obtaining IV access and starting IV fluids, obtaining the history and performing a physical examination, and sending laboratory investigations and documentation. Keeping the situation calm and controlled is important for delivering quality care. If possible, designate tasks ahead of time. Regardless of how many people make up the clinical trauma team, treating emergency signs of airway, breathing, and circulation will always take first priority.

During all trauma resuscitations, one person should be in charge as the “team leader.” The team leader is usually the most senior member present. The team leader’s responsibilities

include coordinating and controlling the resuscitation, ordering any procedures and diagnostic tests, and deciding on transfer to the operating theatre or a higher level of care. Although in many district hospitals there may only be 1 or 2 people to care for the patient, all hospitals should develop a trauma team plan ahead of time based on their available personnel and resources. This plan may vary depending on the time of day if there are fewer health workers available during night hours or weekends.

#### Sample division of roles on the clinical team caring for a trauma patient at a district hospital<sup>5</sup>

##### Team leader

- Coordinate and control resuscitation
- Designate tasks for others
- Ensure treatment of any Quick Check emergency signs
- Ensure protection of the cervical spine and appropriate movement of the patient
- Order all medications, IV fluids, blood
- Order all procedures and diagnostic tests
- Perform any specialized procedures if necessary (i.e. securing the airway, treating tension pneumothorax, splinting fractures) or delegate to another skilled team member
- Monitor progress
- Decide on referral to the operating theatre or a higher level of care

##### Primary nurse

- Obtain IV access
- Monitor and record vital signs and urine output
- Give IV fluids, blood, and medications

##### Nursing assistant

- Completely undress patient
- Help with obtaining vital signs
- Assist with moving patient and patient transport
- Transport blood to lab
- Help gather any necessary equipment and supplies

Following a trauma resuscitation, restock any used equipment, medications, and intravenous fluids. Check the emergency trolley and oxygen cylinder at least twice daily and record all supplies on a log.

#### 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.

<sup>5</sup> Adapted from: Krantz B. *Field triage in resources for optimal care of the injured patient*. Chicago: American College of Surgeons, 1993.

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.

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## 4.2 Assessing and treating the trauma patient

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Assessment of the trauma patient includes the following:

- Quick Check (triage and primary survey)
- secondary exam (secondary survey)
- ongoing assessment and monitoring.

Simultaneously with the assessment, management steps should be initiated including:

- emergency treatments
- resuscitation and stabilization
- definitive care and treatments.

Time	Assessment	Management
0–10 minutes (repeat if patient deteriorates)	Quick Check Secondary survey	Emergency treatments Resuscitation
After 10 minutes	Monitor using patient monitoring form Assess and record every 15–30 minutes until stable	Ongoing resuscitation Stabilize Definitive care and treatments (transfer for diagnostic testing, operating theatre, referral to a higher level of care)

Specific emergency treatments for trauma patients are described in Quick Check including:

- airway management (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).



### Oxygen therapy for trauma patients

Patients with traumatic injuries may have multiple mechanisms that result in deficient oxygen transport. For example, a patient involved in a motor vehicle accident may have an obstructed airway due to coma, impaired gas exchange due to lung contusion, pneumothorax or rib fractures, or inadequate oxygen delivery due to anaemia or hypotension.

During the initial assessment (primary survey), give oxygen to all patients with significant trauma, particularly in suspected head injury patients. Increasing the inspired oxygen concentration reduces the risk of tissue hypoxia while diagnosis and treatment of the underlying injuries is carried out.

Some injuries, such as bruising to the lungs, will get worse as time progresses and there is more tissue swelling and damage. These patients may have increasing oxygenation requirements from hours to days after the injury (delayed hypoxia). Oxygen therapy in major trauma normally should be started at a high concentration, and then titrated as a result of frequent reassessment (Quick Check pages 14–16).

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

Obtain further information including:

- detailed history of the injury
- past medical history
- medications
- drug allergies
- social history.

## First assess and treat immediately life-threatening injuries

### Quick Check and emergency treatments for trauma patients (do not move neck if cervical spine injury possible)

Assess	Look, listen and feel for	Suspect injuries and treat
Airway	Airway obstruction (risk factors include obtundation, obvious trauma to airway, expanding neck haematoma)	Open airway using jaw thrust. Place oral or nasal airway (avoid nasal airway if suspected mid-face fracture). Secure airway with endotracheal tube if clinically indicated and appropriate equipment and personnel are available (Quick Check page 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 Hb and Hct, and type and cross-match. Splint suspected femur or pelvic fracture. Arrange for surgery if suspected intra-abdominal injury or occult haemorrhage. If the patient remains hypotensive after 2 litres bolus (LR or NS) or suspect ongoing heavy blood loss, transfuse blood as per national or local guidelines and consider giving tranexamic acid. Perform ultrasound exam (focused assessment of sonography in trauma – FAST) to assess for free fluid in abdomen (see Section 7.2.20).
Altered consciousness and convulsions	Altered level of consciousness Convulsing Deformity of skull Pupils not equally reactive to light Blood or fluid from ear or nose	Protect from further injury. Manage airway. Give oxygen. Give glucose. Give diazepam if convulsing. Suspect spinal injury or closed head injury and treat (see emergency treatments).
Life-threatening causes of pain	Severe abdominal pain or abdomen hard on palpation (distended, tense, guarding, rebound) Penetrating wound to abdomen	Suspect intra-abdominal injury. Nothing by mouth (NPO). Give IV fluids. Send blood for type and cross-match. Surgical consult Treat pain. Perform ultrasound – FAST exam to assess for free fluid in abdomen (see Section 7.2.20)
	Trauma to head or neck	Suspect head and spinal injury. Immobilize cervical spine. Monitor airway. Call for help.
	Chest pain Ecchymosis to chest wall Air under the skin	Suspect pneumothorax or haemothorax. Suspect rib fractures. Treat pain. If available, obtain upright chest X-ray.

Then look for and treat other injuries (see over).

## Secondary exam: Check the patient from head to toe and look for the following

Assess	Look, listen and feel for	Suspect injuries and treat
Consciousness	Confusion, agitation, coma, convulsions	<b>Head injury</b> If decreasing level of consciousness, agitation or seizures, suspect and manage serious head injury (see Quick Check). Manage airway. Record AVPU . Record Glasgow Coma Scale. Give glucose if known or suspected hypoglycaemia. Manage seizures.
Head and pupils	Size, shape, and reactivity of pupils Inspect scalp for lacerations and skull fractures Palpable defects	<b>Head injury</b> 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). <b>Eye injury</b> Protect eye. Check visual acuity. If suspect globe penetration, call for surgical help.
Maxillofacial	Visual deformity Mid-face stability Malocclusion Palpate for crepitus	<b>Facial fracture</b> Monitor airway. Check and document cranial nerves. Avoid nose blowing. Give antibiotics for open facial fracture. If major facial trauma or malocclusion, call for surgical help.
Neck	Visible trauma Subcutaneous emphysema Haematoma Pain or tenderness of cervical spine	<b>Injury to larynx, trachea or oesophagus</b> Manage airway. NPO. Call for surgical help. <b>Vascular injury</b> Manage airway. NPO. Control any active bleeding. Call for surgical help. <b>Cervical spine injury</b> Immobilize cervical spine (Quick Check page 21). Arrange for radiographic evaluation.
Thorax	Bruising, deformity Uneven chest wall movement Subcutaneous air Decreased breath sounds Muffled heart tones Severe back pain	<b>Pneumothorax or haemothorax, flail chest, sucking chest wound</b> (see Quick Check page 22) <b>Rib fracture</b> Treat pain. Check for associated pneumothorax. Deep breathing exercises. If sub-acute, check for secondary pneumonia. <b>Vascular injury</b> Manage airway. Send Hb, and type and cross-match. Call for surgical help. <b>Pericardial tamponade</b> If haemodynamically unstable (SBP <90 mm Hg), emergent pericardiocentesis. FAST ultrasound to confirm diagnosis if patient stable and equipment and personnel available. <b>For all serious injuries to thorax obtain chest X-ray.</b>

Abdomen or flank	Abdominal pain or tenderness Abdominal distension Abdominal rebound or guarding Visible abdominal wound Ecchymosis back or abdomen, mark of seatbelt across lower abdomen	<b>Liver or spleen injury, pancreatic injury, bowel injury, retroperitoneal haemorrhage, aortic injury</b> NPO. Give IV fluid bolus. Send Hb, and type and cross-match. Give pain medication. Call for surgical help. <b>Perform FAST ultrasound if diagnosis equivocal and equipment and personnel immediately available.</b>
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.	<b>Pelvic fracture</b> If suspect unstable pelvic fracture, wrap tightly with pelvic binder or bed sheet (Quick Check page 22). NPO. Give IV fluid bolus. Send Hb and Hct, and type and cross-match. Give pain medication. Obtain pelvic X-ray. Call for surgical help. <b>GU tract, rectal, vaginal, perineal injury</b> If the patient is conscious and if can void spontaneously, check for gross blood. <b>Do not place Foley catheter if high-riding prostate or blood at urethral meatus. Catheter should pass easily, do not force.</b>
Spine	Palpate for any bony tenderness of spine or step offs. Motor function Rectal tone, saddle anaesthesia Pain and sensation	<b>Vertebral injury or spinal cord injury</b> Keep spine immobilized (see Quick Check page 21). Monitor airway. Treat pain. Document and monitor neurovascular exam. Obtain radiographic evaluation. <b>Call for surgical help.</b>
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	<b>Fracture</b> Check and document neurovascular status. If any neurovascular compromise, reduce immediately. Splint. Treat pain. If open fracture, also: <ul style="list-style-type: none"> <li>• give antibiotics and tetanus toxoid</li> <li>• copiously irrigate and splint</li> <li>• call for surgical help.</li> </ul> If femur fracture, also: <ul style="list-style-type: none"> <li>• send Hb and type and cross-match</li> <li>• NPO</li> <li>• IV fluid bolus</li> <li>• call for surgical help.</li> </ul> <b>Compartment syndrome</b> Perform decompressive fasciotomy. <b>Vascular injury</b> Document exam. NPO. <b>Call for surgical help.</b>
Skin	Bruising, abrasion, laceration	<b>Laceration, abrasion</b> Irrigate wound Suture and splint, if indicated. Give pain control. Give tetanus toxoid. <b>Contusion</b> Give pain control, elevation, and ice, if available.

Following the secondary survey and the initiation of urgent treatments, document all findings, investigation results, medications, or treatments given.

## Resuscitation and stabilization

Assume that any trauma patient in shock (SBP <90 mmHg, pulse >110) is haemorrhaging. The priority is to rapidly identify and stop any ongoing blood loss. Control visible bleeding with manual pressure. Immediately send blood for type and cross-match and Hb. Keep the patient warm. Place a Foley catheter and monitor urine output. A rapid FAST ultrasound exam can be used to identify free fluid in the abdomen or pericardial effusion (see Section 7.2.21). If the patient is unstable with suspected internal bleeding, do not delay treatment for these diagnostic tests. Transport the patient to the operating theatre for an exploratory laparotomy. If no source of bleeding is identified, and the patient remains hypotensive after intravenous fluids and blood, consider other sources of shock, such as septic, cardiogenic, and neurogenic shock.

### Intravenous fluid

- Only isotonic fluids should be used (LR or NS).
- Administer IV fluids rapidly in response to abnormal vital signs.
- If the SBP <90 mm Hg, HR >110, or there is suspected ongoing blood loss, administer 1000 ml LR or NS rapidly and monitor vital signs.
- Monitor urine output.

**Blood** (for complete information on blood transfusion see WHO's *The Clinical Use of Blood Handbook*.<sup>6</sup>)

If 2 litres of IV fluids are given, or if significant blood loss is suspected, arrange for a blood transfusion as soon as possible. If the patient requires a transfusion, continue resuscitation with IV fluids until the blood is available to keep the SBP >90 mm Hg.

- Use national or local guidelines when transfusing blood.
- Blood should be warmed when possible. Cross-matched blood is always preferred, but may not be immediately available in an emergency situation:
  - uncross-matched blood (O-negative) generally available in 0–5 minutes
  - uncross-matched group-specific blood generally available within 10–20 minutes
  - cross-matched blood generally available within 60 minutes.
- If the patient has severe ongoing haemorrhage and is very unstable (SBP <90 mmHg, signs of poor perfusion), start a transfusion of packed red blood cells (PRBC) within 5 minutes and infuse the blood as fast as possible. Give O-negative blood to women of childbearing age, or if male, give O-positive or O-negative.
- If the patient has severe ongoing haemorrhage, but the SBP is >90 and the patient is not yet showing any signs of poor perfusion, it is acceptable to wait for uncross-matched group-specific blood to be available. A transfusion of PRBC should be started at least within 30 minutes and infused as quickly as possible. Frequently re-assess the patient. If the patient becomes very unstable and group-specific blood is not yet available, give O-negative (women), and if male, give O-positive or O-negative.
- If the patient is stable or cross-matched blood is available, give cross-matched blood.
- Observe for transfusion reaction (see Section 10.18).
- If the patient requires a massive blood transfusion, defined as replacement of blood loss equivalent of greater than the patient's total blood volume (70 ml/kg) in less than 24 hours, then transfusion of other blood products (e.g. fresh frozen plasma and platelets) should be given to help the blood clot.
- Calcium is depleted when multiple transfusions are given and should be replaced.

<sup>6</sup> *The Clinical Use of Blood Handbook*. WHO, 2002 (in revision). Available at [http://www.who.int/bloodsafety/clinical\\_use/en/](http://www.who.int/bloodsafety/clinical_use/en/)

## Tranexamic acid

Treatment with tranexamic acid has been shown to safely reduce the number of deaths in bleeding trauma patients. The indications for treatment include evidence of significant haemorrhage (SBP <90, HR >110) or those considered by the clinician to be at risk for haemorrhage. Because the effect of tranexamic acid on death due to bleeding depends importantly on the time interval between injury and the onset of treatment, it should be given as early as possible and within 3–4 hours of the injury.

## Monitoring

For any unstable patient, frequently monitor vital signs, mental status, and urine output, and perform frequent physical examinations. Patients who are stable but have been injured by a high-risk mechanism, such as a fall from a significant height, also should be monitored closely for the first few hours. Use the patient monitoring form, introduced in Section 3.11, to monitor trauma patients. For the first hour, monitor patients, including vital signs and mental status, at least every 15 minutes. After the first hour, use the same monitoring intervals as when caring for other seriously ill patients, such as patients in septic shock. Continue resuscitation until the patient is stabilized or transferred for definitive operative management.

Initial laboratory and diagnostic examinations	Initial and every 15 minutes for 1 <sup>st</sup> 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: <ul style="list-style-type: none"> <li>• X-ray: chest, pelvis, spine, suspected long-bone fractures</li> <li>• diagnostic peritoneal lavage</li> <li>• abdominal ultrasound (FAST – see Section 7.2.20)</li> </ul>	Pulse (normal: 60–100 bpm)  BP (normal: systolic >90)  Respiratory rate (normal 12–16; respond if >20) SpO <sub>2</sub> (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
	Flexes limbs normally to pain	4
	Flexes limbs abnormally to pain	3
	Extends limbs to pain	2
	None	1

If at any point the patient deteriorates, reassess the patient using Quick Check and give any necessary emergency treatments. Repeat a secondary survey to look for occult or missed injuries.

Normal vital signs and improving mental status may suggest that the patient is stabilizing. Some critically injured trauma patients will not stabilize until their injuries are repaired in the operating theatre. The decision whether to rush a patient to the operating theatre needs careful consideration and good communication between the trauma team, surgeon, anaesthetist, and the patient's family. Once the decision is made that the patient requires emergency surgery it should not be delayed.

If a patient remains unstable despite resuscitative efforts, or the patient has a non-survivable injury, consider whether further treatment is futile.

## Definitive care and treatment

Following Quick Check, secondary examination and initial resuscitation, transfer the patient to where they can receive definitive care (ward, operating theatre, referral to higher level of care). If stable, the patient may also be transferred at this time to the radiology department for any necessary tests.

Major trauma patients are at a high risk of complications during their hospitalization, such as pulmonary infections, pressure ulcers, gastric ulcers, and deep vein thrombosis (DVT). See Section 3.0 for more details regarding the general principles in caring for the severely ill patient.

Trauma patients have high nutritional requirements early in the hospital course, and nutrition should be started within 1–2 days. If the patient is unable safely to take food by mouth, start nasogastric feeds slowly and advance as tolerated if there is no contraindication (e.g. severe ileus).

For multi-trauma patients, begin gastric ulcer prophylaxis with a proton pump inhibitor or H<sub>2</sub> 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.<sup>7</sup>

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## 4.3 Violence and injury prevention

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### 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 or helmets for motor cyclists
- preventing drivers from drinking alcohol
- promoting safety in the workplace
- identifying and treating victims of inter-partner violence
- teaching about firearms safety
- violence interruption programmes.

### Ask in all cases of trauma:

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

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<sup>7</sup> *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>



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## 4.4 Manage rape or abuse in adolescents and adults<sup>8</sup>

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### 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;
  - 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.

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<sup>8</sup> *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.<sup>9</sup> Recommended medications should be adapted based on the country. For example, give (for presumptive treatment of gonorrhoea, syphilis, and Chlamydial infection) in a woman:

#### Option 1:

- cefixime 400 mg orally or ceftriaxone 250 mg IM; PLUS
- azithromycin 1 g orally; PLUS
- metronidazole 2 g orally single dose, if trichomonas is prevalent (avoid alcohol when taking metronidazole).

#### Option 2: (if not pregnant and not allergic to penicillin)

- cefixime 400 mg or ceftriaxone 250 IM: PLUS
- benzathine benzylpenicillin 2.4 million IU IM; PLUS
- doxycycline 100 mg orally, twice daily for 7 days or azithromycin 1 g orally; PLUS
- metronidazole 2 g orally single dose, if trichomonas is prevalent (avoid alcohol when taking metronidazole).
- Give HIV post-exposure prophylaxis within 72 hours.
- Recommend baseline HIV testing and counselling.
- Offer emergency contraception if new pregnancy possible (see Section 14.5 – the regimen is the same for HIV-positive and HIV-negative women).
- Inform women that:
  - emergency contraception can decrease the risk of pregnancy if taken within 3–5 days of the assault (depending on the regimen);
  - the medication is not 100% effective;
  - (if she is concerned) emergency contraception pills do not cause abortion (they delay or prevent ovulation or implantation);
  - to avoid nausea and vomiting, eat before taking the pills and, if vomiting occurs within 1 hour, take an antiemetic pill and repeat the dose;
  - the IUD is very effective, as both as emergency and ongoing contraception, if a woman is interested in ongoing contraception.
- Admit or refer as needed.
- Arrange follow up if discharged home.

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## 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.

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<sup>9</sup> *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 <ul style="list-style-type: none"> <li>• HIV </li> <li>• cancer, chemotherapy, and radiation therapy</li> <li>• chronic steroid use</li> </ul> Chronic renal failure Malnutrition Inability to care for wound at home	Location of wound <ul style="list-style-type: none"> <li>• area with limited blood supply (e.g. hands and feet)</li> <li>• involvement of joint or open fracture</li> <li>• tendon involvement</li> </ul> Mechanism of wound <ul style="list-style-type: none"> <li>• crush injury</li> <li>• bite</li> <li>• puncture wound</li> </ul> Duration of the injury (how long ago did the injury occur) Likelihood of contamination <ul style="list-style-type: none"> <li>• foreign body</li> <li>• dirt or debris in wound</li> </ul>

### General approach to wound management

This is the same for all patients with wounds and lacerations.

- Stabilize the patient and assess and treat any life-threatening injuries (Quick Check).
- Apply pressure to any active bleeding.
- Check and record perfusion distal to the wound (distal pulse, capillary refill). Call for help if circulation is compromised.
- Treat pain.
- Take a history and identify factors that increase the risk of infection or poor healing (see table above).
- Examine the wound.
  - Document findings (often it is helpful to draw a picture of the wound).
  - Explore and remove any foreign body.
  - Document any motor or sensory deficit. If there is a deficit, the patient may require consultation or referral.
- Give tetanus toxoid or immunoglobulin for a tetanus-prone wound according to local protocols (see Section 11.34).
- Thoroughly flush the wound with normal saline or clean water. This is the critical step in managing a wound. Irrigation reduces the chance of infection by washing bacteria and debris out of the wound. It is important to use a large volume of fluid to remove all visible dirt and debris from a wound. For contaminated wounds, use at least 2 litres of fluid to irrigate the wound.
- Debridement: if wound edges look dead, remove the dead tissue. Healthy skin should look pink, moist, and bleed easily. Dead skin will be black or grey, may have a white film, and will not bleed easily. Dead skin makes it difficult for the wound to heal and increases the risk of infection.
  - Call for help if not familiar with debridement technique.
  - Inject local anaesthesia. Debridement of a large area of necrotic skin may need to be performed under general anaesthesia in the operating theatre.
  - Using aseptic techniques and scissors or blade, cut dead skin away in thin layers until pink, bleeding tissue is visible.
  - Re-assess the wound.
- Determine final wound care based on the location and extent of the wound, available resources, and the likelihood of infection (see table above).
  - Primary closure
    - ◇ This method is indicated for clean wounds less than 8 hours old with a low risk of infection. If clean, a wound on the face or scalp may be closed up to 24 hours.
    - ◇ Close the wound with sutures to bring wound edges together, preventing wound contamination and facilitating healing.

- ◇ The goal is to bring the sides of the wound close together (good approximation) and limit tension or pulling on the skin. It may be necessary to use both deep sutures (the lower skin level and muscle) and superficial sutures (at the surface) to reduce tension on the wound.
- Delayed primary closure
  - ◇ This method may be chosen if the patient presents with a wound that is more than 8 hours old, or there is concern for contamination.
  - ◇ Clean and debride the wound as described above.
  - ◇ Pack the wound with damp saline gauze.
  - ◇ Give oral antibiotics for 5–7 days (e.g. first generation cephalosporin).
  - ◇ Have the patient return in 2 days to evaluate for closure. Alternatively, for patients who are being admitted, lay down closure sutures at the time of debridement, but do not tie them; tie the closure sutures at the bedside during the first dressing change 48–72 hours later, if the wound is clean.
- Secondary healing
  - ◇ This method should be used for:
    - grossly contaminated or infected wounds
    - wounds with large gaping holes when there is not enough skin at the edges to close the wound
    - puncture wounds
    - gunshot wounds
    - bite wounds.
  - ◇ The wound remains open and is packed with saline soaked gauze.
  - ◇ The gauze is removed every 48–72 hours and the wound is copiously irrigated, reassessed, and the dressing replaced.
  - ◇ The wound gradually becomes smaller, and heals from “inside-out”.

### Key points

- Not all wounds will need to be closed. After cleaning, small wounds and abrasions can be treated with topical antibiotic ointment and a clean dressing.
- Before closing a wound with sutures, determine that wound closure will not increase the risk of infection based on the patient’s co-morbidities, the timing and mechanism of the wound, contamination, and location.
- NEVER close an infected wound with sutures. Pus will accumulate under the closed skin and the infection will worsen. If there is concern about the risk of infection, conservative management is recommended. Allow the wound to close by secondary healing.
- Educate all patients on appropriate wound care including the signs and symptoms of infection and when they should return for follow-up care.
- Consider suturing a wound if:
  - the wound is large (usually greater than 1 cm);
    - ◇ large wounds may need to be considered for eventual consultation or referral for skin grafting;
  - the wound continues to bleed;
  - the wound is over a joint;
  - the wound is in a location where the cosmetic result is important (e.g. face).
- Antibiotic use
  - Antibiotics are not routinely indicated for all wounds.
  - Consider antibiotics if there is a risk of infection (see Table: Factors that increase the risk of infection and poor healing).
  - If there is a suspected open fracture or joint or tendon involvement, give an initial dose of IV or IM antibiotics (e.g. first generation cephalosporin). Consider consultation or referral if a higher level of care is necessary.

- All patients with wounds should receive appropriate discharge instructions to recognize signs and symptoms of infection. If a wound appears infected, or there is a high risk of infection, or an infected wound is worsening when the patient is already on oral antibiotics, consider admission for IV antibiotics and observation. Reconsider the possibility of a retained foreign body.

### Suture techniques

Before debridement and suturing, provide adequate pain control using local anaesthesia.

When using local anaesthesia:

- Ask about any medication allergies.
- Give the anaesthesia solution through a small needle and inject slowly to minimize pain.
- Inject the solution through the edges of the wound where there is no or minimal contamination.
- Do not use a solution containing epinephrine on the fingers, toes, ears, penis, or tip of nose. Refer to *IMEESC* guidelines for wound management, burns, suturing techniques, tendon injuries, management of specific lacerations, gunshot wounds, and land mine injuries.

## 4.6 Fractures

Refer to *Surgical Care at the District Hospital* manual<sup>1</sup> (Sections 17 and 18) for specific splinting techniques, cast application, and traction methods.

### General principles

- In the multiple-injured trauma patient, address all life-threatening injuries before any non-critical orthopaedic injuries.
- A fracture is a break in the continuity of a bone or cartilage.
- Fractures can take from 2–4 months to heal. Healing is affected by the type of bone, age, and other co-morbidities. Treat severe sprains and strains as fractures.
- Goals of fracture management
  - Treat and reduce pain.
  - Prevent infection.
  - Re-align bony fragments so that healing and union can take place and normal function is restored.
- Diagnosis of fractures
  - Suspect a fracture if there is loss of function, pain, swelling, discoloration, or deformity following trauma.
  - Most fractures can be diagnosed clinically.
  - If X-rays are available, at minimum 2 views perpendicular to each other should be obtained prior to reduction.
    - ◇ If there is any compromise of circulation, the limb should be immediately reduced before X-rays.
  - If X-rays are not available and a fracture is suspected, treat the patient as though a fracture is present.
  - Even if X-rays do not show a fracture, if a fracture is suspected clinically, the patient initially should be treated for a fracture with immobilization.
- Treatment
  - Always assess and record vascular status of the limb distal to the fracture.
    - ◇ If no perfusion (limb cold, pale, no pulse, slow or no capillary refill), urgent correction (reduction) of gross deformities is required to restore circulation.
    - ◇ If still no perfusion after re-alignment of the limb, splint and consider urgent orthopaedic consultation or referral.

- ◇ If perfusion is now good following re-alignment, splint the injured segment and obtain X-rays, if available.
- Reduction (bones are manually re-aligned to put the limb back into its normal position).
  - ◇ Reduction initially causes pain, and a patient should always be told what is happening and treated for pain.
  - ◇ Fractures that are not properly reduced will result in non-union and a poor functional outcome.
  - ◇ Always check neurovascular status before and after any reduction.
  - ◇ Relocate any dislocated joints as soon as possible.
- Immobilization (keep the fracture site from moving).
  - ◇ Splints and casts are used for immobilization.
  - ◇ Splints are usually more appropriate for acute injuries because they allow for continued swelling.
  - ◇ Splints prevent the motion of broken bone ends, decrease pain, and minimize further damage to soft tissue, nerves, and blood vessels.
  - ◇ Generally, the joint above and below the fracture site should be immobilized.
  - ◇ Skeletal traction is required for temporary stabilization of certain fractures, such as the hip or femur. Definitive treatment will be dependent on the environment, resources, and other injuries.
- Consider any patient to have an open fracture if there is a wound (more than just a skin abrasion) near a fracture site.
  - Open fractures are orthopaedic emergencies.
  - If an open fracture is suspected:
    - ◇ control haemorrhage with a sterile pressure dressing
    - ◇ perform immediate reduction if any neurovascular compromise
    - ◇ treat pain
    - ◇ carefully remove any gross debris
    - ◇ splint
    - ◇ irrigate with saline and cover the wound with saline soaked gauze
    - ◇ begin IV antibiotics (example first generation cephalosporin)
    - ◇ administer tetanus prophylaxis based on immunization status and local protocols
    - ◇ consider consultation or referral for irrigation and fracture repair in the operating theatre.

## Splints and casts

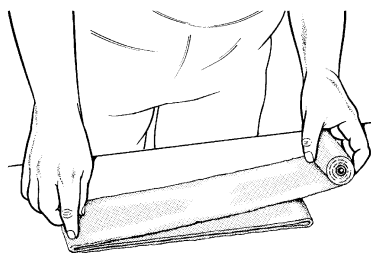
### Key points about splints and casts

- Splints and casts support and protect injured bones and soft tissue, reducing pain, swelling, and muscle spasm.
- Splints are rigid material used to immobilize acutely injured extremities (fractures, strains and sprains, soft tissue injuries). Splints (usually only on one side of the arm or hand) offer less support and protection than a cast and may not be a treatment option in all circumstances, but may be useful for initial management while there is acute swelling.
- Casts are usually made of plaster and are wrapped circumferentially around the extremity, moulded to support and protect the extremity, providing more rigid fixation than splints, but allow less room for swelling than splints. They are often used for definitive treatment of a fracture, and usually applied a few days after the injury when some of the swelling has resolved.
- Construct splints with plaster.
  - If necessary, wood and cardboard will serve as temporary splints.
- As a general rule, immobilize joints in their “functional position” (i.e. 90° flexion at the elbow, neutral position at the ankle). Metacarpo-phalangeal joints (where fingers attach to the hand) should always be immobilized in flexion, never straight.
- Apply plaster when the joint is held in the desired position.

- Avoid moving the joints once the plaster has been rolled, as this movement may cause flexion creases inside the casts and result in pressure sores.
- Always re-assess circulation and perfusion once the plaster is hard.

### **Splint application**

- **Materials**
  - stockinette and padding – protect the skin and allow swelling
  - support material – plaster, pre-formed splints, modified local materials
  - elastic bandages secure the splint in place
  - adhesive tape
  - knife or scissors to cut the splint to the proper length:
  - bucket or pail of wet plaster
  - apron and gloves.
- **Procedure**
  1. Always explain to the patient what you are doing and why.
  2. Treat pain prior to applying a splint.
  3. Remove clothing to adequately visualize the injured extremity.
  4. Check and document neurovascular status (circulation, motor, sensory) before and after application of the splint.
  5. Cover open fractures or joints with saline moistened sterile gauze.
  6. Apply a splint to immobilize a joint above and below the suspected fracture site.
  7. If the injured extremity is visibly deformed, first straighten (reduce) prior to the application of the splint.
  8. Place the joint in the desired position prior to splinting.
  9. If the injury involves the digits, apply padding between the fingers and toes.
  10. If available, place a stockinette over the skin:
    - the stockinette should extend 10–15 cm beyond the area to be splinted at each end;
    - make sure the stockinette is smooth and there are no wrinkles;
    - it may be necessary to cut a slit to avoid wrinkling at the bony prominences.
  11. Wrap padding around the entire area to be splinted:
    - wrap at least 2–3 layers thick
    - each turn should overlap the previous turn by 25%
    - extend 5 cm beyond the edge of the splint at each end
    - use extra padding over the bony prominences
    - avoid wrinkling.
  12. Measure the length of material needed to secure the limb:
    - the plaster width should be slightly greater than the diameter of the limb to be splinted;
    - use 6–12 layers depending on the area to be splinted.

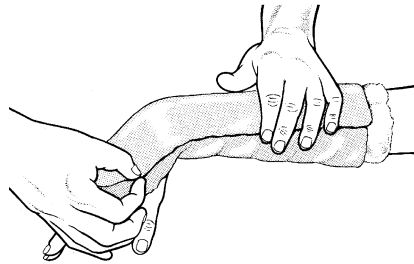


13. Soak the plaster roll in a pail containing water at room temperature. Do not use warm water as the heat given off by the plaster as it sets may burn the patient. Leave the plaster in the water until it is completely soaked and the air bubbles cease to rise.



14. Grasp the plaster layer at each end. Smooth the wet plaster with the palm into a homogeneous layer. Always hold wet plaster with the palm of the hand, not the finger tips, as this may create pressure points and subsequent sores:

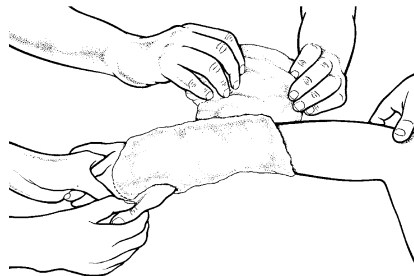
- plaster becomes hot when wet and can cause skin burns;
- apply plaster quickly, or it will dry.



15. Place the plaster splint over the area to be immobilized. Keep the area to be splinted steady and in the desired position.

16. Fold the padding and stockinette back to secure the splint in place and form smooth rounded edges.

17. While still wet, mould the plaster to the limb contours and secure with an elastic bandage or gauze wrap.



### Patient instructions

Give oral and written instructions to the patient or to accompanying relatives or other attendants. Use non-technical language that the patient can understand. Explain the following instructions.

- Keep the splint dry at all times.
- Do not try to scratch your skin under the cast or splint with any object, sharp or blunt.
- For acute injuries, elevate the injured part for 24–48 hours and wiggle your fingers or toes frequently.
- Return to the health clinic immediately if:
  - your splint gets wet or becomes soft or broken;
  - you have increasing pain;
  - you experience numbness or tingling, or have difficulty moving your fingers or toes;
  - you see a change in skin colour of the extremity;
  - your cast or splint has a foul odour.



## Complications

Most problems are caused by improper initial application.

Pressure sores result from skin necrosis caused by localized pressure. They occur over prominent bony areas, from ridges formed during improper application and from foreign bodies placed under the cast. Common sites are:

- heel
- ankle
- dorsum of the foot
- distal ulna at the wrist.

Areas under pressure begin as painful spots but, if ignored, the underlying skin becomes anaesthetised as an open wound develops. Drainage follows, often with a foul smelling odour. Patients who complain of pain under their splint, particularly if away from fracture site or over a known bony prominence, should have their splint removed, the skin under the area examined, and the splint re-applied.

## Compartment syndrome

This is a serious acute emergency caused by swelling in the compartments of an injured limb, which cannot expand. The increasing pressure in the compartment can result in reduced circulation to the limb and nerve and muscle damage. If you suspect compartment syndrome, and are not comfortable with the management, call for assistance.

Increased compartment pressure is commonly caused by:

- tight casts or dressings
- external limb compression
- burn eschar
- fractures
- soft tissue crush injuries
- arterial injury

The most common areas involved are the anterior and deep posterior compartment of the leg and the volar forearm compartment. Other areas include the thigh, the dorsal forearm, the foot, the dorsal hand, and, rarely, the buttocks. Diagnostic physical findings include:

- tense muscle compartments to palpation
- weakness of the involved muscle groups
- pain with passive stretch of the involved muscle
- pain out of proportion to the injury
- decreased sensation (late finding)
- pallor and decreased capillary refill (late finding)
- elevated compartment pressure (if measurement is possible).

Compartment syndrome is a surgical emergency and requires decompression.

See *IMEESC*<sup>7</sup> for further management of compartment syndrome.

### Considerations when caring for the pregnant patient with severe illness and trauma

- The priorities of trauma management are the same as with non-pregnant patients.
- Treat the pregnant patient with the most effective treatment available.
- Place the pregnant patient with shock or severe respiratory distress on their side (preferably the left) to improve uteroplacental blood flow. (Log roll if suspected spine injury – see Quick Check page 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

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## 5. Approach to laboratory investigations

### 5.1 Interpreting laboratory results

#### Evidence-based medicine: steps to using laboratory results

After taking a pertinent history and performing a physical examination, use your knowledge and the appropriate differential diagnosis tables to develop a relevant differential diagnosis, ranked both by what can be common causes and by what can be life-threatening causes.

- Laboratory tests are useful to confirm or rule out a diagnosis (or differential diagnoses); to establish the severity of disease (e.g. CD4 cell count); to monitor treatment outcomes; or to screen for disease (active TB case finding). The tests you choose to order are based on evidence-based health care, national guidelines, and your clinical judgement.
- Order the “best tests” you have available in your setting to either “rule in” or “rule out” a diagnosis that you are considering. Very few tests in medicine are perfect, so it is important that, as the clinician you know how accurate a test is before interpreting a result. For example, how accurate is a single expectorated sputum to diagnose pulmonary tuberculosis in someone with a lung cavity? How accurate is this test in someone without a lung cavity?
- The accuracy of a test can be described by its sensitivity, specificity, and predictive value:
  - **Sensitivity** refers to the ability of the test to correctly identify individuals who truly have the disease. If you perform a test that is highly sensitive for a particular disease and the result is negative, it is very unlikely that that disease is present; hence, the test has been helpful in ruling out the disease in question.

Example: the malaria Rapid Diagnostic Test (RDT) is a very sensitive test. Therefore, if the result is negative, the possibility of malaria has been ruled out. The patient does not have malaria.

- **Specificity** refers to the ability of the test to correctly identify individuals who do not have the disease. If you perform a test that is highly specific for a given disease and the result is positive, you can now be more certain that you have made the correct diagnosis; hence, the test has been helpful in ruling in the disease in question.

Example: an AFB smear on CSF is a very specific test. Therefore, if the result is positive, the possibility of tuberculous meningitis has been ruled in. The patient has tuberculous meningitis.

- **The predictive value** of a test (also called the post-test probability of disease) refers to the ability of the test to correctly identify the disease. Unlike sensitivity and specificity, which do not vary within populations, the predictive value of a test depends on age, gender, geographic location, and disease prevalence.

#### Test your knowledge of evidence-based decision-making by considering a clinical case.

- A 36-year-old man started ART (AZT + 3TC + EFV) in April.
- His pre-treatment CD4 was 15. He is at WHO clinical stage 3, with oral thrush.
- In June, two months after starting ART, he presented with severe headache, confusion, a stiff neck, and fever.
- His chest X-ray was normal.
- The CSF indicated:
  - 19 polys, 253 lymphs
  - protein 0.92
  - glucose 2.6
  - Gram stain – no bacteria

Question:

- What is your differential diagnosis for meningitis?

Differential diagnosis:

- Tuberculous meningitis
- Cryptococcal meningitis
- Bacterial meningitis (partially treated)
- Lymphomatous meningitis

You decide to perform an AFB smear on the CSF. What is the probability that the meningitis of this patient is due to tuberculosis 1) if the test is positive? 2) if the test is negative?

These probabilities depend on the sensitivity and specificity of the test, as described above, and also on how frequent the disease is in your region (prevalence of the disease in the general sick population, also called “pre-test probability”, as it is the probability that the patient has the disease before any testing).

### Situation A

Let us say that evaluation of a cohort of AIDS patients living in your region has shown that 20% of meningitis is due to tuberculosis. You can draw the following 2-by-2 table:

Step 1: Among 1000 patients, 200 (20%) have the disease and 800 do not have the disease.

		Tuberculous meningitis		
		Present	Absent	Total patients
Result of AFB smear of CSF	Positive			
	Negative			
Total patients		<b>200</b>	800	<b>1000</b>

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	<b>120</b>	8	120 + 8 = 128
	Negative	80	<b>792</b>	80 + 792 = 872
Total patients		200	800	1000

$$\begin{array}{ccc} \downarrow & & \downarrow \\ \frac{120}{200} & & \frac{792}{800} \\ = & & = \\ \text{sensitivity} = 60\% & & \text{specificity} = 99\% \end{array}$$

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	<b>120</b>	8	128	→ $120/128 = 94\% = \text{PPV}$
	Negative	80	<b>792</b>	872	→ $792/872 = 91\% = \text{NPV}$
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	<b>12</b>	9	21	→ $12/21 = 57\% = \text{PPV}$
	Negative	8	<b>871</b>	879	→ $871/879 = 99\% = \text{NPV}$
Total patients		<b>20</b>	880	1000	

$$\begin{array}{ccc} \downarrow & & \downarrow \\ \frac{12}{20} & & \frac{871}{880} \\ = & & = \\ \text{sensitivity} = 60\% & & \text{specificity} = 99\% \end{array}$$

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 <sup>1</sup>	70%	96%
	Antibiotic trial to rule out pulmonary TB in smear negative <sup>2</sup>	55%	77%
Cryptococcal meningitis	CSF India ink <sup>3</sup>	72.6%	99%
	CSF cryptococcal antigen <sup>4</sup>	94.1%	99%
	Serum cryptococcal antigen <sup>5</sup>	91.4%	83.3%

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> Asawavichienjinda T, Sitthi-Amorn C, Tanyanont V. Serum cryptococcal antigen: diagnostic value in the diagnosis of AIDS-related cryptococcal meningitis. *Journal of the Medical Association of Thailand*, 1999, 82(1):65–71.

## 5.2 Management of sodium, potassium, and calcium abnormalities

### 5.2.1 Abnormalities of sodium (Na) concentration

#### Hypernatraemia (high Na)

Hypernatraemia is an electrolyte disturbance that is defined by an elevated sodium level in the blood. It may occur in patients who are unwell from other causes (such as diarrhoea, diabetic ketoacidosis, or sepsis). The patient may present with symptoms of thirst, fatigue, weakness, or those of the underlying cause. In severe cases, hypernatraemia may present with **emergency signs** such as confusion, coma, or convulsions (see Section 3.5). **Always consider hypernatraemia in each of these situations.**

A history and a clinical evaluation and, in particular, an assessment of the patient's hydration or volume status will help establish the cause of hypernatraemia and guide initial management.

#### Diagnosis

Serum sodium >145 mmol/litre.

#### Causes

- Hypernatraemia usually is not caused by an excess of sodium, but rather by a relative deficit of free water in the body. It may occur in the following cases:
  - excessive water loss
    - ◇ gastrointestinal losses – diarrhoea, vomiting
    - ◇ cutaneous losses – high fever, sweating, burns
    - ◇ renal losses – hyperglycaemia (by osmotic diuresis), diabetes insipidus (low ADH secretion that may occur with meningoencephalitis or from drugs such as lithium).
  - insufficient water intake
    - ◇ lack of availability
    - ◇ decreased intake due to decreased level of consciousness.
  - excessive sodium administration
    - ◇ excessive IV normal saline (NS) replacement in hospitalized patients.

#### Management

- Avoid rapid correction of serum sodium as this can result in cerebral oedema and permanent neurological damage.
- Assess the volume status (hydration) of the patient.
- Calculate volume of fluid to be replaced. In the dehydrated hypernatraemic patient, the volume of water required to correct the deficit can be calculated from the following equation.

$$\text{Water deficit (in litres)} = \frac{(\text{serum Na concentration} - 140)}{140} \times 0.5 \times \text{body weight (kg)}$$

E.g. if the serum sodium is 160 mmol in a 70 kg patient, then the total water deficit is  $(160-140)/140 \times 0.5 \times 70 = 5$  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.

$$\text{Osmolality (mmol/l)} = 2 \times (\text{Na} + \text{K}) + \text{urea}/2.8 \text{ mg/dl} + \text{glucose}/18 \text{ mg/dl}$$

(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
<b>Dehydrated or hypovolaemic</b> (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 8.3.	<b>Renal losses</b> Diuretics (especially thiazides) Hyperglycaemia (due to osmotic diuresis) Addison's disease <b>Non-renal losses:</b> Gastrointestinal losses (vomiting, diarrhoea, bowel obstruction) Burns	Cautious intravenous hydration using the principles below, and treatment of the underlying cause when possible.
<b>Euvolaemic</b> (normal pulse rate, BP, JVP, peripheries, and urine output)	<b>Serum osmolality &lt;260 mmol/l</b> 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).
<b>Hypervolaemic</b> (raised JVP, peripheral oedema)	Nephrotic syndrome Cirrhosis Congestive cardiac failure	Treat the underlying cause if possible, and restrict total fluid intake to 50–60% of daily fluid requirement (500–1000 ml on average). May require diuresis.

\*Syndrome of inappropriate ADH release (SIADH) is an important cause of low Na but is frequently over-diagnosed; many patients are inappropriately fluid-restricted due to this misdiagnosis. Patients with SIADH are euvolaemic (not dehydrated or oedematous, and not on diuretics). Investigations of a concentrated urine (urine Na >20 mmol/l) in the presence of hyponatraemia (<125 mmol/l) or low plasma osmolality (<260 mmol/kg) confirms this.

## Management

Management should be guided by:

- the volume status of the patient
- the likely duration (chronic hyponatraemia is usually symptomatic)
- symptom severity.

**Correct Na abnormalities slowly** to minimize the risk of permanent neurological deficits or death, which may occur as a consequence of rapid fluid shifts. The increase in serum sodium should be <10 mmol/litre in the first 24 hours and <18 mmol/litre in the first 48 hours.

- In all cases, treat the underlying cause if possible. No further treatment measures are required for asymptomatic or mild hyponatraemia.
- Repeat electrolytes every 12 hours initially to monitor sodium rise, as well as to check for other electrolyte abnormalities.
- In hypovolaemic patients, cautiously hydrate with 0.9% NS to replace the fluid deficit. Use the table in Section 8.3 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.

$$\text{Emergency infusion rate (ml/hour)} = 4 \times \text{weight (kg)} / \text{Na concentration of infusion fluid (\%)}$$

E.g. the infusion rate of 0.9% normal saline in a 70 kg patient should be  $4 \times 70/0.9 \approx 300$  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

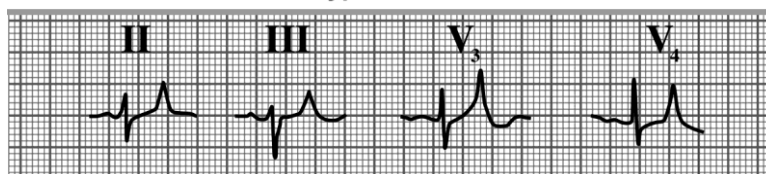
- Falsely high K reading: haemolysed sample commonly causes an elevated reading as potassium leaks from the cells. Repeat the blood test.
- renal failure
- shock (from any causes)
- diabetic ketoacidosis (hyperglycaemia, insulin deficiency)
- medications: potassium supplements, potassium-sparing diuretics (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).

#### Hyperkalemia



- 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  $\beta$  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.

### Hypokalemia



#### 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.

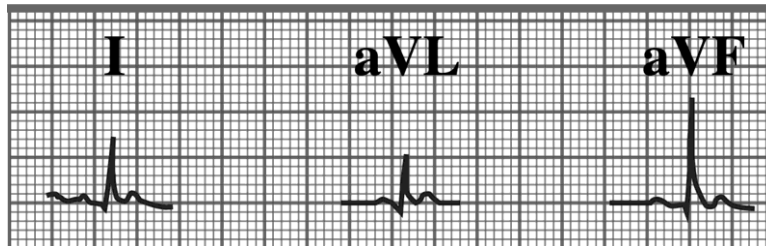
$$\text{Ionized calcium} = \text{Ca} + (40 - \text{serum albumin (g/l)}) \times 0.02$$

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

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## 6. Infection prevention and control

### 6.1 Principles of hospital infection prevention and control

Infection prevention and control (IPC)<sup>1,2,3</sup> are integral to the provision of safe health care. Hospital IPC aims to prevent transmission of communicable diseases including TB,<sup>4,5</sup> blood-borne and enterically transmitted pathogens, acute respiratory diseases,<sup>6</sup> as well as to prevent infection during medical procedures (see Section 7 Procedures) or surgery (covered in other sources).

The purpose of IPC includes preventing the transmission of both endemic and epidemic infections. Community-acquired infections can be amplified by transmission within the health facility in the absence of effective IPC practices, with transmission to other patients, visitors, and health workers. These practices are ongoing requirements that apply every day, as well as when there are novel organisms causing an acute respiratory disease or a hemorrhagic fever. This manual for limited-resource settings assumes middle or high TB burden, requiring consistent attention to TB infection control.

Hospital managers should refer to other sources on developing, implementing, and monitoring an IPC programme<sup>7</sup>, training health workers in IPC, providing adequate infection control commodities, assuring a safe blood supply, managing a sterilization section within the hospital,<sup>8</sup> and improving the infrastructure to make the hospital a safer work environment.

Hospital infrastructure should be arranged and improved as necessary to facilitate hand hygiene, safe waste management, and patient placement. Triage and waiting areas should be well ventilated (open air shelters with a roof are recommended for patient waiting areas), and narrow, poorly ventilated corridors avoided as patient waiting areas. Improving air ventilation<sup>9</sup> in rooms for patient care includes leaving windows and doors open when possible to maximize cross ventilation. Prioritize IPC recommendations based on assessment of the risk of nosocomial infection in the specific health-care facility and in specific patient care areas. This Section is aimed at health workers who should refer to the IPC guidelines and use appropriate precautions in their clinical work.

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<sup>1</sup> *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](http://www.who.int/csr/resources/publications/WHO_HSE_EPR_2009_1/en/index.html)

<sup>2</sup> *Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level.* WHO, 2016. Available at <http://www.who.int/gpsc/ipc-components-guidelines/en/>

<sup>3</sup> *Operations Manual for Delivery of HIV Prevention, Care and Treatment at Primary Health Centres in High-Prevalence, Resource-Constrained Settings.* WHO, 2008. Available at [http://www.who.int/hiv/pub/imai/operations\\_manual/en/index.html](http://www.who.int/hiv/pub/imai/operations_manual/en/index.html)

<sup>4</sup> *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](http://whqlibdoc.who.int/publications/2009/9789241598323_eng.pdf)

<sup>5</sup> *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](http://www.stoptb.org/wg/tb_hiv/assets/documents/TBICImplementationFramework1288971813.pdf)

<sup>6</sup> *Infection prevention and control of epidemic – and pandemic-prone acute respiratory infections in health care.* WHO 2014. ISBN 978 92 4 150713 4

<sup>7</sup> *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](http://whqlibdoc.who.int/hq/2009/WHO_HSE_EPR_2009.1_eng.pdf)

<sup>7</sup> *Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level.* WHO 2016.

<sup>8</sup> *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](http://new.paho.org/hq/index.php?option=com_content&task=view&id=2106&Itemid=229&lang=en)

<sup>9</sup> *Natural Ventilation for Infection Control in Health-Care Settings.* WHO, 2009. Available at [http://whqlibdoc.who.int/publications/2009/9789241547857\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241547857_eng.pdf)

<sup>10</sup> GARvent weblink <http://www.who.int/csr/bioriskreduction/natvent/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<sup>11</sup> 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:<sup>12,13</sup>

- hand hygiene (see Section 6.2)
- appropriate personal protective equipment (PPE) (see Section 6.3):
  - gloves
  - facial protection (eyes, nose, and mouth)
  - gown
- respiratory hygiene and cough etiquette (see Section 6.4)
- prevention (and management) of injuries from sharp instruments (see Section 6.5)
- environmental cleaning (see Section 6.6)
- appropriate handling of contaminated linens (see Section 6.7)
- waste disposal (see Section 6.8)
- patient care equipment (see Section 6.9).

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<sup>11</sup> *Infection control standard precautions in health care*. WHO, 2006. Available at [http://www.who.int/csr/resources/publications/4EPR\\_AM2.pdf](http://www.who.int/csr/resources/publications/4EPR_AM2.pdf)

<sup>12</sup> *Infection prevention and control of epidemic – and pandemic-prone acute respiratory infections in health care*. WHO 2014. ISBN 978 92 4 150713 4

<sup>13</sup> *Infection control standard precautions in health care*. WHO, 2006. Available at [http://www.who.int/csr/resources/publications/4EPR\\_AM2.pdf](http://www.who.int/csr/resources/publications/4EPR_AM2.pdf)

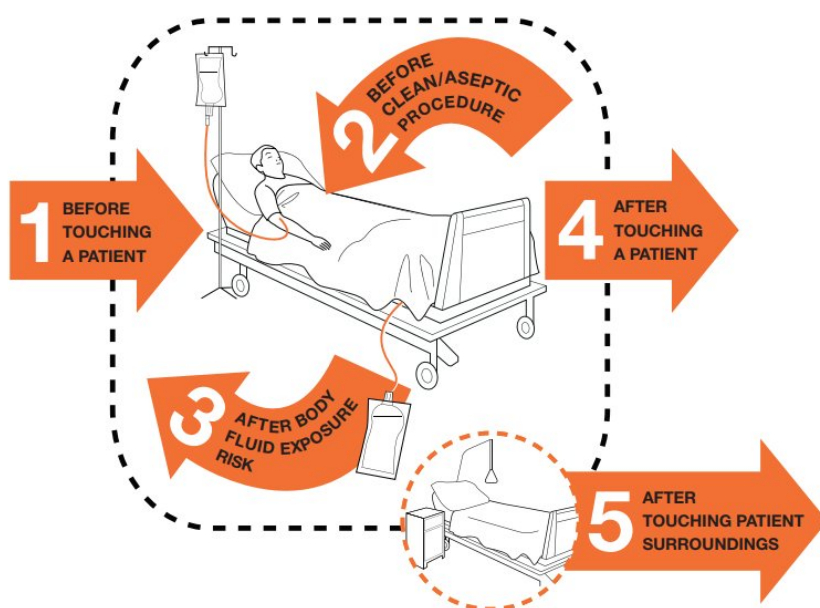
## 6.2 Hand hygiene<sup>14</sup>

- Ensure availability of hand-washing facilities with clean running water.
- Ensure availability of hand hygiene products (clean water, soap, single-use clean towels, and alcohol-based hand rub). Alcohol-based hand rubs should be made available at every point of care and are the standard of care.
- When to wash hands with soap and running water:
  - when hands are visibly dirty.
- When to use alcohol-based hand rub:
  - when hands appear clean (i.e. are not visibly soiled).

### Indications for hand hygiene

- Before and after any direct contact between a health worker and a patient and contact between patients, whether or not gloves are worn. Hands should be washed before gloves are put on.
- Immediately after gloves are removed.
- Before handling an invasive device.
- After touching blood, body fluids, secretions, excretions, non-intact skin, and contaminated items, even if gloves are worn.
- During care, e.g. when moving from a contaminated to a clean body site of the same patient.
- After contact with inanimate objects in the immediate vicinity of the patient.
- Ensure that hands are dry before starting any activity.
- Dry hands with single-use towels.

# Your 5 Moments for Hand Hygiene



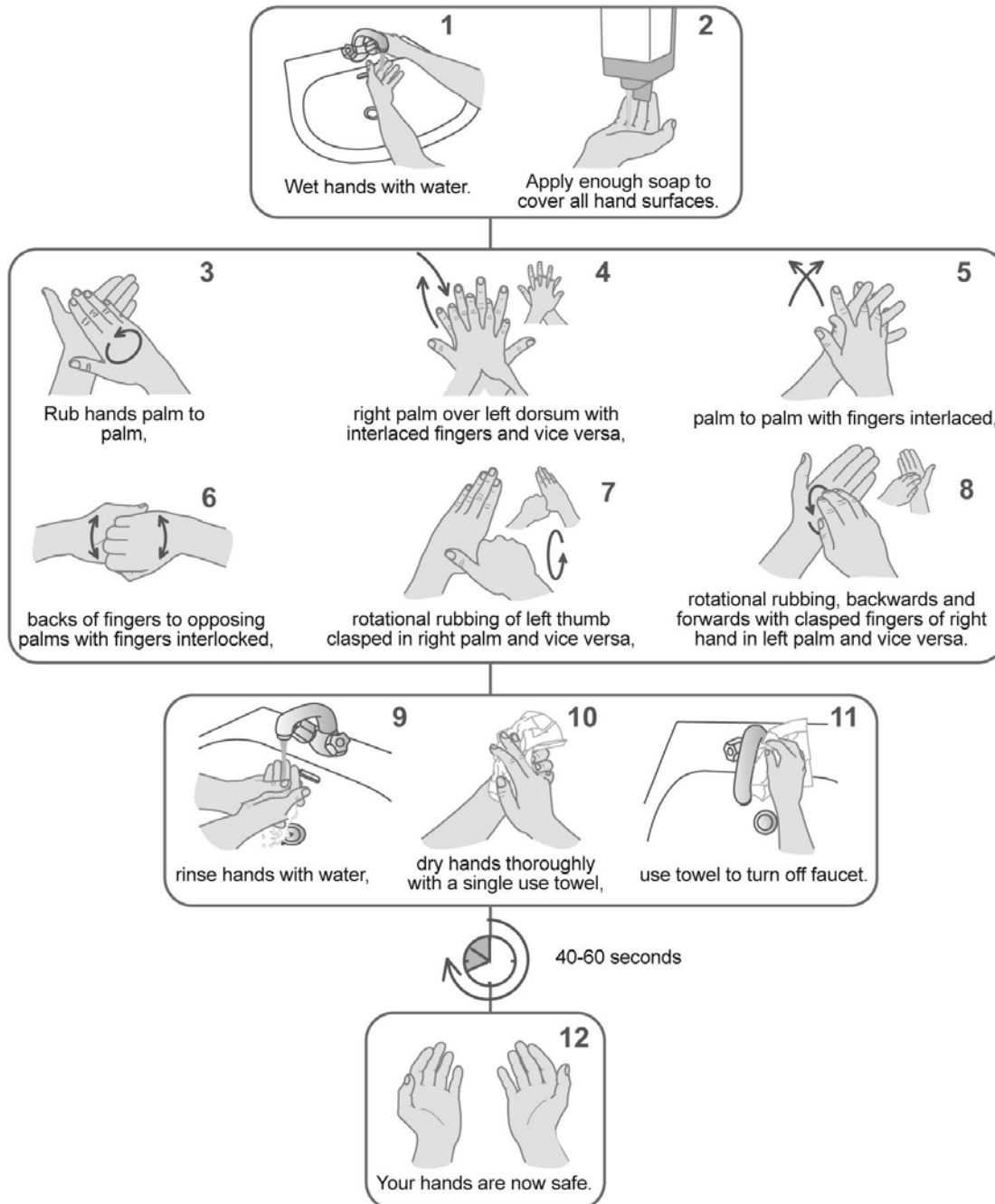
<sup>14</sup> WHO Guidelines on Hand Hygiene in Health Care. WHO, 2009. Available at [http://whqlibdoc.who.int/publications/2009/9789241597906\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf)

<sup>15</sup>Evidence of hand hygiene as the building block for infection prevention and control. WHO, 2017.

**Techniques for hand hygiene**  
**Hand washing (40–60 seconds)**

- Wet hands and apply soap; rub all surfaces; rinse hands and dry thoroughly with a single use towel; use towel to turn off faucet and dispose of the used towel.

**Figure: How to wash the hands with soap and water<sup>16</sup>**

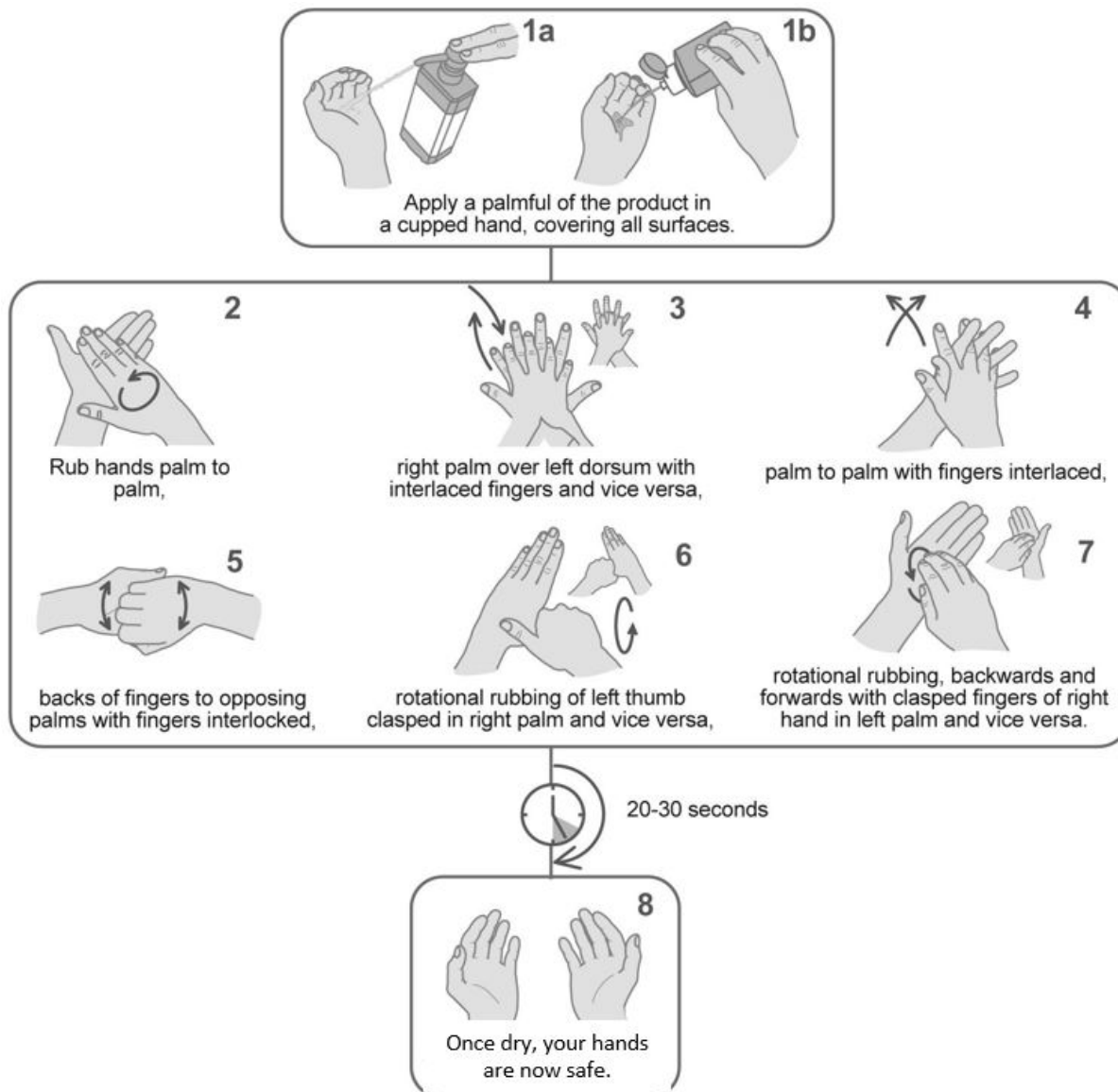


<sup>16</sup> WHO Guidelines on Hand Hygiene in Health Care. WHO, 2009. Available at [http://whqlibdoc.who.int/hq/2009/WHO\\_IER\\_PSP\\_2009.07\\_eng.pdf](http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.07_eng.pdf)

## 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<sup>16</sup>



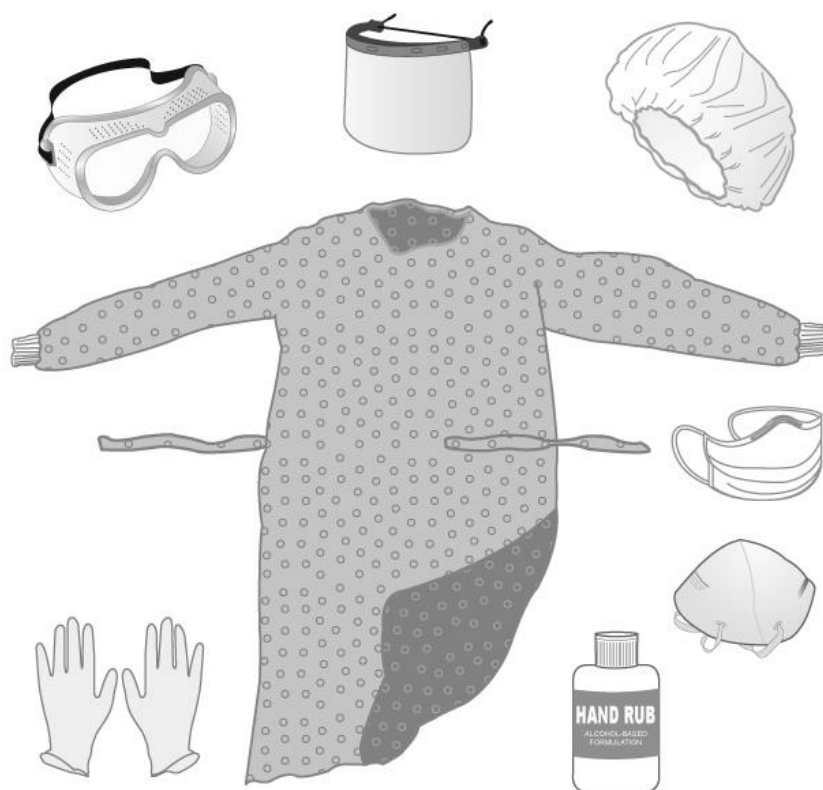
## 6.3 Appropriate personal protective equipment (PPE)

**Assess the risk** of exposure to body substances or contaminated surfaces **BEFORE** any health-care activity. **Make this a routine!**

- Select PPE based on the assessment of risk:
  - clean, non-sterile gloves
  - clean, non-sterile fluid-resistant gown
  - mask and eye protection or a face shield.
- Ensure that there is a continued supply of PPE.
- Educate and train hospital staff how to wear, remove, and dispose of PPE.

Some PPE is used based on the procedure or type of patient care, no matter what organism (these are part of standard precautions). Additional PPE may need to be added based on the patient's likely diagnosis and suspected pathogen- see Table 6a for additional precautions by suspected organism and Table 6b for the appropriate PPE by suspected organism. Full PPE may be required rather than the basic PPE described below. If suspect acute respiratory disease of concern, see Section 6.11, or 6.13 if suspect Ebola/Marburg- full PPE described here is also needed for CCHF or Nipah. 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). See Section 6.10

**Figure: Examples of personal protective equipment**



## PPE to use for any patient according to likely exposure to blood, secretions, non-intact skin

### Gloves

- Wear gloves if there is any chance of touching blood, body fluids, secretions, excretions, mucous membranes, or skin, especially skin that is not intact.
- Change between tasks and procedures on the same patient after contact with potentially infectious material, to prevent further contamination.
- Remove after use, before touching non-contaminated items and surfaces, and before going to another patient. Perform hand hygiene immediately after removal.

### Facial protection (eyes, nose, and mouth)

- Wear a surgical or procedure mask and eye protection (eye visor, goggles), or a face shield, to protect mucous membranes of the eyes, nose, and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.
- Masks should be used only when it is useful and recommended.

### Gown

- Gowns protect the skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays.
- Wear a gown whenever there is any risk of splashes of blood or body fluids.
- If splashing with blood or other body fluids is anticipated and gowns are not fluid-resistant, wear a waterproof apron over the gown.
- Remove soiled gowns as soon as possible, and perform hand hygiene.

## Steps to wear basic PPE

1. Assess risk.

2. Select and gather the necessary PPE.



3. Put on the gown.



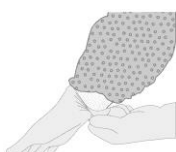
4. Put on the mask.



5. Put on eye protection.



6. Put on gloves (over cuff).





## Steps to remove basic 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.



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## 6.4 Respiratory hygiene and cough etiquette

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- Educate all staff, health workers, patients, and hospital visitors on respiratory hygiene and cough etiquette.
  - Covering mouth and nose when coughing or sneezing.
  - Hand hygiene after contact with respiratory secretions.
  - Spatial separation of persons with acute febrile respiratory symptoms.
- Have tissues available in the waiting area or provide a medical mask.
- When tissues, cloths, or face masks are not available, all staff, health workers, patients, and visitors need to be instructed to lift their arm up and cover their nose and mouth with the inner surface of the arm or forearm when they cough or sneeze.
- Remind all staff, health workers, patients, and visitors to dispose of the tissues and masks in no-touch receptacles and to wash their hands.
- Have posters, at least, in patient waiting areas to remind patients and health workers.

### Persons with respiratory symptoms should apply source control measures

- Such persons need to cover their nose and mouth with a tissue or mask when coughing or sneezing, dispose of used tissues and masks appropriately, and perform hand hygiene after coughing or sneezing.

### Actions for health-care facilities

- Place patients with acute febrile respiratory symptoms at least 1 metre (3 feet) away from others in common waiting areas.
- Post visual alerts at the entrance to health-care facilities instructing persons with respiratory symptoms to practice respiratory hygiene and cough etiquette.
- Make hand hygiene resources, tissues, and masks available in common areas and areas used for the evaluation of patients with respiratory illnesses.

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## 6.5 Prevention of needle-stick and injuries from other sharp instruments<sup>18</sup>

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

Use care when handling, using, cleaning, and disposing of needles, scalpels, and other sharps.

- Do not bend, break, or otherwise manipulate used needles, scalpels, or other sharp instruments.
- Do not recap needles.
- Keep a sharps container nearby when giving injections. Discard single-use needles and syringes immediately after use and directly into the sharps container, without recapping and without passing to another person.
- Close, seal, and send sharps containers for incineration before they are completely full (follow your facility protocol carefully).

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<sup>18</sup> WHO best practices for injections and related procedures toolkit. WHO, 2010. Available at [http://whqlibdoc.who.int/publications/2010/9789241599252\\_eng.pdf](http://whqlibdoc.who.int/publications/2010/9789241599252_eng.pdf)

Indications for glove use when giving injections	Precautions
<p>Wear non-sterile, well-fitting, single-use gloves:</p> <ul style="list-style-type: none"> <li>• 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;</li> <li>• when performing venipuncture or venous access injections, because of the potential for blood exposure at the puncture site;</li> <li>• 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).</li> </ul>	<p><b>Do not</b> use gloves:</p> <ul style="list-style-type: none"> <li>• when undertaking routine intradermal, subcutaneous, and intramuscular injections: <ul style="list-style-type: none"> <li>○ if the health worker's skin is intact</li> <li>○ if the patient's skin is intact.</li> </ul> </li> <li>• Gloves do not provide protection against needle-stick or other puncture wounds caused by sharp objects.</li> <li>• Needles, scalpels and other sharps should be handled with extreme caution.</li> </ul>

### Summary of best practices for injections

DO	DO NOT
<ul style="list-style-type: none"> <li>• 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.</li> <li>• Use one pair of non-sterile gloves per procedure or patient.</li> <li>• Use a single-use device for blood sampling and drawing.</li> <li>• Disinfect the skin at the venipuncture site.</li> <li>• Discard the used device (a needle and syringe is a single unit) immediately into a robust sharps container.</li> <li>• If recapping a needle is unavoidable, use the one-hand scoop technique. <ol style="list-style-type: none"> <li>1. Leave the needle cap on a flat surface, placed against a firm, upright surface with the cap opening facing towards you.</li> <li>2. Lift the needle and syringe vertically and guide the tip of the used needle into the cap using only one hand.</li> <li>3. Once the tip is covered, use the other hand to fix the cap into place.</li> <li>4. Clean the surface with disinfectant afterwards to avoid leaving any blood.</li> </ol> </li> <li>• Seal the sharps container with a tamper-proof lid.</li> <li>• Place laboratory sample tubes in a sturdy rack before injecting into the rubber stopper.</li> <li>• Immediately report any incident or accident linked to a needle or sharps injury, and seek assistance.</li> <li>• Assess for need then start post-exposure prophylaxis (PEP) as soon as possible.</li> </ul>	<ul style="list-style-type: none"> <li>• DO NOT forget to clean your hands.</li> <li>• DO NOT use the same pair of gloves for more than one patient.</li> <li>• DO NOT wash gloves for reuse.</li> <li>• DO NOT use a syringe, needle, or lancet for more than one patient.</li> <li>• DO NOT touch the puncture site after disinfecting it.</li> <li>• DO NOT leave an unprotected needle lying outside the sharps container.</li> <li>• DO NOT recap a needle using both hands.</li> <li>• DO NOT overfill or empty sharps from a container.</li> <li>• DO NOT inject into a laboratory tube while holding it with the other hand.</li> <li>• DO NOT delay HIV PEP after exposure to potentially contaminated material. Beyond 72 hours, PEP is NOT effective.</li> </ul>

## 6.6 Environmental cleaning

- Use adequate procedures for the routine cleaning and disinfection of environmental and other frequently touched surfaces.
  - Floors and horizontal work surfaces should be cleaned at least once a day.
  - Cleaning should always be carried out from “clean” areas to “dirty” areas, in order to avoid contaminant transfer.
  - Dry sweeping with a broom should never be done.
  - Rags with dust should not be shaken out and surfaces should not be cleaned with dry rags. Cleaning with a moistened cloth helps to avoid contaminating the air with air-borne particles.
- Clean BEFORE you disinfect.
- Change cleaning solutions and equipment frequently, as these items will get contaminated quickly (follow your hospital protocols).

**Table: Cleaning, disinfecting, or sterilizing**<sup>19</sup>

Setting	Manual cleaning with water and detergent	Disinfection (sodium hypochlorite 1% in-use dilution, bleaching powder, alcohol (70%))	Sterilization (steam under pressure, dry heat sterilization, automated chemical)
Floors, work tops	✓		
Spillage – of blood, body fluids, secretions, and excretions	✓	✓	
Commode, toilet seats	✓	✓	
Mops, wash mops	✓		
Dressing trolleys	✓	✓	
Mattress and pillows (always cover with plastic covers)	✓	✓	
Reusable instruments	✓		✓
AMBU bag and mask	✓		✓

## 6.7 Linens<sup>20</sup>

Handle, transport, and process used linen so as to:

- Prevent skin and mucous membrane exposure and contamination of clothing.
- Avoid transfer of pathogens to other patients or the environment:
  - All used linen and waste should be placed in bags or containers that are able to withstand transportation without being damaged.
  - Any solid matter on soiled linen should be removed and flushed down a toilet.
  - Used linen should be handled carefully to prevent contamination of surrounding surfaces or people.
  - Used linen should be washed according to normal routines.

In managing suspect VHF patients, staff should use full PPE and heavy duty/rubber gloves when handling, transporting and processing used linen. If the linen is heavily soiled, avoid manipulation and preferably incinerate.<sup>21</sup>

<sup>19</sup> 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](http://whqlibdoc.who.int/hq/2009/WHO_HSE_EPR_2009.1_eng.pdf)

<sup>20</sup> 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](http://new.paho.org/hq/index.php?option=com_content&task=view&id=2106&Itemid=229&lang=en)

<sup>21</sup> Clinical Management of patients with viral haemorrhagic fever, a pocket guide for front-line health workers. WHO, 2016

## 6.8 Waste disposal

- Ensure safe waste management.
- Treat waste contaminated with blood, body fluids, secretions, and excretions as clinical waste, in accordance with local regulations.
- Human tissue and laboratory waste that is directly associated with specimen processing should be treated as clinical waste.
- Segregate at the point of generation the 4 categories of waste:
  1. sharps
  2. non-sharps infectious waste
  3. non-sharp non-infectious waste
  4. hazardous waste.
- Discard single use items properly.

## 6.9 Patient care equipment

- Handle equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposure, contamination of clothing, or transfer of pathogens to other patients or the environment.
- Clean, disinfect, sterilize, and reprocess reusable equipment appropriately before use with another patient.

**Table: How to set up 3 colour-coded waste containers for most rooms in the hospital (plus a hazardous waste container in the pharmacy and laboratory only)**

Waste category	Segregate using colour-coded waste containers	Collect	Dispose
<b>Sharps</b> (needles, scalpels) – infectious or not	<b>YELLOW</b> Safe sharps container must be: <ul style="list-style-type: none"> <li>• puncture-proof</li> <li>• covered</li> <li>• closable</li> <li>• upright and stable during use</li> <li>• leak-proof at sides and bottom</li> <li>• clearly labelled for user</li> </ul>	<ul style="list-style-type: none"> <li>• Close lid or cover, seal with tape, and submit for waste pickup when they are no more than <math>\frac{3}{4}</math> full.</li> <li>• Never overfill or force items into these containers.</li> <li>• Collect regularly for disposal.</li> </ul>	<ul style="list-style-type: none"> <li>• 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).</li> <li>• 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.</li> </ul>
<b>Non-sharps infectious waste*</b> (anatomical waste, pathological waste, dressings, used syringes, used single-use gloves)	<b>YELLOW OR RED</b> <ul style="list-style-type: none"> <li>• bags or containers</li> <li>• 15–40 litre capacity, with lids</li> </ul>	<ul style="list-style-type: none"> <li>• Containers should be collected, emptied, cleaned, disinfected, and replaced after each intervention (e.g. in an operating or maternity unit) or twice daily.</li> <li>• Bags should not be cleaned and reused but disposed of as sharps infectious waste.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-sharps infectious waste should be buried in a pit fitted with a sealed cover and ventilation pipe for on-site treatment in small health centre settings.</li> <li>• Otherwise, treat on-site or off-site with high-temperature incineration or steam sterilization.</li> <li>• Special arrangements may be needed for disposing of placentas, according to local custom.</li> </ul>
<b>Non-sharp, non-infectious waste</b>	<b>BLACK</b> <ul style="list-style-type: none"> <li>• containers</li> </ul>	<ul style="list-style-type: none"> <li>• Should be collected, emptied, cleaned and replaced daily.</li> </ul>	<ul style="list-style-type: none"> <li>• May be included in the municipal waste stream or buried in a pit or landfill</li> </ul>

<b>(paper, packaging)</b>	20–60 litre capacity	<ul style="list-style-type: none"> <li>• Alternatively, plastic bags may be used inside the containers for easy removal and disposal.</li> </ul>	<p>site.</p> <ul style="list-style-type: none"> <li>• Non-food and non-medical items may be recycled.</li> <li>• If space is limited, this waste should be incinerated. Ashes and residues should be buried in a pit.</li> </ul>
<b>Hazardous waste**</b>	Appropriately labelled containers placed in secure locations.	<ul style="list-style-type: none"> <li>• These may be stored in a small, labelled container at the pharmacy.</li> </ul>	<ul style="list-style-type: none"> <li>• Follow specific and appropriate treatment protocol and dispose of at the facility or send to a central health facility.</li> <li>• Manage stock of chemicals and pharmaceuticals well to reduce waste quantities and save on purchase costs.</li> </ul>

\* 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.

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## 6.10 Select additional infection control interventions including PPE, based on the risk assessment, epidemiology, or likely pathogen.

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### Droplet precautions

#### Additional precautions for infections transmitted by large droplets

A respiratory aerosol of certain infections produces large particles or droplets (>5 µm in diameter) that typically remain suspended in the air for a limited period of time and settle within 1 m (3 feet) of the source.

#### What to do in addition to standard precautions when such droplet transmission is possible.

- All health workers for all patient care within 1 meter of the patient should wear a medical mask or surgical mask (tight fitting).
- Use single rooms for infectious patients. Otherwise, cohort patients with same suspected etiology. If not possible, place patient beds at least 1 m apart and arranged to keep a distance between patients.

### Airborne precautions

#### Additional precautions for infections transmitted by small droplet nuclei

Smaller particles (small droplet nuclei ≤5 µm in diameter) evaporate quickly; the resulting dried residues settle slowly from the air, and remain suspended in the air for variable lengths of time.

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

Particulate respirator, e.g. N-95 or similar

- Use adequately ventilated single rooms (≥12 ACH). If single rooms are not possible, cohort patients with the same diagnosis. Airborne precaution rooms can be naturally or mechanically ventilated, with adequate air exchange rate of at least 12 ACH and controlled direction of air flow.

### Contact precautions

#### Additional precautions for infections transmitted by contact

Contact transmission can be direct (direct body surface to body surface contact and physical transfer of micro-organisms) or indirect (e.g. contaminated hands or equipment that carry and transfer the micro-organisms).

#### What to do in addition to standard precautions

- Gloves and gowns for all patient care.
- Use disposable equipment or dedicate equipment for patient care. If equipment must be shared among patients, clean and disinfect it between each patient use.
- Use single rooms. Otherwise, cohort patients with the same diagnosis. If not possible, place patient beds at least 1 m apart. For pathogens of potential international concern, a single room is more important.

**Table 6a: Precautions by suspected organisms – examples**

<b>Additional precautions by suspected organisms – IN ADDITION TO STANDARD PRECAUTIONS</b>	
<b>Additional precautions:</b>	<b>Disease or organisms include</b>
<b>Droplet precautions</b>	<ul style="list-style-type: none"> <li>• Acute respiratory diseases (ARD) transmitted through large droplets including:               <ul style="list-style-type: none"> <li>○ Influenza (seasonal, pandemic) and</li> <li>○ ARD with no pathogen identified, no risk factor for tuberculosis or ARI of potential international concern (influenza-like illness= ILI)</li> </ul> </li> <li>• Diphtheria- pharyngeal</li> <li>• Meningococcal meningitis (<i>Neisseria meningitides</i>) for first 24 hours of antimicrobial therapy</li> <li>• Mumps (infectious parotitis)</li> <li>• <i>Pertussis</i> (whooping cough)</li> <li>• Pneumonic plague</li> </ul>
<b>Contact precautions</b>	<ul style="list-style-type: none"> <li>• <i>Vibrio cholera</i>, <i>Shigella</i> species</li> <li>• Resistant bacteria (such as methicillin-resistant <i>Staphylococcus</i>)</li> <li>• <i>Clostridium difficile</i></li> <li>• Different forms of gastroenteritis</li> <li>• Diphtheria- cutaneous</li> <li>• Herpes simplex or localized zoster</li> <li>• Hand, foot and mouth disease</li> </ul>
<b>Contact plus droplet precautions</b>	<ul style="list-style-type: none"> <li>• Adenovirus, para-influenza, RSV</li> <li>• Ebola/Marburg, Crimean-Congo haemorrhagic fever, Lassa fever (although Lassa is less infectious than Ebola, use the same precautions)</li> <li>• Avian influenza (e.g. H5N1, H7N9)</li> <li>• SARS, MERS-CoV</li> <li>• Nipah</li> </ul>
<b>Airborne precautions</b>	<ul style="list-style-type: none"> <li>• Infectious pulmonary TB- especially MDR</li> <li>• Measles</li> <li>• Varicella (chickenpox) (not localized zoster)</li> <li>• Whenever performing aerosol-generating procedures such as endotracheal intubation or bronchoscopy- for acute respiratory infections, for viral haemorrhagic fevers</li> </ul>
<b>Contact plus airborne</b>	<ul style="list-style-type: none"> <li>• When a novel ARI is identified and the mode of transmission is unknown, it may be wise to implement the highest level of IPC precautions whenever possible, including the use of particulate respirators, until the mode of transmission is clarified.</li> <li>• Smallpox</li> </ul>
<b>No additional - standard precautions only</b>	<ul style="list-style-type: none"> <li>• Common bacterial respiratory infections caused by organisms such as <i>Streptococcus pneumoniae</i>, <i>Haemophilus influenzae</i>, <i>Chlamydia</i> spp., <i>Mycoplasma pneumoniae</i>.</li> <li>• Most blood-borne pathogens including HIV and HBV.</li> <li>• Anthrax- cutaneous</li> <li>• Scrub typhus</li> <li>• Japanese encephalitis</li> </ul>



**Table 6b: Epidemic-prone diseases and other priority pathogens: isolation, IPC precautions and PPE**

**Note:** this table does not include recommendations for vaccine; implementation of respiratory hygiene and cough etiquette; monitoring and managing ill healthcare personnel.

Note: Also use airborne precautions for any ARI or VHF with person-to-person transmission during an aerosol-generating procedure.

Organism/disease	Isolation or ward care	IPC precautions	PPE
<p><b>Viral haemorrhagic fevers (VHF) with person-to-person transmission</b> (Ebola, Marburg, Lassa, CCHF)</p>	<p><b>Isolation-</b> in isolation room – transfer to ETU if more than 2-3 patients or mobile ETU will arrive</p> <p>Separate suspect and confirmed patients. See ETU principles.</p>	<p><b>Standard plus contact plus droplet</b></p>	<p>Full barrier PPE (i.e., coveralls, separate hood, apron either goggles or face shield, gloves, gumboots; though N95 unnecessary since no airborne transmission, N95 often worn due to requirement for a structured, non-collapsible mask.</p> <p>For <b>aerosol-generating procedures</b> (e.g., endotracheal intubation or bronchoscopy), N95 should be worn</p>
<p><b>Highly Pathogenic Avian Influenza (e.g. H5N1, H7N9) and novel coronaviruses (e.g., SARS, MERS-CoV)</b></p>	<p><b>Isolation-</b> in isolation room; if large number, cohort patients in separate ward with good ventilation.</p> <p>In order to avoid cross-contamination from patient to patient, an area of 8 to 10 m<sup>2</sup> must be allocated to each bed. It is also necessary to keep some distance between two beds. Beds should be spaced about 2 meters apart, with patients' heads spaced about 3 meters apart.</p> <p>Transfer to a larger isolation unit if lack of sufficient safe space between patients and sufficient trained health workers to manage patients.</p>	<p><b>Standard plus contact plus droplet</b></p>	<p>Full barrier PPE (same as for VHF)- many would use an N95 mask.</p> <p>Contact and droplet precautions are recommended by WHO: <i>Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care</i>. 2014.</p> <p>Note that CDC recommends airborne precautions for highly pathogenic Avian influenza (<a href="https://www.cdc.gov/flu/avianflu/clinicians-evaluating-patients.htm">https://www.cdc.gov/flu/avianflu/clinicians-evaluating-patients.htm</a>) and SARS <a href="https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines.pdf">https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines.pdf</a>.</p> <p>UK also recommends airborne precautions for both <a href="http://www.hse.gov.uk/biosafety/diseases/avianflu.htm">http://www.hse.gov.uk/biosafety/diseases/avianflu.htm</a>; <a href="http://www.hse.gov.uk/biosafety/diseases/sars.htm">http://www.hse.gov.uk/biosafety/diseases/sars.htm</a></p>

<p><b>Novel ARI identified, and the mode of transmission is unknown.</b></p> <p><b>Smallpox</b></p>	<p><b>Isolation-</b> in isolation room; if large number, cohort patients in separate ward with good ventilation and airborne precautions; minimum requirement for airborne diseases is 12 air volume changes in 1 hour.</p> <p>In order to avoid cross-contamination from patient to patient, an area of 8 to 10 m<sup>2</sup> must be allocated to each bed. It is also necessary to keep some distance between two beds. Beds should be spaced about 2 meters apart, with patients' heads spaced about 3 meters apart.</p> <p>Transfer to a larger isolation unit if lack of sufficient safe space between patients and sufficient trained health workers to manage patients.</p>	<p><b>Standard plus contact plus airborne</b></p>	<p>Full barrier PPE (same as for VHF) plus N95 mask.</p> <p>When a novel ARI is newly identified, the mode of transmission is usually unknown. Implement the highest available level of IPC precautions (including the use of particulate respirators), until the situation and mode of transmission is clarified.</p> <p>CDC also recommends these precautions if possible for monkeypox.  <a href="https://www.cdc.gov/poxvirus/monkeypox/clinicians/infection-control-hospital.html">https://www.cdc.gov/poxvirus/monkeypox/clinicians/infection-control-hospital.html</a></p>
<p><b>Measles</b>  <b>Varicella</b>  <b>Disseminated zoster</b>  <b>Tuberculosis if pulmonary infiltrate- especially MDR TB</b></p>	<p><b>Isolation-</b> in isolation room – if large number, cohort patients in separate ward with good ventilation and airborne precautions; minimum requirement for airborne diseases is 12 air volume changes in 1 hour</p>	<p><b>Standard plus airborne</b></p>	<p>Gown, gloves, N95 mask with either goggles or face shield</p>
<p><b>Influenza (seasonal, pandemic)</b>  <b>RSV</b>  <b>Parainfluenza virus</b>  <b>Adenovirus</b>  <b>Human metapneumovirus</b></p>	<p><b>Isolation-</b> in isolation room – if large number, cohort patients in separate ward</p>	<p><b>Standard plus droplet</b></p>	<p>Gowns, gloves, regular, mask; for <b>aerosol- generating procedures</b> (e.g., endotracheal intubation or bronchoscopy) N95 should be worn; procedures should be performed in room with <b>good ventilation</b> (12 air volume changes/hour).</p> <p>Droplet precautions can be discontinued when adenovirus and influenza ruled out.</p>
<p><b>Cholera</b></p>	<p><b>Cholera treatment unit</b>          -Separate ward in hospital or tent in community (<u>no</u> use of isolation rooms)</p>	<p><b>Standard plus contact</b></p>	
<p><b>Typhoid fever, C difficile, rotavirus, norovirus</b></p>	<p><b>Admit to regular ward</b></p>	<p><b>Standard plus contact/ enteric</b></p>	
<p><b>Diarrhoea with blood</b></p>	<p><b>Admit to regular ward</b></p>	<p><b>Standard plus contact</b></p>	

<b>Meningococcal meningitis</b>	<b>Admit to regular ward (+ some special precautions)</b>	<b>Standard plus droplet</b> (for first 24 hours antibiotic treatment); family caregiver in close contact should receive prophylaxis	Wear mask
<b>Yellow fever Japanese encephalitis</b>	<b>Admit to regular ward</b>	<b>Standard</b> (plus mosquito control)	
<b>Dengue, chikungunya</b>	<b>Admit to regular ward</b>	<b>Standard</b>	
<b>Plague- bubonic</b>	<b>Admit to regular ward</b>	<b>Standard plus contact</b>	
<b>Plague- pneumonia</b>	<b>Admit to regular ward</b>	<b>Standard plus contact; droplet</b> (until 48-72 hours of antibiotic treatment)	Gloves, apron, face shields, surgical masks  Consider <b>post-exposure prophylaxis</b> if unprotected close contact (within 1-2 m)
<b>Cutaneous anthrax; anthrax pneumonia (inhalation anthrax)</b>	<b>Admit to regular ward</b>	<b>Standard plus contact</b>	Gloves, apron, face shield (if risk of splash); masks unnecessary on general wards (standard surgical mask in operating theatre). Hand wash with <b>soap and water</b> after PPE removal due to risk of contamination by spores

## 6.11 Special precautions for acute respiratory diseases (ARDs) that are prone to result in epidemics or pandemics update

### Separate and fast track patients with or suspected to have ARDs of potential concern

- ARDs of potential concern include MERS-CoV, SARS-CoV, new influenza viruses causing human infection, and novel ARDs that can cause large-scale outbreaks and outbreaks with high morbidity and mortality.
- Place patients who are coughing or have a suspected ARD of concern in an area separate from other patients and "fast-track" for rapid diagnosis and treatment.
  - They should move to the front of the queue for all services and be assessed promptly.
  - They should wait near an open window or in a comfortable area separate from the general waiting room.
- Accommodate ARD patients at least 1 metre away from other patients.
- For suspected ARDs of concern, prevent contact with contaminated equipment and the environment.
  - Place the patient in a single room or cohort with similarly infected patients.
  - Limit patient unprotected movement and have them wear a mask when moving about.

**Table: Precautions for ARDs according to specific clinical settings and procedures<sup>22</sup>**

Setting or procedure	Infection control measures							
	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	✓	✓			✓	✓		✓

<sup>22</sup> *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](http://whqlibdoc.who.int/hq/2008/WHO_HSE_EPR_2008.2_eng.pdf)

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## 6.12 Special precautions for infectious TB patients

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- As for acute respiratory diseases, place patients who are coughing or have suspected TB in an area separate from other patients and have them "fast-tracked" for rapid diagnosis and treatment.
  - They should move to the front of the queue for all services and be assessed promptly.
  - They should wait near an open window or in a comfortable area separate from the general waiting room.
  - "Fast-track" aims to minimize time spent in the hospital for patients suspected of having TB.
- Community-based approaches for the management of TB patients (including MDR-TB) should be prioritized over hospitalization
  - Complement with education of household members and other close contacts on TB infection control.
- Avoid unnecessary admissions of TB patients to health-care facilities.
  - Open doors and windows to use the natural air flow in the hospital.
- On TB wards, the infectious TB patient should wear a medical mask, especially if correct cough etiquette is not observed.
  - The health care workers should wear an N-95 mask when taking care of an infectious TB patient in a close environment.
- Patients with known or suspected drug-resistant TB (DR-TB) should be separated from other patients, including other TB patients.

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## 6.13 Precautions when caring for patients with suspected or confirmed Filovirus (Ebola, Marburg) haemorrhagic fever<sup>21,23, 24,</sup>

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### Use Standard precautions + Contact precautions + Droplet precautions!

**Contact precautions** are used in addition to standard precautions to reduce the risk of transmitting infectious agents by direct and indirect touch (or contact).

**Droplet precautions** are used in addition to standard precautions to reduce the risk of transmitting infectious agents that spread by large droplets (>5µm).

In addition to standard precautions, the following are WHO recommendations for direct patient care for known or suspected Filovirus haemorrhagic fever patients. These were developed for Ebola and Marburg but the full PPE and other precautions described below are also applicable for CCHF and Nipah.

- Restrict all non-essential staff from patient care areas.
- Maintain a register of all people entering the patient care area.
- Limit the number of visitors allowed access to the patient to those necessary for the patient's well-being and care, such as a child's parent or caregiver. All visitors should wear full PPE.
- Ensure that all those entering the Ebola Treatment Unit (ETU) patient care area use full PPE according to recommendations. Before they enter the isolation area, instruct all visitors on putting on, using and removing PPE correctly and on correct hand hygiene practices. Make sure they understand and follow the instructions strictly.
- Apply infection control precautions to avoid any possible unprotected direct contact with blood and body fluids (e.g., blood, urine, faeces, vomit, sweat, saliva, semen, breast milk) when providing care to any VHF patient, including suspected cases.
- Perform hand hygiene according to the indications listed below by using either an alcohol-based handrub or soap and running water and applying the correct technique recommended by WHO. Bleach/chlorine solutions 0.05% may be used in emergency situations until alcohol-based handrubs or soap and water become available at the facility.
- Perform hand hygiene before and after direct patient care, after any contact with potentially contaminated surfaces, and after removing PPE. Neglecting to perform hand hygiene after removing PPE reduces or negates the benefits of the protective equipment.
- Wear double correctly sized gloves (non-sterile examination gloves or surgical gloves, preferably nitrile gloves, when entering the patient care area. See guidelines below on the 2-step procedure to change gloves safely between patients or if compromised.
- Wear a disposable gown and waterproof apron, or a disposable coverall and waterproof apron, to cover clothing and exposed skin. The gown and the coverall should be made of fabric that is tested for resistance to penetration by blood and body fluids and to blood-borne pathogens.
- Wear facial protection to prevent splashes to the nose, mouth and eyes.
- Wear a fluid-resistant medical/surgical mask with a structured design that does not collapse against the mouth (for example, duckbill, cup shape).
- Wear either a face shield or goggles.
- Wear waterproof boots (for example, rubber/gum boots).
- Wear a head cover that covers the head and neck.

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- Before leaving the isolation area of a patient with suspected VHF, carefully remove and dispose of protective equipment, following the steps exactly.
  - When removing protective equipment, be careful to avoid any contact between the soiled items (for example, gloves, gowns) and any area of the face (eyes, nose or mouth).
  - Ensure that clinical and non-clinical personnel are assigned exclusively to VHF patient care areas and that 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. See section 3 for precautions for preparing medicines for injection and risk assessment before deciding to administer medicines or insert an IV.
  - Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care.

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<sup>23</sup> *Interim infection prevention and control guidance for care of patients with suspected or confirmed filovirus haemorrhagic fever in health-care settings, with focus on Ebola*. Geneva: World Health Organization 2014

<sup>24</sup> *Guideline on hand hygiene in health care in the context of filovirus disease outbreak response*. Geneva: World Health Organization; 2014

### **Specify who should wear full PPE**

- All doctors, nurses and health workers who provide direct patient care to suspected VHF patients.
- All support staff who clean the isolation room, handle contaminated supplies and equipment, launder re-usable supplies and collect and dispose of infectious waste from VHF patients.
- All laboratory staff who handle patient specimens and body fluids from suspected VHF cases.
- Laboratory support staff who clean and disinfect laboratory equipment used to test VHF specimens.
- Burial teams who remove bodies of deceased VHF patients and prepare them for burial.
- Family members who care for VHF patients.
- Any other person who enters the red zone.

### **Steps to put on and remove full PPE<sup>25,26</sup>**

Viral haemorrhagic fevers can be transmitted from person to person, usually through direct contact with the contaminated blood or body fluids of an infected person, or through exposure to objects that have been contaminated with infected secretions. Infection probably occurs most often through oral or mucous membrane exposure (that is, eyes, mouth and nose) or breaks in the skin. Currently, there is no evidence for human-to-human transmission of VHF through an airborne route.

The following information about proper PPE during a VHF outbreak addresses health workers providing direct and indirect care to VHF patients. It constitutes the minimum guidance to achieve appropriate protection for IPC. Importantly, during an outbreak the types of PPE available in the field may not be the same at all sites and may even differ based on the organization providing them. Thus, it is imperative that the clinical team involved in triage and clinical management of patients assesses the evolving situation during the outbreak to determine whether the minimum requirements are available or additional protective measures are necessary. In any case, it is important for clinicians to weigh the benefits of protecting themselves and patients against the risks of compromising patient care through unnecessary barriers or excessively uncomfortable protective equipment.

Accordingly, the following instructions are an illustration of the steps to put on and take off the required PPE, with some additional measures depending on the conditions occurring during the outbreak. They may need adaptation according to local circumstances.

<sup>25</sup> *Personal protective equipment for use in a filovirus disease outbreak Rapid advice guideline* 2016;

<sup>26</sup> *Personal protective equipment in the context of filovirus disease outbreak response. rapid advice guideline.* Geneva: World Health Organization; 2014;



### **Purpose of using PPE for VHF**

To ensure safety of health workers and patients:

- Avoid contamination from patient's body fluids.
- Avoid self-contamination (e.g. hands touching your mouth, nose or eyes).
- Avoid contamination when you take off PPE.
- Avoid transmission to others (patients, co-workers, visitors).

### **Principles of using PPE**

- Protect eyes, nose and mouth at all times (keep facial protection to the end).
- Never touch your face with gloved hands.
- Always remove PPE carefully to avoid self-contamination when doffing.

### **Recognizing who people are among those providing care in the ETU**

- Place the name of the person in PPE in a visible location (for example, on the disposable apron) so that the person can be easily recognized inside the treatment center.
- Important to include the "buddy" system (to supervise/support each other during donning/doffing PPE and working inside the red zone).
- Distinguish roles – who is a clinician, a hygienist/cleaner, etc.

**Have a dedicated, trained staff member at all times to supervise removal (doffing) of PPE that assures each step of safe removal.**

**Safe and effective use of PPE depends on:**

- Adequate and regular supplies
- Adequate staff training
- Proper hand hygiene
- Appropriate behavior
- Close supervision and support.

**Do not touch your face – eyes, nose or mouth with gloved or ungloved hands.**

Hang the wallchart on donning and doffing PPE, according to whether coveralls or gowns are used. For donning coveralls:

[http://apps.who.int/iris/bitstream/10665/150116/WHO\\_HIS\\_SDS\\_2015.2\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/150116/WHO_HIS_SDS_2015.2_eng.pdf?ua=1)

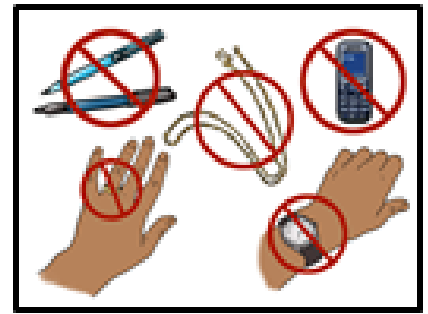
For doffing coveralls

[http://apps.who.int/iris/bitstream/10665/150116/WHO\\_HIS\\_SDS\\_2015.2\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/150116/WHO_HIS_SDS_2015.2_eng.pdf)

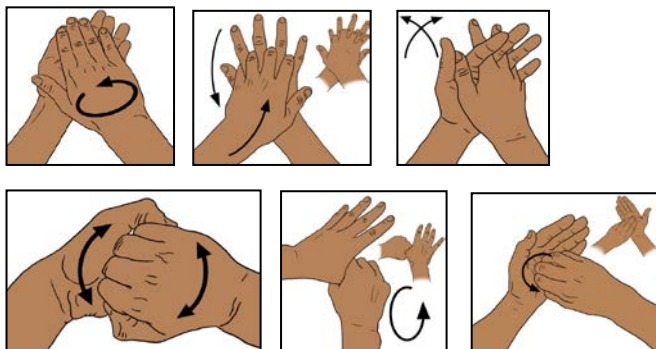
## Steps to put on PPE including coverall

1. Remove all personal items (jewelry, watches, phones, pens, etc).
2. Put on the scrub suit and rubber boots\* in the changing room

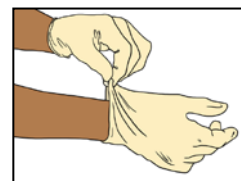
\*if not available use closed shoes (slip-ons without shoelaces and fully covering the dorsum of the foot and ankles) and shoe covers (nonslip and preferably impermeable).



3. Move to the clean area at the entrance of the isolation unit.
4. By visual inspection ensure that all sizes of the PPE set are correct and the quality is appropriate.
5. Undertake the procedure of putting on PPE under the guidance and supervision of a trained observer (colleague/buddy).
6. Perform hand hygiene



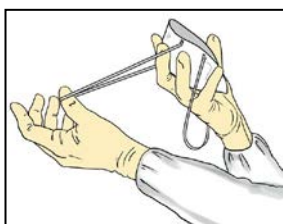
7. Put on gloves (examination, nitrile gloves)
8. Put on coverall.



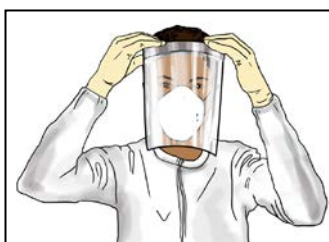
Make a thumb (or middle finger) hole in the coverall sleeve to ensure that your forearm is not exposed when making wide movements. Some coverall models have thumb loops attached to sleeves, which can be used instead.



9. Put on face mask.



10. Put on face shield OR goggles.



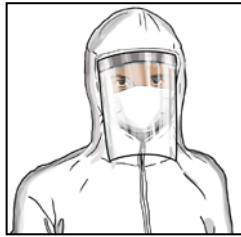
OR



11. Put on head and neck covering: surgical bonnet covering neck and sides of the head (preferable with face shield) OR hood.



OR

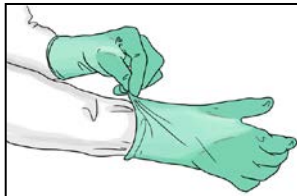


12. Put on disposable waterproof apron (if not available, use heavy duty, reusable waterproof apron).



*It is difficult to don some apron models after one has mask and goggles/ face shield on. In such cases it should be done after step 8.*

13. Put on a second pair of (preferably long cuff) gloves of the cuff of the coverall. Do not use adhesive tape to attach the gloves



14. Self-check in mirror.

15. Check buddy and write name/occupation/time of entry of the PPE

Enter the decontamination area by walking through chlorine tray. If available, use scrub brush to remove any particulate matter (mud or organic material) that may be on the soles or surface of the boots and then wipe all sides with 0.5% chlorine solution.

### Steps to remove PPE with a coverall

1. Always remove PPE under the guidance and supervision of a trained observer (colleague).

Ensure that infectious waste containers are available in the doffing area for safe disposal of PPE. Separate containers should be made available for reusable items.

2. Perform hand hygiene on gloved hands (0.5% chlorine or clean running water and soap).

During work in the patient area, outer gloves should be changed between patients and prior to exiting (change after seeing the last patient).

WHO recommends not to spray at this step. In the West African outbreak, however, most doffing stations include a sprayer. If spraying is going to take place, spraying should take place only below the nipple line to minimize splashing or misting above the neck. Furthermore, if spraying is used at this step, staff should still maintain maximum attention while removing PPE, because they may still be contaminated by the Ebola virus even after being sprayed.

3. Remove apron leaning forward and taking care to avoid contaminating your hands.

When removing a disposable apron, tear it off at the neck and roll it down without touching the front area. Then, untie the back and roll the apron forward.

When removing a reusable apron over the head, take care to not disrupt the face shield/ goggles/ mask.



4. Perform hand hygiene on gloved hands (0.5% chlorine or clean running water and soap)

5. Remove head and neck covering (bonnet or hood), taking care to avoid contaminating your face, and dispose of safely.



6. Perform hand hygiene on gloved hands (0.5% chlorine or clean running water and soap).
7. Remove coverall and outer pair of gloves.

Ideally in front of a mirror, tilt head back to reach zipper, unzip completely without touching any skin or scrubs, and start removing coverall from top to bottom. After freeing shoulders, remove the outer gloves while pulling the arms out of the sleeves. With inner gloves roll the coverall from the waist down and from the inside of the coverall, down to the top of the boots. Use one boot to pull off coverall from other boot and vice versa, then step away from the coverall and dispose of it safely.

\*Outer pair of gloves can also be removed before removing the coverall. In that instance perform additional hand hygiene as in point 6.



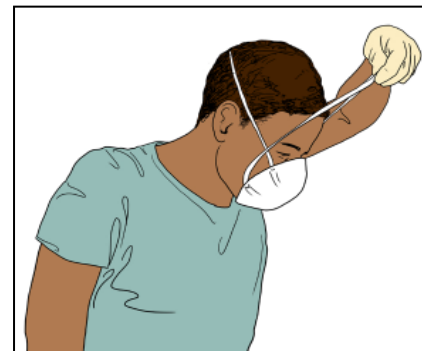
8. Perform hand hygiene on gloved hands (0.5% chlorine or clean running water and soap).

9. Remove eye protection by pulling the string from behind the head (keep eyes closed) and dispose safely



10. Perform hand hygiene on gloved hands.

11. Remove the mask from behind the head (keep eyes closed), by first untying the bottom string above the head and leaving it hanging in front; and then the top string next, from behind the head, and dispose of safely



12. Perform hand hygiene on gloved hands (0.5% chlorine or clean running water and soap).

13. Decontaminate boots appropriately (all sides and bottom) and move to lower risk area one foot at a time.  
If removing the boots, avoid touching them. And perform additional hand hygiene on gloved hands.

14. Remove gloves carefully with appropriate technique and dispose of safely.



15. Perform hand hygiene (alcohol-based hand rub or clean running water and soap).

At the end of the day, boots should be disinfected by soaking in a 0.5% chlorine solution for 30 minutes, and then rinsed and dried.

Note: Donning and doffing procedures may need to vary based on specific type of PPE  
If you are using gowns in a non-Ebola health facility, follow the donning and doffing steps in <http://www.who.int/csr/resources/publications/ebola/ppe-steps/en/>.



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## 7. Procedures<sup>1,2</sup>

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### 7.1 General considerations in performing procedures

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#### 7.1.1 Patient consent

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Before performing a procedure, it is important to receive consent from the patient. If the patient is unable to give consent (e.g. the patient is comatose or similarly incapacitated), a proxy (a family member or legal guardian) may do so on behalf of the patient. In such situations, the proxy should make the decision he or she believes the patient would make if they were able and competent. The decision to obtain consent involuntarily should not be taken lightly, and the patient should have the right to appeal.

Explain what will be done before doing the procedure:

- Explain why the procedure is necessary:
  - What are the benefits?
  - What are the risks, including pain associated with the procedure?
- Ask if the patient has questions or concerns and address them.
- Check that the patient has understood.
- Obtain permission to proceed.
- Document on the patient chart the discussion and consent.
- Be mindful of the comfort and privacy of all patients and their families.

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#### 7.1.2 Patient safety considerations, precautions and anaesthesia

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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 Section 7.3.2.



Some health facilities prepare a trolley that is kept stocked with instruments and materials used to perform common procedures. The contents will vary depending on the types and frequency of procedures at a given health facility.

Standard precautions, safe injection practices, and safe waste management should be used before, during, and after **all** procedures. See Section 6.

- These include hand hygiene and gloves for all procedures, and face protection and a gown when relevant.
- Always use care when handling, using, cleaning, and disposing of needles, scalpels and other sharps.
- Treat waste contaminated with blood, body fluids, secretions, and human tissue as clinical waste in accordance with local regulations.
- Sterile gloves should be used and a sterile field maintained for:
  - excision skin biopsy
  - lymph node biopsy
  - thoracocentesis
  - chest tube placement

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<sup>1</sup> *Surgical Care at the District Hospital*. WHO, 2003. Available at [www.who.int/surgery/publications/en/SCDH.pdf](http://www.who.int/surgery/publications/en/SCDH.pdf)

<sup>2</sup> *Comprehensive cervical cancer control: a guide to essential practice*. WHO, 2006. Available at [whqlibdoc.who.int/publications/2006/9241547006\\_eng.pdf](http://whqlibdoc.who.int/publications/2006/9241547006_eng.pdf)

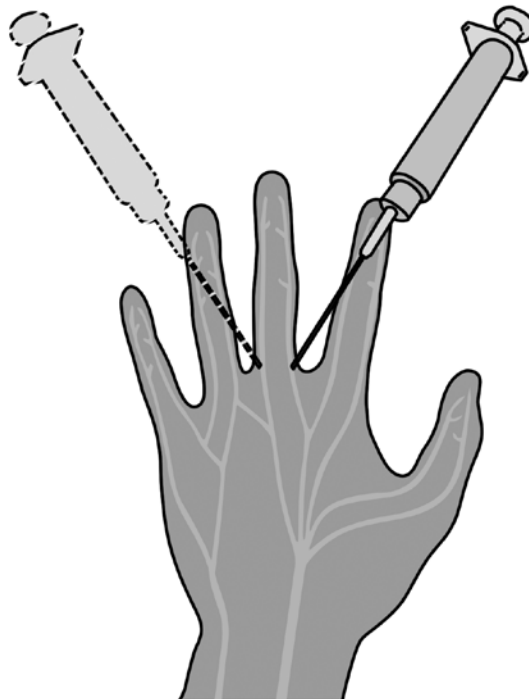
- lumbar puncture
- paracentesis, arthrocentesis, pericardiocentesis
- bone marrow biopsy
- urinary catheter insertion
- IUD placement
- suprapubic urinary catheter placement.
- A sterile field requires the careful application of an antiseptic and draping with sterile drapes, such as towels or paper drapes.
- Always remember to sterilize or disinfect all reusable equipment after a procedure.

### Anaesthesia using lidocaine

Most of the procedures below can be done with anaesthesia using lidocaine in one of two ways:

- Locally
  - Lidocaine is injected into the area to be anaesthetized; larger areas can be covered with a field block by injecting widely around the area in a diamond pattern.
- Digital block
  - Lidocaine is injected at the base of the digit or penis at the 2, 6, and 10 o'clock positions, in order to anaesthetize the entire digit (do not use epinephrine (adrenaline) here). Digital block is preferable, where possible, as it requires smaller doses of anaesthetic for a given area.
- The dose of lidocaine will vary widely by procedure and size of the area to be anaesthetized.

The table below gives maximum doses for lidocaine with and without epinephrine.



Maximum drug doses for lidocaine			
Agent	Concentration %	Maximum safe dose mg	Maximum volume ml
Lidocaine	0.5	300	60
	1.0	300	30
	2.0	300	15
Lidocaine-epinephrine	0.5	500	100
	1.0	500	50
	2.0	500	25

\* *Clinical Procedures in Emergency Medicine*, 4th Edition (adapted). James R. Roberts, Jerris R. Hedges (Eds). Saunders, Philadelphia, 2004.

- Avoid using lidocaine with epinephrine on the digits, penis, or other extremities. This can lead to vasoconstriction and gangrene.
- Using a small needle (25- to 30- gauge) for injecting lidocaine will reduce pain and bleeding. Also, small needles slow the speed of the injection and reduce tissue distortion. They should be used with a small syringe, usually 10 ml.
- When using lidocaine for local anaesthesia, always draw back the plunger before injecting, to make sure the needle is not in a blood vessel.
- Try to minimize the number of punctures (and associated pain) by not withdrawing the needle completely after the initial puncture. Instead, redirect it along a separate path.
- Lidocaine jelly may be used for certain procedures (e.g. urinary catheter insertion, IUD placement).

### 7.1.3 Safe collection and transport of samples if suspect dangerous pathogen

**Safe collection:** Diagnostic laboratory activities if suspect VHF or other dangerous pathogen with human-to-human transmission <sup>3</sup>

- All specimens should be regarded as potentially infectious. Health workers who collect or transport clinical specimens should adhere rigorously to full PPE and other VHF precautions to minimize the possibility of exposure to pathogens.
- Activities such as micro-pipetting and centrifugation can mechanically generate fine aerosols that might pose a risk of transmission of infection through inhalation.
- Laboratory personnel handling potential VHF clinical specimens should wear full PPE, particulate respirators (for example, EU FFP2, US NIOSH-certified N951), and eye protection or powered air purifying respirators (PAPR) when aliquotting, performing centrifugation or undertaking any other procedure that may generate aerosols.
- When removing protective equipment, avoid any contact between the soiled items (for example, gloves, coveralls or gowns) and any area of the face (that is, eyes, nose or mouth).
- Perform hand hygiene immediately after the removal of protective equipment used during specimen handling and after any contact with potentially contaminated surfaces.
- Place specimens in clearly labeled, non-glass, leak-proof containers and deliver directly to designated specimen handling areas.
- Disinfect all external surfaces of specimen containers thoroughly (using an effective disinfectant) prior to transport. (Example of effective disinfectant: alcohol or sodium

<sup>3</sup> Clinical Management of Patients with Viral Haemorrhagic Fever, World Health Organization, Geneva, 2016.

hypochlorite at 0.5%, 5000 ppm available chlorine (that is, 1:10 dilution of household bleach at initial concentration of 5%).

- A system of sample collection and transport is required that can adjust to the evolving situation (increase or decrease in number of cases, new mobile laboratories being established, etc.). Personnel who collect and handle samples (laboratory personnel; nurses, doctors and phlebotomists who do blood sampling); personnel who package samples for transport; and surveillance officers who obtain oral swabs in dead bodies) should be trained on how to put PPE on and take it off. Safe shipment of highly infectious biological substances should adhere to locally developed SOPs that ensure the following procedures for investigations are followed:
  - Ensure that all specimen collection containers and materials are available.
  - Ensure that all the equipment is assembled. Ideally, use needle safe devices, if available, and always have a sharps box at hand.
  - Ideally, invasive procedures should be undertaken by two health workers.
  - Follow necessary protective precautions when collecting samples including full PPE.
  - Ensure that samples are appropriately labelled, including three unique patient identifiers – name, age and unique identification number.
  - Triple package samples- see below.
  - Send the samples immediately to the appropriate reference laboratory, marked “Urgent” with the biohazard sign. There may be a country-wide network of laboratories where samples for transportation to the national reference laboratory (or a laboratory in a neighboring country) are gathered. Often the regional centres have the means to pick up samples from lower-level health units in their areas of operation.
- Due to the potential risk of transmission to laboratory workers, additional blood tests are not to be sent to the laboratory that does routine testing until the results of the VHF screen are known and negative. An exception to this is the use of rapid diagnostic tests (RDTs) for malaria, HIV and other point-of-care testing equipment by appropriately trained personnel in full PPE within the red zone.

## **Storage of potentially infectious samples/materials**

### **Requirements**

- PPE
- Specimen log
- Inventory log
- Marker/pen
- Cold maintaining system as per the required storage temperature –
  - Refrigerator (2-8 °C)
  - Freezer (-20 °C/-30°C)
  - Ultra-low freezer (<-70 °C)
  - Liquid Nitrogen (-196 °C)
- Sample box/container
- Spill management kit
- Waste disposal bags

### **Procedure**

1. Wear PPE
2. Place the specimens in the designated pre-labelled box/container.
3. Place the box/ container in aforesaid cold system (as per required temperature).

4. Do not keep different types of samples in same box/container.
5. Keep different types of samples in different designated locations of the refrigerator/freezer
6. Keep the samples separately from reagents in different cold system (preferable)/locations to prevent from mix up/contamination.
7. Maintain the temperature logs.
8. Maintain inventory log.

#### Safe transport<sup>4</sup>:

Use triple packaging for Category A pathogens:

	Category A	Category B	Exemption- not subject to dangerous goods regulations
Definition	An infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.	An infectious substance which does not meet the criteria for inclusion in Category A.	<i>Substances that do not contain infectious substances or that are unlikely to cause disease in humans or animals</i>
Examples (see reference for all)	<p>CCHF virus Ebola virus Hantaan virus Hendra virus Nipah virus</p> <p><u>Cultures only</u> of many other pathogens including: JE, <i>Bacillus anthracis</i>, <i>Brucella melitensis</i> or <i>suis</i>, <i>Burkholderia pseudomallei</i>, dengue virus, Hepatitis B, highly pathogenic avian influenza virus, <i>Shigella dysenteriae</i> type 1, Yellow fever, <i>Yersinia pestis</i>, Foot and mouth disease virus.</p>		<p><b>Unless meeting criteria for A or B:</b></p> <p>This category includes Dried blood spots Fecal occult blood screening sample Decontaminated medical or clinical waste For transfusion or transplantation</p> <p>An informed professional judgement based on the known medical history, symptoms and individual circumstances of the source, human or animal, and endemic conditions determined that there is only minimal likelihood that pathogens are present</p>
Packaging required	Triple packaging for Category A, itemized content list,		

<sup>4</sup> Guidance on regulations for the transport of infectious substances 2017–2018, World Health Organization, 2017: <http://www.who.int/ihr/publications/WHO-WHECPI-2017.8/en/>

## Transportation of infectious materials

### Requirements

- PPEs
- Specimen log
- Declaration forms
- Shipment logs/ tracking log
- Marker/pen
- Cold maintaining materials (ice packs, gel packs, dry ice, etc. as per the required shipment temperature)
- Triple packaging system
- Spill management kit
- Waste disposal bags

### National shipment within the country

Principally the sample shipment procedure should be based on international standard (International Air Transport Association (IATA) guideline). National shipment therefore should follow the norms of international guidelines and comply with the triple packaging system locally adapted with best available materials.

**Note:** Always ship the samples making sure that specimen reaches NPHL/designated lab on a working day.

### International shipment

Samples may need to be transported by road and/or air to carry out primary/confirmatory diagnostic tests on samples, characterization of microbial pathogens etc. In order to prevent transportation associated accidents it is important that infectious substance be packaged and transported according to tested and standard methods. It also requires that any individual transporting an infectious substance be trained in the transportation of dangerous goods (infectious substances). The shipping infectious substances by air fall under the Dangerous Goods Regulations (DGR) of the IATA.

### The basic triple packaging system:

The triple packaging system, the choice for the transport of infectious and potentially infectious substances, is exemplified in the two figures below. This packaging system consists of three layers:

- The primary receptacle, the secondary packaging and the outer packaging. The primary receptacle containing the specimen must be watertight, leak-proof and appropriately labelled as to content. The primary receptacle is wrapped in enough absorbent material to absorb all fluid in case of breakage or leakage.
- A second watertight, leak proof packaging is used to enclose and protect the primary receptacle(s). Several wrapped primary receptacles may be placed in a single secondary packaging. Volume and/or weight limits for packaged infectious substances are included in certain regulatory texts.
- The third layer protects the secondary packaging from physical damage while in transit. Specimen data forms, letters and other types of information that identify or describe the specimen and identify the shipper and receiver, and any other documentation required must also be provided according to latest regulations.

The basic triple packaging system applies for the transport of a variety of infectious substance; however, high-risk organisms must be shipped according to more stringent requirements.

**Training requirements:** For national shipment, the lab staff is required to have basic sample shipment training while for International shipment of infectious materials (category A/B), lab staff should be a trained one in IATA guideline with valid licence.

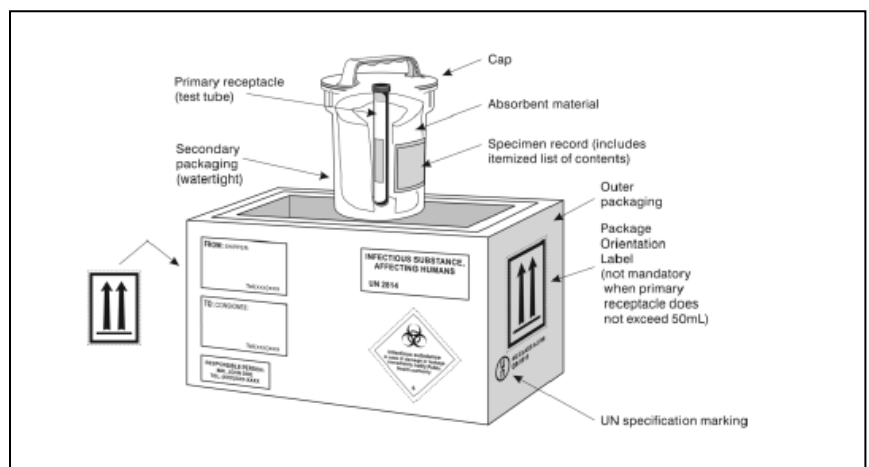
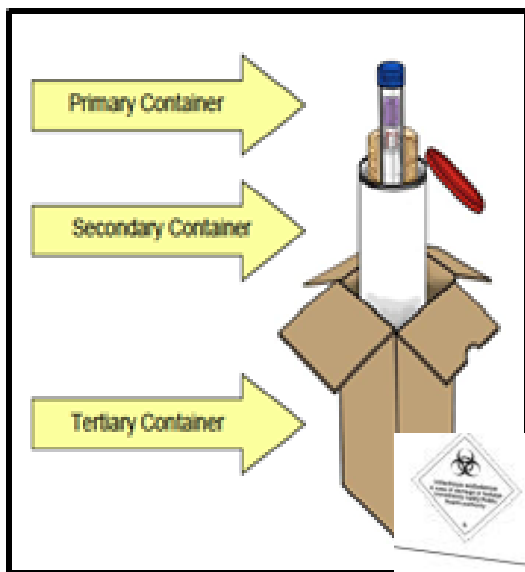
**Marking, labelling and documentation**

- Place all marking on packages in such a way that they are clearly visible and not covered by any other label or marking.

Each package shall display the following information on the outer packaging.

- The shipper’s (sender’s, consignor’s) name and address
- The telephone number of a responsible person, knowledgeable about the shipment
- The receiver’s (cosignee’s) name and address
- The United Nations number followed by the proper shipping name (UN 2814 “INFECTIOUS SUBSTANCE, AFFECTING HUMANS”). Technical names need not be shown on the package
- Temperature storage requirements
- When dry ice or liquid nitrogen is used: the technical name of the refrigerant, and the net quantity.
- Place specific labels for: 1. Biohazard sign for infectious substance, 2. Handling label for Orientation with the words “THIS SIDE UP” or “THIS END UP” should be present on the surface of the pack.

The efficient transport and transfer of infectious substances requires good coordination between the sender, the carrier and the receiver to ensure that the material is transported safely and arrives on time and in good condition.



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### 7.1.4 Where to send samples which are not processed on site

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A system for sending samples from district to provincial level and/or to national level will be described in an Annex below.

Contacts for reporting and samples:

**EDCD Tel: 01-4255796; Fax: 01-4262268; Email: [ewarsedcd@gmail.com](mailto:ewarsedcd@gmail.com)**

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**NPHL Tel: 01-4252421; Fax: 01-4252375; Email: [nphl@wlinnk.com.np](mailto:nphl@wlinnk.com.np)**

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## 7.2 Diagnostic procedures

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### 7.2.1 Skin biopsy – shaving or scraping

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#### Indications

- Best used for raised lesions or those on convex surfaces.

#### Contraindications

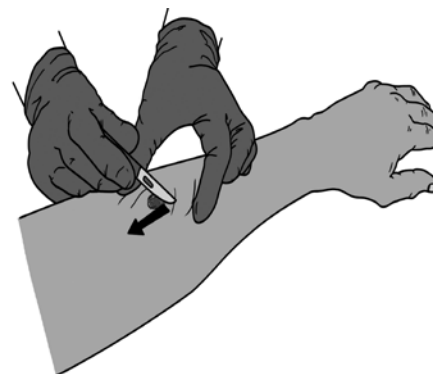
- Do not perform shave biopsy of pigmented lesions – melanoma is more difficult to stage if shaved.

#### Equipment

- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel blade and handle
- culture media
- microscope slides
- formalin.

#### Procedure

1. Cleanse the area of the biopsy with skin antiseptic.
2. Anaesthetize the area with 1–2% lidocaine.
3. If flat, inject anaesthetic or saline under the lesion to raise it slightly.
4. Hold the scalpel parallel to the skin and begin. Complete the incision in one stroke. The aim is to take only a specimen of superficial tissue.
5. If done for the diagnosis of cutaneous leishmaniasis, the slit-skin technique should be used. Incise several millimetres outward from the active border of a lesion, making sure to go deep enough to penetrate the dermis. This should be followed by a scrape as above.
6. Dress the wound with simple dry gauze dressing. If the subcutaneous tissue is encountered, the technique for an excision biopsy should be used to close the wound.



#### Investigations

- If suspicion is for neoplasm, and enough biopsy material is available, send in formalin. If not much material, perform a thin smear, allow to air dry, and fix with methanol.

#### Diagnosis of cutaneous leishmaniasis (see Section 11.19)

- The diagnostic yield for cutaneous leishmaniasis will be increased by:
    - using several techniques (needle aspirate, punch biopsy, scraping)
    - taking several specimens with each technique
    - biopsying multiple areas of the lesion, including edges.
- Note that scrapings should be taken last to avoid contamination.
- Needle aspirates should be sent for culture.
  - Punch biopsy samples should be divided into three parts and sent for:
    - culture
    - impression smear (similar to thin smear)
    - histopathology (poor for diagnosis, but useful for excluding other causes).
  - Scrapes should be sent for histopathology.

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## 7.2.2 Skin biopsy – punch

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### Indications

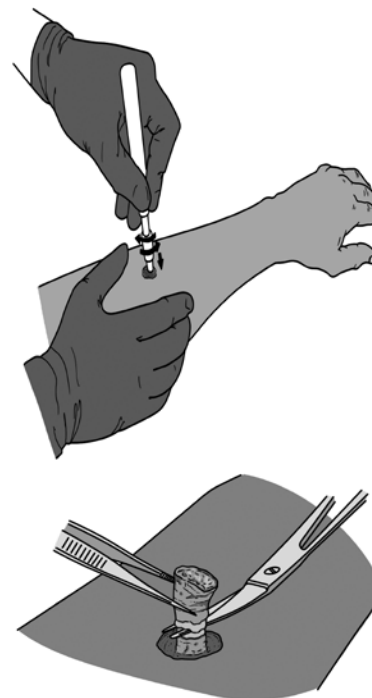
- any inflammatory lesions or suspected Kaposi sarcoma
- leishmaniasis.

### Equipment

- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- cylindrical punch biopsy knife
- formalin
- suture material, needle driver, forceps.

### Procedure

1. Cleanse the area of the biopsy with skin antiseptic.
2. Anaesthetize the area with 1–2% lidocaine.
3. Stretch the skin perpendicular to the Langer's lines (natural creases in the skin).
4. Hold the cylindrical knife (trepphine) perpendicular to the skin and gently push downward while rotating it clockwise and counter clockwise to cut through the skin. The trephine should be withdrawn after penetrating into the subcutaneous tissue.
5. Use a forceps or needle (the one used to anaesthetize the skin may be re-used here) to lift the specimen, and cut it free from the underlying tissue. Be sure to make the cut below the dermis. Avoid squeezing the specimen with a haemostat or forceps to avoid crush artefact.
6. If the wound is less than 2 or 3 mm, it can be dressed and allowed to heal by secondary intention. Wounds larger than 4 mm should be sutured with one or two simple sutures.



### Investigations

- Send the biopsied tissue in formalin.
-

## 7.2.3 Skin biopsy – excision

### Indications

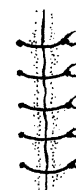
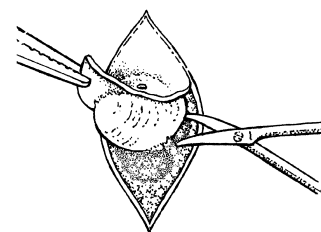
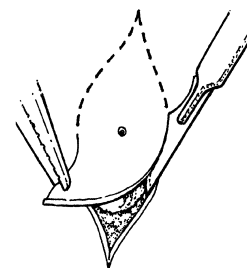
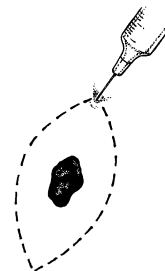
- basal cell and squamous cell carcinomas (squamous cell carcinoma is life-threatening and should be treated with wide local surgical excision.)
- melanoma.

### Equipment

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

### Procedure

1. Cleanse the area of the biopsy with skin antiseptic.
2. Anaesthetize the area with 1–2% lidocaine.
3. Incise the skin with a scalpel parallel to the direction of the skin lines (Langer's lines). These can be found by placing two fingers on opposite sides of the incision and gently squeezing them and the skin together.
4. Use elliptical incisions, making the long axis large enough to close the skin without deformity. A rule of thumb is to make the long axis twice as long as the short axis.
5. Lift the sample with forceps and separate it from the underlying tissue.
6. Excise subcutaneous lesions after gaining access through the skin incision. Do not remove skin unless the subcutaneous mass is adherent.
7. Close the wound with simple interrupted sutures as needed.



### Investigations

- Send biopsied tissue in formalin.

## 7.2.4 Fine needle aspiration (FNA)

### Indications

- FNA is a quick and minimally invasive procedure to evaluate a mass or lymphadenopathy (see Section 10.5).

### Contraindications

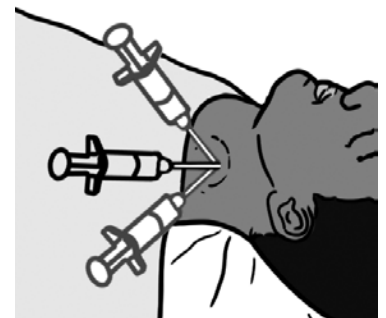
- Pulsatile or air-filled mass.

### Equipment

- antiseptic
- 10 ml syringe, 22-gauge needle (large bore needles exacerbate bleeding and tumour seeding)
- microscope slides
- mask for the health worker if TB is suspected.

### Procedure

1. Clean the skin with antiseptic.
2. Fix the lymph node or mass so that it will not move. A right-handed clinician grasps the mass with the left hand and the syringe in the right hand.
3. Enter the lymph node parallel to the fingers of the left hand, ensuring that the left hand fingers are not in any danger.
4. Apply gentle suction syringe by pulling back the plunger 2–3 ml.
5. The mass is entered and multiple, sequential passes are made without exiting the skin surface. If the skin is exited, air will be pulled into the syringe and the specimen will be sucked from the bore of the needle into the syringe. This will make it difficult to get the specimen onto the slide.
6. Release the syringe completely and exit the skin.
7. Place a small drop of aspirated fluid on a glass slide. It may be necessary to carefully remove the needle (with the specimen cored in the centre) and withdraw the plunger of the syringe, then re-attach the needle and gently depress the plunger, pushing the specimen out.
8. A smear is made by laying another glass slide on top of the drop of fluid and pulling the slides apart to spread the fluid or, using a needle, to scrape it across the slide.



### Investigations

- If suspected TB lymphadenopathy, send AFB smear. See Section 15.
- If there is a fair volume of specimen, consider sending fluid for mycobacterial or bacterial culture.
- If suspected malignancy, spray with fixative and send for cytology.
- Wet smears can be placed in 95% ethyl alcohol and treated with the Papanicoulau technique and stains.
- Specimens should be air dried and prepared for a Wright-Giemsa stain when the differential diagnosis includes salivary, lymphoproliferative or fatty tumours.
- If suspected plague, aspirate and look for small gram-negative or bipolar-staining (“safety-pin”) ovoid coccobacilli on a smear. Also send for culture (slow growing).

### Complications

- Pneumothorax – see Quick Check page 32 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.
- 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.

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## 7.2.5 Lymph node biopsy (excisional)

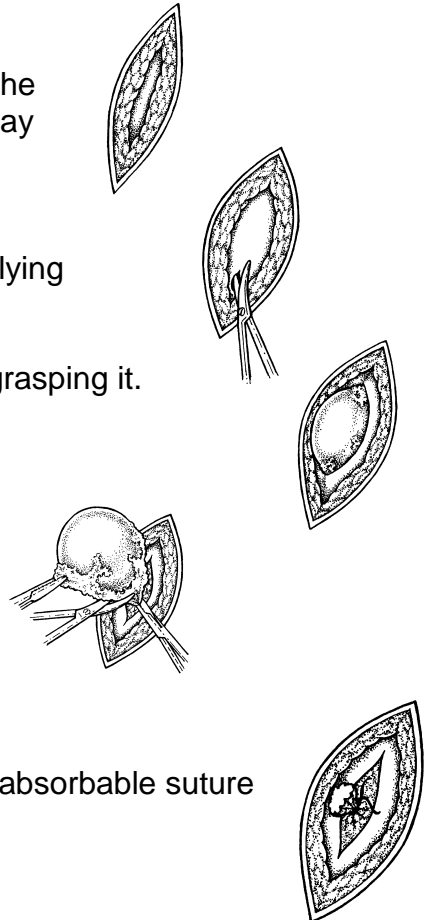
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### Equipment

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

### Procedure

1. Lymph nodes are located beneath the fascia and, therefore, require deeper dissection than skin or subcutaneous lesion biopsies. A general anaesthetic may be required.
2. Make an incision along the skin lines and dissect through the subcutaneous tissue, while controlling any bleeding that may arise.
3. Identify the lymph node with a fingertip and incise the overlying superficial fascia.
4. Dissect the node from surrounding tissue without directly grasping it.
5. Instead, grasp the attached adventitial tissue with a small artery forceps, or place a figure-of-8 suture into the node for traction.
6. Separate all the tissue attached to the node.
7. Control the hilar vessels with forceps and ligate them with absorbable suture after the node has been removed.



### Investigations

- Send biopsied tissue for histology in formalin.
- If suspected bacterial infection, send a portion of the node for culture.

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## 7.2.6 Bone marrow aspiration and biopsy

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### Indications

- unexplained blood disorders (e.g. anaemia, elevated blood count, high or low platelets, etc.)- see Sections 10.14 and 10.15
- suspected haematologic malignancy
- diagnosis of suspected leishmaniasis 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 10<sup>9</sup>/litre)- may require a platelet transfusion
  - skin infection or osteomyelitis near the chosen site.

### Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- and 21-gauge needles)
- scalpel blade and handle
- bone marrow aspiration needle with removable stylet and 1–2 ml syringe
- bone marrow biopsy (Jamshidi) needle with a device for removal of the biopsied tissue
- dressing material
- microscope slides, culture media, and other collection materials as needed.

### Procedure

1. Bone marrow aspiration and bone marrow biopsy are specialized procedures, and should be done by a clinician experienced in doing the procedure.
2. Discuss with the pathology laboratory prior to the procedure to determine which tests are available and how sampled tissue should be sent.
3. Patients may benefit from being pre-medicated with paracetamol. Diazepam or midazolam may be given in case of severe anxiety.
4. It is advisable to have an assistant to help with specimen preparation at the end of the procedures; aspirate samples can clot quickly and must be rapidly prepared to avoid this.
5. The posterior and anterior iliac crests 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. As a part of the preparation of the site, shave the hair and clean the part thoroughly with savon.
10. 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 with 2% lidocaine. Two separate (but close) sites will be required if both a biopsy and aspiration are planned. For leishmaniasis diagnosis, only an aspirate is needed.

11. While waiting for the anaesthetic to take effect, make sure to have all the materials required to collect the biopsied tissue or aspirated fluid.
12. Make a small 3 mm incision at the site.

### **Bone marrow aspiration**

1. The aspiration is done with a sterilized sternal puncture needle which is short and stout with a well-fitting stylette to make sure that the needle does not pierce too deep.
2. Insert the bone marrow aspiration needle (with stylet) into the site, holding it perpendicular to the skin. Once the needle has pierced the periosteum, there is a feeling of loss of resistance needed to push the needle. At this point a negative suction should be done to suck the bone marrow out.
3. 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.
4. 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.
5. Once the required number of aspirates have been obtained, the needle should be withdrawn with stylet in place.
6. The needle is then withdrawn carefully and the material sucked put into a sterile tube.  
For leishmaniasis diagnosis:
7. In contrast to the splenic aspirate, the bone marrow has blood mixed with the bone marrow. One drop of the material aspirated should be placed on a glass slide about 1 cm from the edge of the slide.
8. With a micropipette or by a filter paper, the blood should be sucked out by the filter paper. This is because the presence of blood can interfere with identification of LD bodies.
9. Use the edge of another slide as a spreader to make a thin smear of the bone marrow. While making a thin slide, make sure to prepare a trail of marrow cells.

### **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

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### 7.2.7 Splenic aspirate<sup>5</sup>

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Before doing the splenic aspiration, it is important to make sure that the patient does not have a bleeding or clotting disorder. This can be ensured by doing platelet and prothrombin time estimations and assessments of bleeding time and clotting time. If these are abnormal then the splenic aspiration should not be done. If the patient has a local infection at the site where the aspiration is planned, the test should not be done until the infection has been treated. Do not perform a splenic puncture if the patient is severely anaemic.

#### **Procedure**

- Clean the skin at aspiration site thoroughly the same way as for a surgical procedure. It should be dry when the aspiration is done.
- Use a 5 ml syringe and 21-gauge needle for the procedure.
- Withdraw the plunger of the syringe about 1 ml to create negative suction.
- Pierce the skin and puncture the spleen by pushing the needle deep. Maintain the suction all the way while injecting and withdrawing so as to maintain a negative suction.
- Coordinate the procedure such that the diaphragm does not move while the procedure is being carried out.
- Expel part of the material sucked on the side of a sterile culture tube, label the culture tube and transport it to the microbiology laboratory for examination.
- The other part of the material sucked should be placed on a clean slide about 1 cm from the edge and a thin smear made of the aspirate.
- After the procedure, keep the patient under close observation.
- Observe the pulse, respiratory rate and measure the blood pressure every half an hour for any complications.
- The patient should be kept under observation for a period of 12 hours after the procedure.

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<sup>5</sup> Government of Nepal Ministry of Health and Population: National Strategic Guideline on Kala-azar Elimination Program in Nepal, 2014



## 7.2.8 Microscopy of tissue aspirates for *Leishmania donovani*<sup>6</sup>

- The slides collected should be labeled to facilitate the identification of the patient. Write the patient's name, identification number and the date on which the slide was prepared.
- Each slide should be fixed before staining. This can be done by dipping the slide in methyl alcohol for 20 minutes.
- The slides can be stained by using Leishman's stain or Geimsa's stain. These stains are available commercially but can also be prepared locally. It is preferable to use commercially available stains since there can be variations in quality if each laboratory prepares its own stains.
- The air-dried slides or properly fixed slides should be transferred to a jar containing Geimsa's stain diluted with 15-20 volumes of buffer. The slides then should be kept upright to dry and allow the stain to dry out. If Leishman's stain is used, the slide should be kept horizontally on a slide rack or on a tray with the help of two glass rods using them as a support. After placement, the slide is flooded with the stain for about 30-60 seconds and then by adding double the volume of water. After this, the slide should be allowed to stain for a period of about 5-7 minutes. The slide should then be washed in a stream of buffered water until it acquires a pinkish tinge. After this, the slide should be kept vertically to dry out. The stained slides should be examined for LD bodies under a good quality microscope with 10 x eyepiece and 100 x oil immersion lenses.

<b>Grading of parasite density:</b>	
<b>Grade</b>	<b>Average parasite density</b>
Grade 6 plus	More than 100 parasites/field
5 plus	10-100 parasites/field
4 plus	1-10 parasites /field
3 plus	1-10 parasites/10 fields
2 plus	1-10 parasites/100 fields
1 plus	1-10 parasites/1000 fields
0	0 parasites/1000 fields

<sup>6</sup>Government of Nepal Ministry of Health and Population: National Strategic Guideline on Kala-azar Elimination Program in Nepal, 2014

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### 7.2.9 Gram stain

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#### 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.

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### 7.2.10 Wet mount

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#### 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, or from other site being investigated.
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.

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### 7.2.11 Urinalysis

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#### 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.

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### 7.2.12 Taking stool samples, including Cary-Blair for cholera and Salmonella

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#### 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).

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## 7.2.13 Stool sample for parasites

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### Stool direct smear<sup>7</sup>

- 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.

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## 7.2.14 Chemical test for occult blood in stools<sup>8</sup>

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This test is used for detection of bleeding in the intestine caused by polyps, tumours, or inflammation and sometimes for screening for parasitic infection, e.g. *Trichuris trichiura*, hookworm, and *Entamoeba histolytica*.

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:

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<sup>7</sup> *Bench aids for the diagnosis of intestinal parasites*. WHO, 2004.

Available at [http://www.who.int/wormcontrol/documents/benchaid/training\\_manual/en/](http://www.who.int/wormcontrol/documents/benchaid/training_manual/en/)

<sup>8</sup> *Manual of basic techniques for a health laboratory, 2<sup>nd</sup> edition*. WHO, 2003.

Available at <http://whqlibdoc.who.int/publications/2003/9241545305.pdf>

- 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 (-)
-

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### 7.2.15 Whole blood clotting time

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#### 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.

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### 7.2.16 Thin and thick blood films for malaria<sup>10</sup> and lymphatic filariasis

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#### Indications

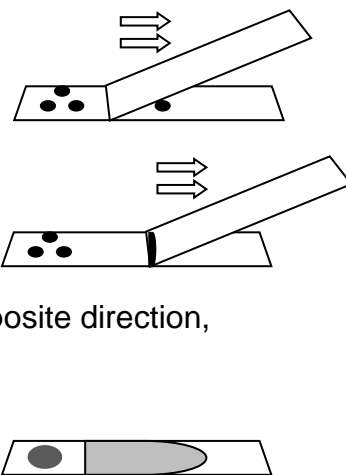
- diagnosis of malaria (see Section 11.25).

#### Equipment

- 2 microscope slides
- methanol
- Giemsa solution.

#### Procedure

1. Place a small amount of blood near the middle of the slide for the thin film. Place two or three smaller drops off to the side for the thick film. Place the slide on a flat surface.
2. Hold another slide over the first at a 45 degree angle so that it just touches it. Slowly drag the upper (spreader) slide towards the drop of blood.
3. On contact with the spreader slide, the blood should spread along the width of the slide.
4. The spreader should then be drawn smoothly and rapidly in the opposite direction, producing a feathered edge.
5. Join the drops of blood intended for the thick film using a corner of the spreader slide. This should not require excessive stirring, only 3 to 6 circular or rectangular movements.
6. Allow the slide to air dry and label with a soft lead pencil.
7. Fix the thin film by adding a few drops of methanol and allow to dry. Try to avoid exposing the thick film to methanol.
8. Flood the slide with Giemsa solution and allow 30–45 minutes out of sunlight.
9. Rinse with water, drain, and air dry.
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.



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<sup>10</sup> Bench aids for the diagnosis of malaria infection. WHO, 2002.

Available at <http://whqlibdoc.who.int/publications/2000/9241545240.pdf>

For lymphatic filariasis, can use a thin smear but blood must be collected after DEC or at midnight- see Section 11.14.

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### 7.2.17 Rapid diagnostic tests- as available

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Rapid tests can be performed for many organisms and will be provided and should be used according to the current Nepal guidelines for each disease or suspected organism. RDT test kits supplied may vary over time.

#### Test kit preparation (applicable to all test kits) <sup>12</sup>

- **The manufacturer's instructions should be followed for each test kit.**
- Follow all storage procedures. Some kits that do not require refrigeration but should still be kept in a cool place. (If you lack refrigeration, make sure that the tests you use do not need it.) If kept in a cool place, remove the number of tests and reagents that you expect to use that day and let them stand for at least 20-30 minutes to reach room temperature (20-25°C). The use of cold test kits may lead to false-negative results. Close the pouch that the test comes in properly before storing.
- Check expiry date to make sure the kit has not gone bad. Do not use the kit beyond that date.
- If a desiccant (a chemical that absorbs water to keep the package dry) is included in the package, do not use the kit if it has changed colour.
- Once opened and brought to room temperature, a test kit should be used immediately.
- Prepare your lab logbook: write down the test batch number (test kits are made in large quantities by manufacturers and each is labelled with a number) and expiry date; write the name of the person performing the test and date. Clearly write specimen number and record the results right away.
- Validate the test kit using the manufacturer's directions and the positive and negative controls provided. Controls are used to ensure that a test is working properly; giving positive results for positives and negative results for negatives. This is the process of internal quality control. Preferably, run the controls prior to the beginning of each day's testing, whenever a new kit lot is introduced and whenever you are concerned with storage conditions.
- Different lab staff members should alternate running the controls on different days. For kits that do not contain controls, controls may be provided from your district hospital lab. These controls should be stored appropriately. This is in addition to the internal control which is built into the test kit (making sure that a control line is seen to ensure that the specimen was added, and that the test was done properly). Record results of control tests on the lab worksheet and in the QC logbook.
- Write the specimen number on the lab logbook.
- Remove the test device from its protective wrapping.
- Write the specimen number on the test device. Always label specimens and test devices clearly.
- Follow all the manufacturer's instructions, including the full waiting time until the test should be read for results. Do not read tests early, even if the control line is visible. Failure to wait the full waiting time can lead to false negative results, and do not read past the specified end-point time.

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<sup>12</sup> *Operations Manual for Delivery of HIV Prevention, Care and Treatment at Primary Health Centres in High- Prevalence, Resource-Constrained Settings. WHO, 2008 . Available at [http://www.who.int/hiv/pub/imai/operations\\_manual/en/index.html](http://www.who.int/hiv/pub/imai/operations_manual/en/index.html)*

- Do not use reagents from one kit with another kit. Some may require a pipette (a narrow, glass or plastic tube into which small amounts of liquid are suctioned for transfer or measurement). Make sure you have all the materials needed for testing before you begin.



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### 7.2.17.1 RDT for malaria<sup>13</sup>

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“Rapid diagnostic tests are immuno-chromatographic tests that are used to detect parasite-specific antigens in a finger-prick blood sample. RDTs are available commercially in different formats such as dipsticks, cassettes or cards. Rapid diagnostic tests are relatively simple to perform and to interpret, and they do not require electricity or special equipment. Specific SOPs should be followed in using the RDTs for testing the suspected cases, using the finger prick/venipuncture blood.

Some RDTs are designed to diagnose one particular species (*Plasmodium falciparum*) by detecting *Plasmodium falciparum* specific PfHRP-II antigen. Other RDTs are designed to detect antigen specific to all four human malarial parasites (pan species specific/genus specific) plus species specific antigen distinguishing each human malarial parasite. Rational use of RDT could be helpful in diagnosing human malaria where microscopy is unavailable due to various reasons.

Quality RDT is a valuable complement to microscopy because it helps to expand coverage of parasite based diagnosis to the periphery and minimize exclusively use of clinical diagnosis in starting antimalarial treatment. RDTs are particularly useful for outbreak/epidemic investigation especially in remote areas.

Rapid Diagnostic Tests detecting plasmodium antigen(s) have been successfully introduced into National Malaria Control Program. Increased access to early diagnosis is ensured by availability of RDTs up to SHPs and HPs where microscopy is not feasible. However, clinical management decisions should be based on symptoms/signs plus Laboratory (Microscopy/RDT) results taken together.

Rational use of these tests, as with microscopy, depends on stringent and functional quality assurance program; NMCP is working closely with NPHL and academic institute in establishing a functional QA system and networking together with defined role of the Regional Health Directorates. Availability of microscopic laboratory diagnostic facility at sub-health posts / health posts is limited. The necessity for rational use of antimalarials in the face of detection of drug resistant malarial parasites and availability of limited and high cost antimalarial places increasing importance on accuracy of malaria diagnosis. NMCP has introduced bi-valent RDTs for the diagnosis of *P. falciparum* and *P. vivax* in the sub-health posts / health posts of the high risk districts as early as 2009 and is continued.”

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<sup>13</sup> from EDCD: NATIONAL MALARIA TREATMENT PROTOCOL 2015, Kathmandu, 2015.

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### 7.2.17.2 RDT for kala-azar (visceral leishmaniasis)<sup>14</sup>- rK39

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#### **Points to remember:**

- The test should be performed as per the manufacturer's instructions.
- It is preferred that the tests should be performed in serum as opposed to whole blood.
- The vial or the pouch of the test kits should be checked for expiry date to ensure that the test strips have not expired.
- The strip should be taken out from the vial or the pouch only at the time of performing the test.
- If the strip has not been used within one hour of taking out from the vial or the pouch, it should be discarded.

#### **Procedure:**

- Remove the test strip from the pouch or the vial.
- With a new lancet, prick the fingertip of the patient suspected to be suffering from Kala-azar.
- Lancets should not be re-used because of the risk of transmitting HIV and Hepatitis B and C.
- Let the blood come out on its own. Do not use pressure or squeezing for obtaining blood.
- Place one drop of blood or serum (as indicated in the manufacturer information sheet) on the absorbent pad of the strip bottom.
- Place the test strip into a test tube so that the end of the strip is facing downwards. This would encourage the blood to migrate upwards by capillary action. Follow the recommendations made by the manufacturer to obtain the best results.
- Add 2-3 drops of buffer solution provided with the kit to the pad.
- Read the results in 10 minutes. Do not read the results before or after 10 minutes. If the time period of 10 minutes is not adhered to there are chances of mistake being made.

#### **Interpretation of the results:**

The rK39 test stays positive in the patients who had KA infection for a long time after the treatment. The dipstick test can be positive in healthy persons from endemic areas who are infected with leishmania but not sick. Therefore the test should be performed only in a clinically suspected case of KA, who has a first-time episode.

#### **Positive result:**

The test is positive if both the control and test lines appear. A faint red line is to be considered as a positive result.

A red line appears in the control line where the blood/serum was placed and another red line appears where the blood has migrated through capillary action. The red line appears in the control line a little distance away from where the blood/serum was placed. Thus there should be two red lines for the test to be positive.

#### **Negative result:**

The test is considered as negative if there is a red line where the drop of blood was placed but there is no red line where the blood has migrated by capillary action at the end of 10 minutes.

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<sup>14</sup> From- Government of Nepal Ministry of Health and Population: National Strategic Guideline on Kala-azar Elimination Program in Nepal, 2014

**Invalid result:**

The test is considered as invalid if no control line appears whether the test line appears or not. There is no red line at the place where the drop of blood was placed or in the test area where the blood is to migrate by capillary action. The test is also invalid if there is a red line in the test area but no red line in the control area where the blood was initially placed. If the test is invalid, a fresh sample with a new strip is recommended for retesting for which the correct procedures should be strictly followed.

**Storage of rK39 test Strips:**

The test strips and the buffer should be stored safely at room temperature between 20 and 30 degrees Celsius since the temperature in excess of 30 degrees can reduce the quality of the test.

The test strips and the buffer should not be frozen since freezing deteriorates the quality of the reagent.

**Note:** It is not advisable to store large quantities of 'rK39' test kits in the peripheral locations since it is difficult to maintain appropriate temperature. However, the test kits can be stored for a long time in identified central locations in the districts where the temperature can be properly maintained as required in the specifications. These locations should serve as the supply points for the peripheral units. The supplies can be made once in a month or when health workers come for a review meeting.

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**7.2.17.3 RDT for scrub typhus**

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Scrub typhus rapid test kit is provided by EDCD. It usually comes positive after 4-5 days of illness.

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**7.2.17.4 RDT for dengue**

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Biocan TELL ME FAST™ Dengue IgG/IgM Combo Test Device (Serum/Plasma/Whole blood) is a qualitative test for the detection of IgG and IgM antibodies to dengue virus in human serum plasma or whole blood. The test provides differential detection of anti-dengue IgG and anti-dengue-IgM antibodies and can be used for the presumptive distinction between a primary and secondary dengue infection.

This test is provided by EDCD. IgM starts increasing from day 2; on the RDT, usually positive after day 3.

**Interpretation of results:**

**IgM POSITIVE:** Two distinct red lines appear. The control line (C) and IgM (M) line are visible on the test cassette. The test is positive for IgM antibodies. This is indicative of a primary dengue infection.

**IgG POSITIVE:** Two distinct red lines appear. The control line (C) and IgG (G) line are visible on the test cassette. The test is positive for IgG antibodies. This is indicative of a past dengue infection.

**IgM and IgG POSITIVE:** Three distinct red lines appear. The control line (C), IgM (M) and IgG (G) lines are visible on the test cassette. The test is positive for IgM and IgG antibodies. This is indicative of a secondary dengue infection.

**NEGATIVE:** One distinct red line appears. The control line (C) is the only line visible on the test cassette. No IgG or IgM antibodies were detected. The result does not exclude dengue infection. A new sample should be drawn from the patient in 3-5 days and then should be retested.

**INVALID:** Control line fails to appear. The test results are INVALID, if no control line (C) is visible, regardless of the presence or absence of lines in the IgG (G) or IgM (M) region of the cassette. Repeat the test using a new cassette.

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### 7.2.15.5 RDTs for HIV

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Nepal uses three tests (Determine, Unigold and Statpack). If all are positive, give a positive report. If after Determine is positive and one of remaining is negative, the test is inconclusive. Repeat after 2 weeks.<sup>15</sup> Follow the following algorithm for three tier testing.

A1= Determine

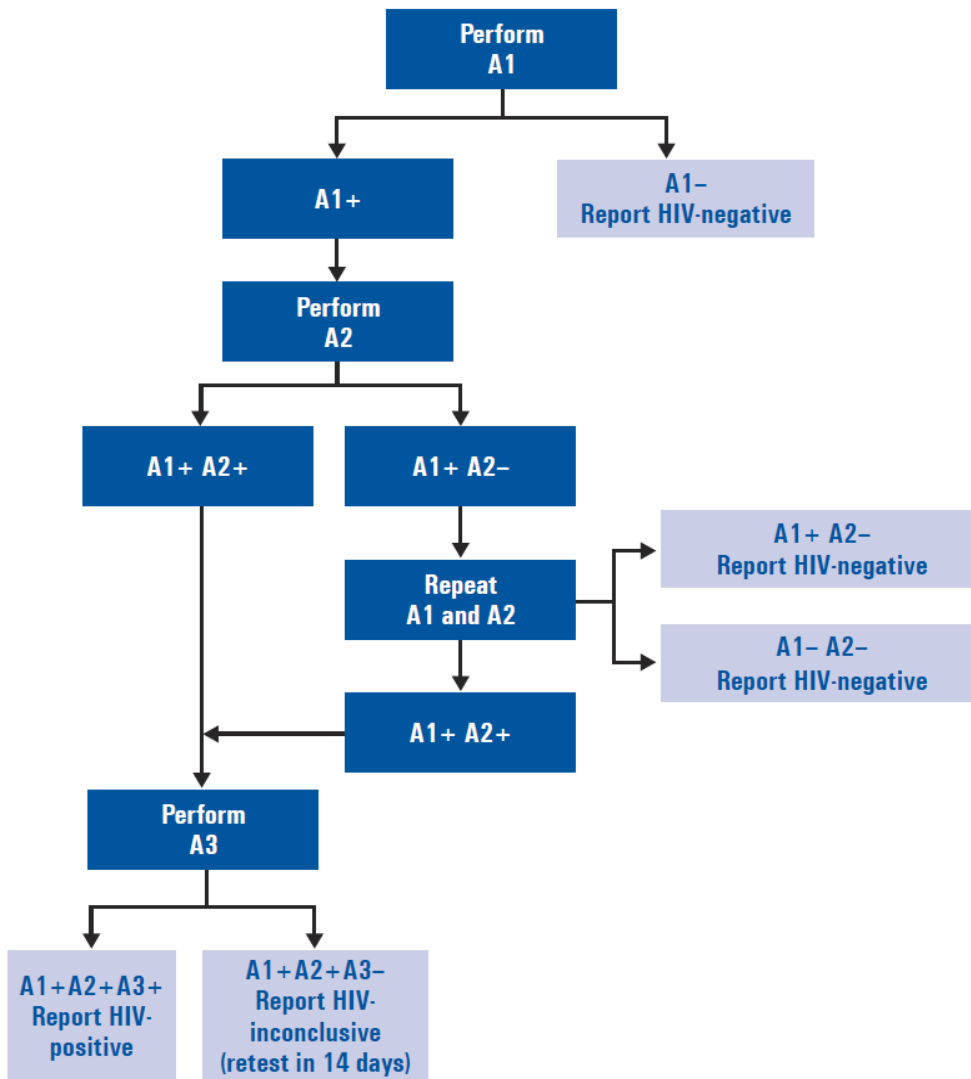
A2= Unigold

A3= Statpack

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<sup>15</sup> Nepal National Centre for AIDS and STD Control: powerpoint presentation on HIV Testing and Treatment monitoring.






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### 7.2.18 Serum by gravity separation

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- Stand tube up right to allow for gravitational flow
- Remove serum (approximately 2 mL for 5 mL blood sample) with pipette to 3-5 mL container (cryo-vial) for serum sample.

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### 7.2.19 PCR for suspect SARS, VHF, MERS-CoV, scrub typhus etc

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For PCR: Whole blood or blood clot, serum/plasma or tissue; oral swab from corpses; semen and breast milk (in Ebola patients).

Refrigerate whole blood, serum or clot and oral swabs. Send to NPHL.

A PCR test, often referred to as real time or reverse transcriptase PCR or RT-PCR, provides evidence of the virus in the blood or tissues during the acute phase of the clinical disease. It is the preferred method of confirmation, both for blood samples and for oral swabs from corpses. The basis of PCR testing is to detect viral RNA by amplifying the number of RNA copies with each cycle run of the machine. PCR test results are often reported in terms of cycle threshold (Ct) or viral load (copies/ml). The Ct is defined as the number of cycles needed to detect viral

RNA over a background level (that is, to exceed the threshold). Ct is inversely proportional to viral load (i.e. the lower the Ct the higher the viral load).

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## 7.2.20 AFB (Ziehl Neelsen)<sup>16</sup>

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### Indications

- diagnosis of TB.

### Equipment

- microscope slide
- Bunsen burner or spirit lamp
- 3 mm wire loop
- forceps
- Ziehl Neelsen carbol fuchsin
- decolouriser: 3% HCL-ethanol or 20–25% H<sub>2</sub>SO<sub>4</sub>
- 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.

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<sup>16</sup> *AFB smear staining*. WHO/Union, 2004. Available at <http://www.theunion.org/index.php/en/resources/scientific-publications/item/185-afb-smear-staining>.

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## 7.2.21 Collect respiratory sample into viral transport media (for ILI, SARI)

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- For diagnosis of virus infections of the upper respiratory tract, a variety of specimens may be used: nasal swab, nasopharyngeal aspirate, nasal wash, throat swab.
- These are usually analyzed with RT-PCR which detects RNA; takes 6-8 hours in the laboratory to get results; and has high sensitivity and specificity.
- For detection of influenza A or B, nasal or nasopharyngeal samples have highest yield.
- However, throat swabs are most commonly used in Nepal.

### 7.2.21.1 How to collect samples

**When to collect:** Collect samples as early in the illness as possible- **within 4 days** of symptom onset for influenza A or B. After that, viral shedding and the yield from the samples goes down.

**Use appropriate PPE during collection:**

- Gloves
- Surgical Mask

*Note: For some patients and procedures, additional precautions such as gown and eye protection may be needed.*

If you suspect zoonotic influenza or MERS-CoV and you are equipped and trained to do so, add airborne precautions—particulate respirator. See Section 6

**Equipment:**

- Use sterile Dacron/polyester, calcium alginate or rayon swabs with plastic or aluminum shaft. Do not use cotton swabs or wood shafts which can interfere with the RT-PCR
- Sterile vial containing viral transport media (VTM)
- Tongue depressor

### How to hold the swab

When taking nasal, nasopharyngeal or throat swabs, the swab should be held between the thumb and the first and second fingers with the shaft protruding beyond the web of the thumb (like a pencil) (Fig. 2). The main reason for this is that if the patient makes a movement in reaction to the swabbing, the swab will slide out of harm's way if held the first way (Fig. 4 – with the patient represented by the open gloved hand of the operator) but not if held in the second way (Figs. 3 &5). In this case, discomfort would be caused and the patient could be injured. In addition, control over the swab is much greater if it is held correctly.



Fig. 2. Swab held correctly



Fig. 4. Correctly held swab can slide out of harm's way



Fig. 3. Swab held incorrectly

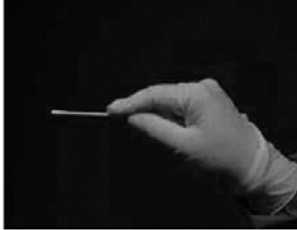
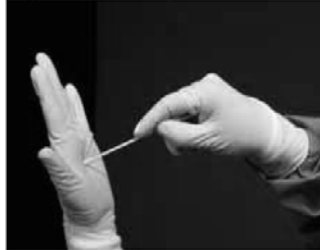
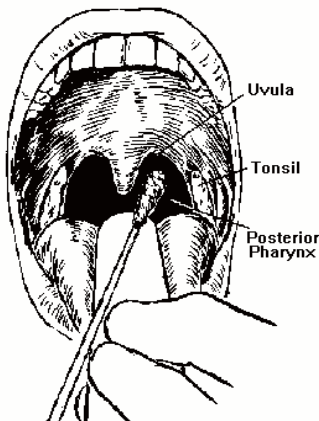


Fig. 5. Incorrectly held swab can injure the patient



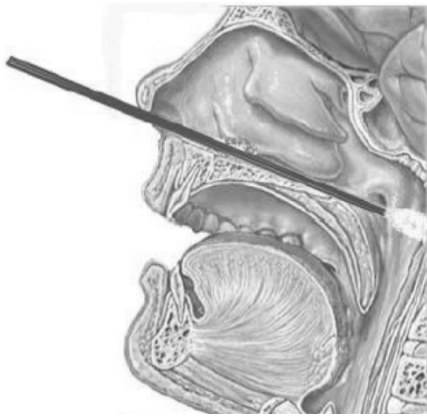
### Collection of throat swabs (posterior pharyngeal swabs) (most commonly done in Nepal):

- Tilt patient's head back 70 degrees.
- Hold the tongue out of the way with a tongue depressor (N.B. This procedure can induce the gag reflex).
- Use a strong light source to locate areas of inflammation and exudate in the posterior pharynx and the tonsillar region of the throat behind the uvula.
- Have the subject say "aahh" to elevate the uvula.
- Hold the swab and with a sweeping motion (rubbing back and forth), swab the posterior pharyngeal wall and tonsillar pillars (see figure below).
- Withdraw the swab without touching cheeks, soft palate, teeth, gums or tongue.
  - Place tip of swab into sterile viral transport media tube and cut off applicator stick.



### Collection of nasopharyngeal swab (preferred)

- Tilt patient's head back 70 degrees
- Insert swab into nostril (swab should reach depth equal to distance from nostrils to outer opening of the ear). Leave swab in place for several seconds to absorb secretion
- Slowly remove swab while rotating it (Swab both nostrils with same swab).
- Place tip of swab into VTM and snap/cut off applicator stick

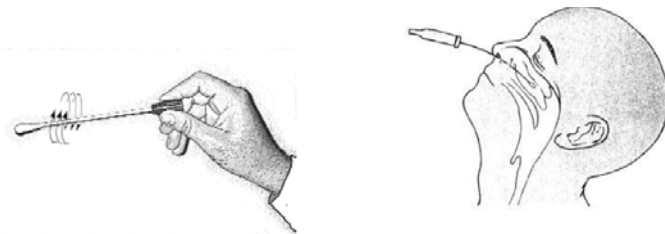


### Collection of combined Nasal & Throat Swab

- In some cases, collection of nasopharyngeal swab is difficult to do e.g. infants, older patients, so a combination of a deep nasal swab and throat swab is an acceptable alternative.
- Tilt patient's head back 70 degrees.
- While gently rotating the swab, insert swab less than one inch into nostril (until resistance is met at turbinates).
- Rotate the swab several times against nasal wall and repeat in other nostril using the same swab.
- Place tip of the swab into sterile viral transport media tube and cut off the applicator stick.
- For throat swab, take a second dry polyester swab, insert into mouth, and swab the posterior pharynx and tonsillar areas. (Avoid the tongue.)
- Place tip of swab into the same tube and cut off the applicator tip.

### Collection of deep nasal swab:

- Use a sterile polyester swab (with aluminum or plastic shaft)
- Tilt patient's head back 70 degrees
- While gently rotating the swab, insert swab less than one inch into nostril (until resistance is met at turbinates)
- Rotate the swab several times against nasal wall and repeat in other nostril using the same swab.
- Place tip of the swab into sterile VTM tube and cut of the applicator stick



### Collection of nasopharyngeal/nasal Aspirate

- In addition to above equipment, sterile suction catheter/suction apparatus is needed.
- Attach catheter to suction apparatus.
- Tilt patient's head back 70 degrees.
- Insert catheter into nostril. (Catheter should reach depth equal to distance from nostrils to outer opening of ear.)
- Begin gentle suction. Remove catheter while rotating it gently.
- Place specimen in sterile viral transport media tube.

*Note: NP aspirate may not be possible to conduct in infants*

**If patient is hospitalized with SARI with a lower respiratory infection, consider also collecting lower respiratory tract sample (if trained and equipped):**

- expectorated or induced sputum
- endotracheal aspirate
- bronchoalveolar lavage

This is particularly important if you suspect zoonotic influenza and MERS-CoV and you are equipped and trained to do so and have appropriate PPE- consult with your national programme.

#### **7.2.21.2 Packing and storing**

1. Place the swab immediately into a sterile vial containing VTM.
2. Break the applicator stick off near the tip to permit closure of the lid. Plastic swab handles usually have a weak point in them to allow them to be broken off for insertion into a specimen tube. Others have a handle made of a brittle plastic that will snap easily. If the shaft cannot easily be broken off so that it is short enough to fit into the VTM tube, it will have to be cut. To do this:
  - cut the shaft with scissors, taking care not to touch the tip;
  - allow the tip to slide into the VTM and then cap the tube (do not let cut portions of the bag or wrap fall into the tube);
  - sterilize the cutting edge of the scissors by the use of flame (e.g. by the use of a spirit burner, a Bunsen burner or another suitable heat source);
  - allow scissors to cool before reuse.
3. Label the specimen container (the cap should not be marked as it may be switched during handling) using a permanent marker or bar code (so does not smear or rub off) with the following information:
  - the unique identifier
  - the specimen date
  - the type of specimen in the tube (e.g. nasopharyngeal swab, nasal swab, throat swab etc.).
4. Storing: Specimens should be immediately placed on refrigerant gel packs or at 4 degrees Celsius (refrigerator) after placed in the VTM for transport. Keep specimens refrigerated (2-8 degrees Celsius) prior to shipping

#### **7.2.21.3 How to interpret results**

A negative test does not exclude influenza virus infection in patients with signs and symptoms of influenza!

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## 7.2.22 Peak flow measurement<sup>17, 18</sup>

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### Indications

For asthma or COPD (see Section 8.2), the peak flow meter is useful:

- To help establish the diagnosis of asthma or COPD
- 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.
- Cardboard disposable (or plastic reusable) mouthpiece



### How to measure peak expiratory flow rate (PEFR)

**Step 1:** Before each use, fit mouthpiece to end and 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:** Ask the patient to stand up straight and remove any foreign substance from his or her mouth.

**Step 3:** Ask patient to exhale completely.

**Step 4:** Ask patient to inhale as deeply as possible.

**Step 5:** Instruct patient to put the mouthpiece of the peak flow meter into your mouth (with the tongue under the mouthpiece.) Close lips tightly around the mouthpiece, creating a seal.

**Step 6:** 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 (the goal is to raise the PFM dial as high as possible).

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- this is in litres per minute (l/min)..

**Step 7:** Repeat the entire routine three times.

**Step 8:** 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

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<sup>17</sup> American Lung Association

<sup>18</sup> UpToDate- accessed .....

patients from inhaling through the meter during use. 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.

### **To aid in the diagnosis of asthma or COPD**

- Measure the PEF before inhalation of salbutamol (PEF before bronchodilator)
- Give 2 puffs of salbutamol metered-dose inhaler (MDI) or with a spacer
- Measure PEF again in 15 minutes (PEF after bronchodilator)
  - o if the PEF improves by 20%, a diagnosis of asthma is very probable
  - o if the PEF improves by less than 20%, a diagnosis of COPD is more likely

**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.**

### **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.

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.

## 7.2.23 Ultrasound

This Section provides a brief introduction to clinician-performed, bedside trauma 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.<sup>19,20</sup> Additional figures referred to below may be found at the end of this Section.

### Equipment

- ultrasound machine (with curved or phased array probe, and transvaginal probe)
- ultrasound gel (do not use alcohol; shampoo or water are acceptable gel substitutes)
- non-alcohol-based cleaning solution or wipes for probes
- condom or probe cover for transvaginal probe.

### Trauma ultrasound

Trauma ultrasound can be performed quickly at the patient's bedside, and provides time-sensitive information to determine the presence of intra-abdominal or intra-thoracic haemorrhage. While ultrasound provides useful information regarding the presence or absence of bleeding, it cannot usually diagnose specific organ injury or the source of bleeding. The ultrasound exam should be performed soon after the patient arrives.

### Indications

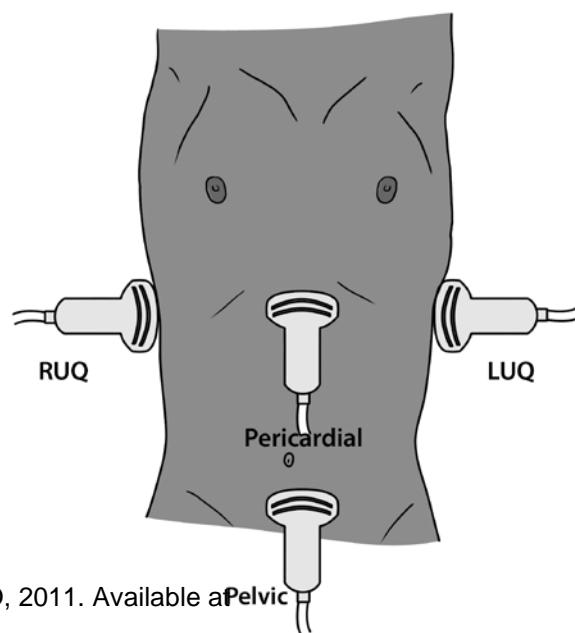
- torso trauma with suspected haemoperitoneum, haemothorax, or haemopericardium
- torso trauma with hypotension, tachycardia, or shock.

### Procedure

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

**This figure shows the 4 regions for trauma ultrasound.**

- a. **Pericardial (subxiphoid).** Place the probe in the subxiphoid region of the abdomen, with the probe marker facing the patient's right side. Aim the probe into the left chest, and assess for free fluid between the muscular myocardium (grey in colour on the ultrasound screen) and the pericardium (bright white in colour on the screen) (see figures 1a–1b).
- 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



<sup>19</sup> *Manual of diagnostic ultrasound. Volume 1, Second Edition.* WHO, 2011. Available at [http://whqlibdoc.who.int/publications/2011/9789241547451\\_eng.pdf](http://whqlibdoc.who.int/publications/2011/9789241547451_eng.pdf)

<sup>20</sup> *Manual of ultrasound for low-resource settings.* Partners in Health, 2011. Available at [http://parthealth.3cdn.net/6e013074d8f4c4c7d8\\_mblfxb8q.pdf](http://parthealth.3cdn.net/6e013074d8f4c4c7d8_mblfxb8q.pdf)

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.

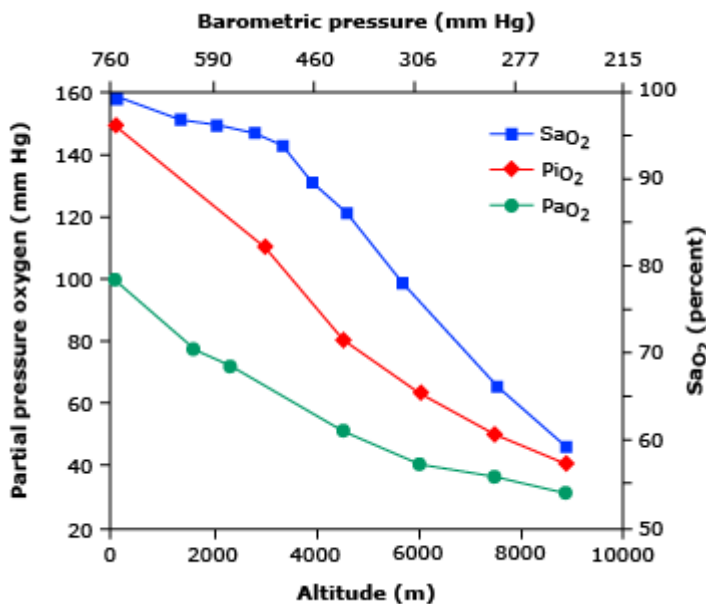
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**7.2.24 Pulse oximetry**

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**How to measure oxygen saturation (SpO<sub>2</sub>):** A pulse oximeter measures oxygen saturation of haemoglobin in the blood by comparing absorbance of light at different wavelengths across a translucent part of the body. Pulse oximetry is easy to use, and is the best method available for detecting and monitoring hypoxemia (low oxygen saturation).

**Oxygenation at different altitudes**



Increasing altitude results in a decrease in inspired oxygen (PiO<sub>2</sub>), arterial oxygen<sub>2</sub> (PaO<sub>2</sub>), and arterial oxygen saturation (SaO<sub>2</sub>). Note that the difference between PiO<sub>2</sub> and PaO<sub>2</sub> narrows at high altitudes because of increased ventilation, and that SaO<sub>2</sub> is well maintained while awake until over 3000 meters.

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## 7.3 Therapeutic procedures

### 7.3.1 Chest tube (intercostal chest drain)


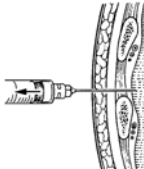
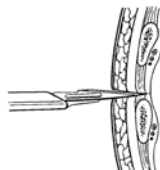
#### Indications

- Pneumothorax:
  - Tension pneumothoraces require immediate needle decompression followed by chest tube. See Quick Check page 32 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

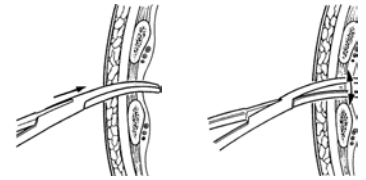
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine with epinephrine (5–10 ml syringe, 23- to 25-gauge needle)
- scalpel
- curved forceps and clamp
- chest tube and underwater seal drainage system (or one-way valve device and drainage bag)
- suture material (0 or 1–0 sutures required 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 latissimus 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.

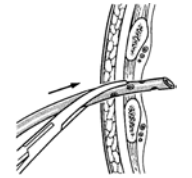


10. Use blunt dissection to penetrate the intercostal tissue to the pleura. Insert the closed clamp over the top of the rib and, once past the rib, open and spread to dissect, slowly enlarging the opening while proceeding inward. This will create a tunnel through which the tube may be inserted.

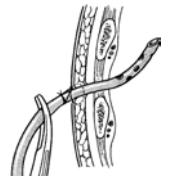


11. Insert a finger into the tunnel to confirm that it has penetrated through to the pleural space. A finger should be swept around to ensure the liver or spleen is not nearby.

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 tube 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.
- Empyema – 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 symphysis (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.

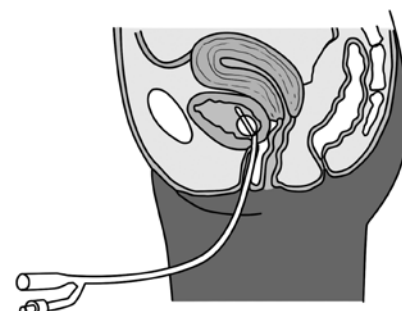
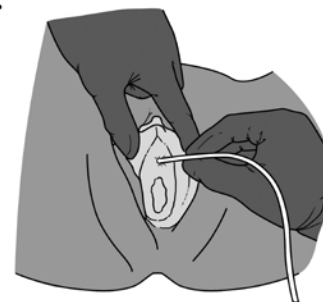
1. Position the patient lying face up with knees bent and apart.
2. Put on sterile gloves and, with sterile swabs, apply antiseptic to the labia and urethra. Isolate the area with a perforated sterile towel.
3. Check the integrity of the urinary catheter balloon, and then lubricate the catheter with 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 Urinary catheter insertion – male

#### Indications

- acute urinary retention
- monitoring urinary output.

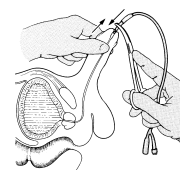
#### Equipment

- 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.

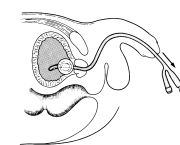
#### Procedure

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.

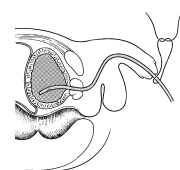
If right-handed, stand to the patient's right, hold the penis vertically and slightly stretched with the left hand, and introduce the urinary catheter gently with the other hand.



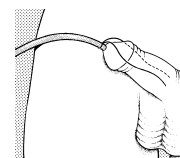
At 12–15 cm, the catheter may stick at the junction of the penile and bulbous urethra, in which case angle it down to allow it to enter the posterior urethra. A few centimetres further, there may be resistance caused by the external bladder sphincter. This may be overcome by asking the patient to relax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

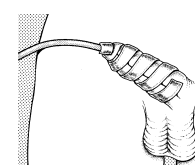


5. Remember to pull the foreskin back over the glans once the catheter has been placed. If left retracted (glans exposed), the foreskin can contract, causing a paraphimosis.

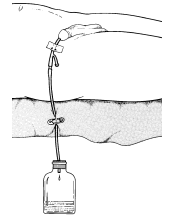


6. Fixation of the catheter:

- 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.

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## 7.3.4 Suprapubic catheter

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### Indications

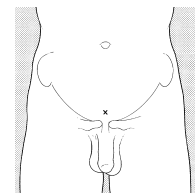
- Bladder puncture may become necessary if urethral catheterization fails.

### 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.

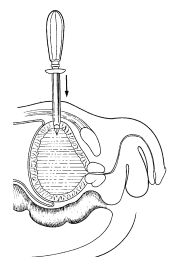
### Equipment

- 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.

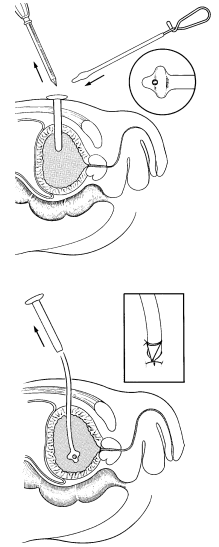


### Procedure

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.

### 7.3.5 Inserting a nasogastric (NG) tube

#### Indications

- upper GI bleed
- small bowel obstruction
- evaluation of gastrointestinal injury
- preoperative gastric decompression.

#### Contraindications

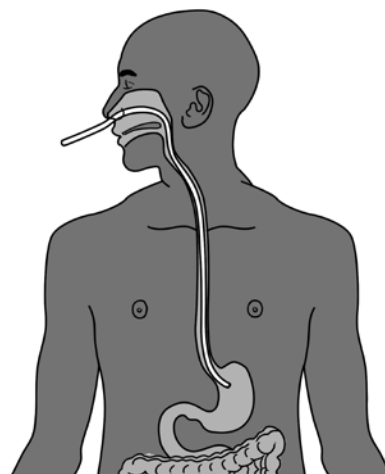
- facial fractures (use orogastric tube instead)
- severe coagulopathy
- oesophageal stricture
- recent alkali ingestion (may cause oesophageal perforation).

#### 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.

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### 7.3.6 Gastric lavage

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#### 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.

### 7.3.7 Venous cutdown

#### Indications

- Used as a means of obtaining venous access in emergencies when no other options are available:
  - shock
  - pulseless cardiac arrest
  - IV drug users with sclerosed veins
  - distorted surface anatomy.

#### Contraindications

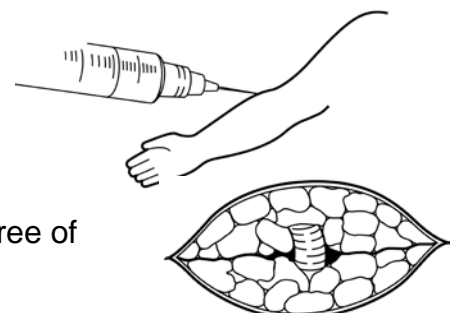
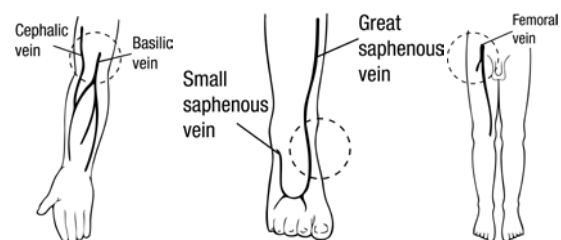
- Should not be performed if less invasive means of obtaining venous access are available.
- There is infection over cutdown site.
- Relative:
  - coagulation disorders
  - impaired immunity
  - impaired wound healing.

#### Equipment

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

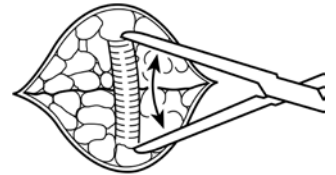
#### Procedure

1. The most commonly used vessels for venous cutdown include the greater saphenous, basilic, and cephalic veins. The saphenous vein is easily accessible at its location just anterior to the medial malleolus, and the accompanying nerve is relatively unimportant, making it a good site for cutdown.
2. Clean the area with antiseptic and cover with sterile drapes; be sure to maintain strict aseptic technique.
3. The skin and subcutaneous tissue should be anaesthetized with lidocaine.
4. A tourniquet may be placed proximal to the cutdown site; this will help visualize the vein.
5. Using the scalpel, incise the skin perpendicular to the vein. A longitudinal incision will not allow the required degree of exposure.

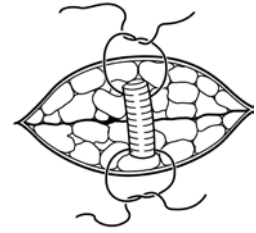




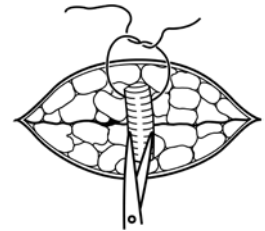
6. Carefully isolate and mobilize the vein using blunt dissection.



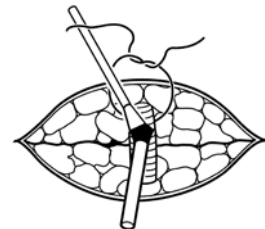
7. Using the haemostat, gently lift the vein free from the underlying connective tissue and pass two sutures under it proximal and distal to the site on the vein that will be cannulated.



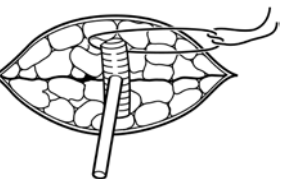
8. Tie the distal suture. The proximal suture may be left untied, as it will be used to control any bleeding.



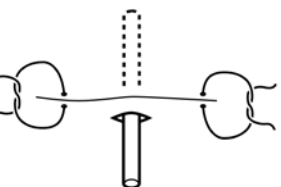
9. Incise the vein at a 45° angle between the two sutures. Do not incise more than halfway through as this may cause the vein to tear and retract from the field.



10. Use the venous dilator to lift the proximal corner of the incision and carefully cannulate the vein with the IV catheter. This may be the longest part of the procedure. The IV tubing may now be attached.



11. The proximal suture should be tied around the vein and the catheter to hold it in place.



12. The tourniquet may now be removed and the incision closed.

13. Once access has been established, the cutdown site should be dressed and the extremity splinted to prevent kinking or dislodgement of the cannula.

### Complications

- haematoma
- infection
- phlebitis and thromboembolism
- injury to surrounding structures.

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## 7.4 Diagnostic and therapeutic procedures

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### 7.4.1 Thoracentesis (chest tap)

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#### 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

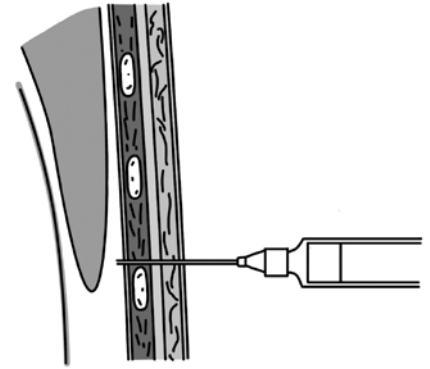
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle, 20-gauge needle)
- 16-gauge needle; obese patients may require longer needle – consider using a spinal needle
- 30 ml syringe – may need larger (50–100 ml) for large effusions
- drip giving 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.

### Contraindications

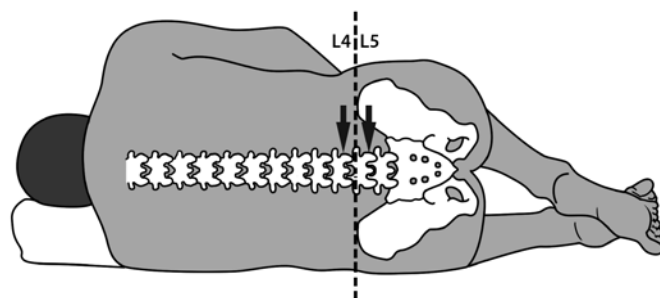
- Infection at the site.
- Increased intracranial pressure evidenced by focal neurological signs, papilloedema, altered mental status, or recent seizure. Lumbar puncture performed on a patient with increased intracranial pressure can lead to fatal cerebral herniation (brain shift) (see Section 10-10b).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

### Equipment

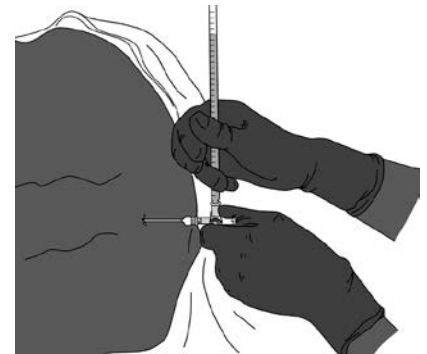
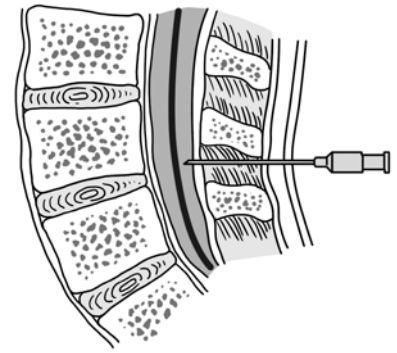
- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- 20- to 22-gauge spinal needle with stylet
- CSF pressure manometer or IV tubing and pole
- dressing material
- microscope slides
- specimen tubes and culture media.

### Procedure

1. Lumbar puncture can be a painful procedure, and some patients may require IV sedation, especially if they are delirious or uncooperative. It is advisable to pre-medicate all patients with paracetamol; however, this should not delay the procedure and the administration of antibiotics.
2. Carefully examine the patient for signs of increased intracranial pressure as described above. If increased intracranial pressure or a CNS space-occupying lesion is suspected, obtain a CT scan of the brain (if available) before performing the lumbar puncture (see Section 10-10b for further details).
3. This manual recommends performing a lumbar puncture prior to the administration of antibiotics if it can be done within 15 minutes. If this is not possible, or if the lumbar puncture is deferred, always give empirical antibiotics if meningitis is suspected.
4. Position the patient lying on one side with the spine flexed (draw shoulders forward and bring thighs towards the abdomen). Patients may also be positioned sitting upright with the spine flexed. However, this position will not allow for accurate measurement of the opening pressure. It may be helpful to have an assistant in front of the patient to help with positioning and reassurance.
5. Lumbar punctures are typically performed at the level of the L4–L5 interspace, well below the end of the spinal cord. The interspace may be found by drawing an imaginary line between the iliac crests. Placing four fingers on the iliac crests with thumbs pointing inwards, towards the spine, may help.



6. Clean area with antiseptic.
7. Anaesthetize the skin and subcutaneous tissues with lidocaine.
8. Gently introduce the spinal needle with bevel turned upward and angled slightly towards the head. Slowly advance. If the needle hits bone, withdraw to just under the skin and change angles (usually aiming more steeply towards the head) before advancing the needle again.
9. When the subarachnoid space is entered, there may be a slight “give”. At this point, the stylet should be carefully withdrawn to confirm the flow of cerebrospinal fluid (CSF). It should flow freely from the needle and should not ever be aspirated.
10. Measure opening pressure (usually between 10–20 cm H<sub>2</sub>O).
  - 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

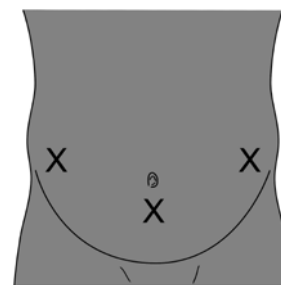
- Diagnostic
  - sample for investigation of ascites of undetermined etiology
  - evaluation for peritonitis
  - evaluation of intra-abdominal haemorrhage or bowel perforation in trauma.
- Therapeutic
  - relief of abdominal pain and discomfort caused by tense ascites
  - relief of dyspnoea caused by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

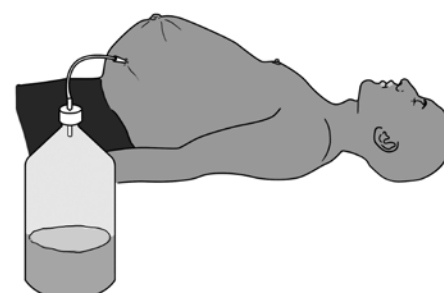
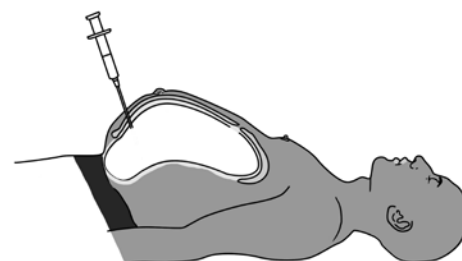
#### Equipment

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

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### 7.4.4 Arthrocentesis (joint aspiration)

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#### Indications

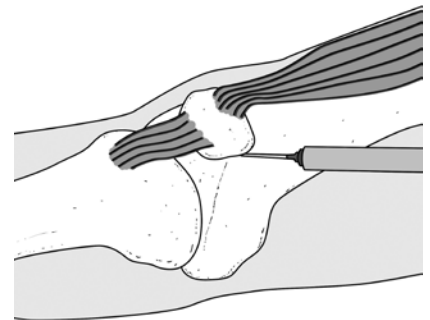
- suspected infectious or crystal-induced arthropathy
- unexplained joint effusion or monoarthritis
- symptomatic relief from a large effusion
- see Section 10.13 Painful joints.

#### Contraindications

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

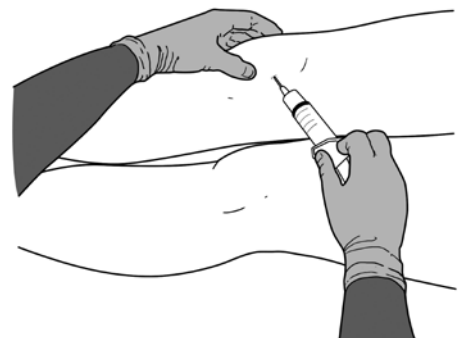
#### Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine (5–10 ml syringe, 23- to 25-gauge needle)
- 21-gauge needle and syringe
- dressing material
- microscope slides
- specimen tubes and culture media.



#### Procedure (knee joint aspiration)

1. Position the patient lying face up on the examination table. Examine the knee to determine the size of the joint effusion, and presence of any overlying skin infection.
2. Palpate the superolateral or superomedial aspect of the patella and mark a spot 1 cm superior and lateral to this point. Cleanse the area with skin antiseptic.
3. The area may be anaesthetized, but merely stretching the skin may also help reduce discomfort.
4. Steady the patella with one hand.
5. Insert a 21-gauge needle (with an appropriately sized syringe attached) at a 45° angle to the knee, aiming for below the patella.



6. Fluid should be easily aspirated once the needle has penetrated more than a few centimetres. Gently compressing the opposite side of the joint may increase flow.
7. Once sufficient fluid has been withdrawn to ease the patient's symptoms, the needle may be withdrawn and the fluid in the syringe sent for studies.

### Investigations

(see Section 10.13 Painful joints for interpretation)

- cell count and differential, protein
- Gram stain and culture
- polarized microscopy (if in an area with high prevalence of crystal-induced arthritis).

### Complications

- Latrogenic septic arthritis if the patient appears to be in shock, with fast heart rate and low blood pressure, see Quick Check page 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 (semi-elective or emergent).

### Contraindications

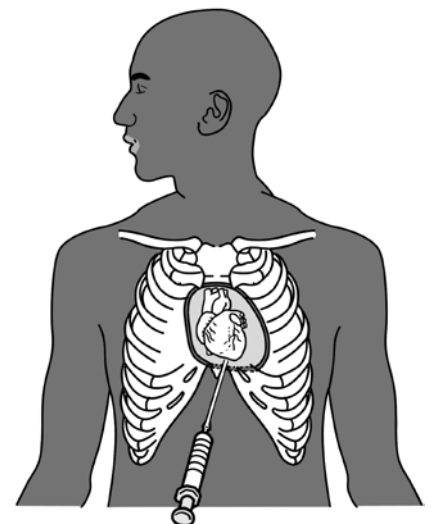
- small pericardial effusion
- traumatic haemopericardium, haemopericardium due to aortic dissection, and purulent pericarditis (surgical approach preferred)
- bleeding diathesis.

### Equipment

- sterile gloves and sterile towels or drapes
- antiseptic
- lidocaine, 5–10 ml syringe, 23- to 25-gauge needle
- long 18-gauge needle
- dressing material
- microscope slides and culture media.

### Procedure

1. If possible, this procedure should be done by an experienced operator with guidance from fluoroscopy or echocardiography or ultrasound, and in a cardiac catheterization laboratory or operating room.
2. After the area has been sterilized and anaesthetized, the needle should be inserted 1 cm to the left of the xiphoid process, and directed towards the left shoulder. One should maintain a 30° angle to the skin to avoid the pleura and nearby arteries.
3. While the needle is being inserted, aspiration should be gently and intermittently attempted until fluid is withdrawn. A “pop” or sudden change in the density of the tissue being penetrated may occur, indicating that the pericardium has been accessed. Sanguineous pericardial fluid may be distinguished from blood by dropping a small amount onto a clean, dry sponge. If it is pericardial fluid, the resulting spot should appear much lighter than blood.
4. In the emergency or tamponade situation, the removal of even 50 ml may at least temporarily improve haemodynamics.





5. No more than 1 litre of fluid at a time should be aspirated in order to avoid acute right ventricular dilatation.

### **Investigations**

- Gram stain, chemistry and culture
- cytology
- if tuberculous pericarditis is suspected, perform adenosine deaminase and send for mycobacterial culture.

### **Complications**

- Myocardial or coronary vessel laceration may present in a delayed fashion as hemopericardium or cardiac tamponade – (see Quick Check page 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.

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## 8.1 Fever

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Fever refers to a recent history of fever or an elevated body temperature of more than 38°C if measured centrally (ear, rectal, or oral) or 37.5°C axillary. The most common cause is an infection which may be localized or systemic; other causes include malignancy, allergic reaction, and inflammatory disorders. This section deals with fever without focal signs. For fever with focal signs, please see the appropriate section.

### 8.1.1 Clinical approach to a patient with fever

<b>Step 1:</b>	<b>Perform Quick Check</b> Use the Quick Check and ensure that there are no serious or life-threatening conditions. Be aware that patients with severe febrile illness may require active fluid management and require empirical antibiotics for possible life-threatening sepsis and antimalarials for possible severe malaria (in malaria endemic areas).
<b>Step 2:</b>	<b>Take a history and examine the patient.</b> Look for signs and symptoms that may point to a focus of infection, e.g. cough, painful ear, pain on urination. Consult the specific Section.
<b>Step 3:</b>	<b>Assess HIV status</b> 
<b>Step 4:</b>	<b>Consider likely differential diagnosis using the DDx table(s).</b> <ul style="list-style-type: none"><li>• If there is no obvious focus of infection, classify the fever:<ul style="list-style-type: none"><li>○ fever 7 days or less</li><li>○ fever more than 7 days.</li></ul></li><li>• If hyperthermia (temperature &gt;40.5°C), see DDx and treat.</li><li>• If specific focus of infection, see appropriate Section.</li></ul>
<b>Step 5:</b>	<b>Perform investigations.</b>
<b>Step 6:</b>	<b>Initiate treatment, monitor the response, and reconsider the diagnosis.</b> <ul style="list-style-type: none"><li>• If the cause of the fever is found, go to the relevant Sections for management.</li><li>• If the diagnosis is still unclear, follow a systematic approach to reassessment and empirical treatment.</li></ul>

## History<sup>1</sup>

Ask the patient for symptoms of infection, and then use the relevant Sections of this manual to further manage the patient, e.g.:

- headache, neck stiffness, photophobia (Section 10.9b Headache)
- cough, shortness of breath, chest pain (Section 8.2 Cough)
- skin lesion (Section 10.1 Skin disorders)
- abdominal pain (Section 10.5a Abdominal pain)

Important features of the history include:

- duration of fever (less than or more than 7 days)  
This is important to help ascertain possible diseases based on incubation period, if patient has travelled or had a particular exposure.
- exposure to locally endemic diseases
  - consider the local geographical distribution of diseases
  - consider outbreaks of specific infections
  - consider seasonal variation of diseases
- recent exposure history
  - ask about recent travel – consider diseases that are common in the area that was visited or where the person works (such as migrant worker from India). Travel history may make you suspect falciparum malaria etc
  - source of drinking water (tap water or “dhughedhara” (stone spout) water)
  - contact with animals and birds
  - known TB contact
  - recent unprotected sex
  - intravenous drug use
- vaccination history
  - ? typhoid fever vaccine (although efficacy only about 70% and no protection against paratyphoid)
- co-morbidities
  - consider infections that a patient may be predisposed to as a result of co-morbidities such as diabetes, HIV, sickle-cell anaemia;
  - medical history of recent illness and the possibility of incompletely treated disease or drug resistance, e.g. malaria, typhoid, TB;
  - current medications;  
consider drug reactions if the patient has recently initiated a new medication known to commonly cause drug reactions, e.g. cotrimoxazole, ART (especially nevirapine or abacavir), TB medication.

## Examination

Examine the patient thoroughly paying attention to sites of possible infection:

- general examination
  - monitor temperature (might be normal at that particular moment)
  - assess for confusion or decreased level of consciousness
  - assess hydration, count heart rate and respiratory rate
  - look for pallor, jaundice, lymphadenopathy, nail abnormalities (splinter haemorrhages)
  - skin lesions, including rash- make sure to look under the patukas (cummerbund) and bandages
  - insect or animal bites
  - nutritional status (wasting)

<sup>1</sup> Generic WHO IMAI DCM version adapted with guidance from: *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

- head and neck
  - conjunctiva- suffused; discharge?
  - neck pain or stiffness
  - throat, tonsils, ears for inflammation and discharge
  - sinus tenderness
  - mouth (Koplik's spots, ulcers or lesions)
- chest
  - difficult breathing, fast breathing
  - crackles, bronchial breathing, absent breath sounds
  - new heart murmur, change in old murmur
- abdominal or genitourinary:
  - enlarged liver or spleen
  - abdominal tenderness or mass
  - pain over kidneys (flank pain)
  - pelvic tenderness or mass
  - rectal and vaginal examination for pain, discharge, ulcers, mass
- muscles and joints
  - red, hot, swollen, painful joint(s) with reduced mobility
  - swollen, painful limb (deep venous thrombosis, cellulitis).

#### Laboratory

- If living in or travelled to an endemic area- malaria test (RDT or microscopy)
- In all patients consider: urine dipstick.

Additional tests, as indicated - see fever flowchart and DDx tables in next Section) which follow:

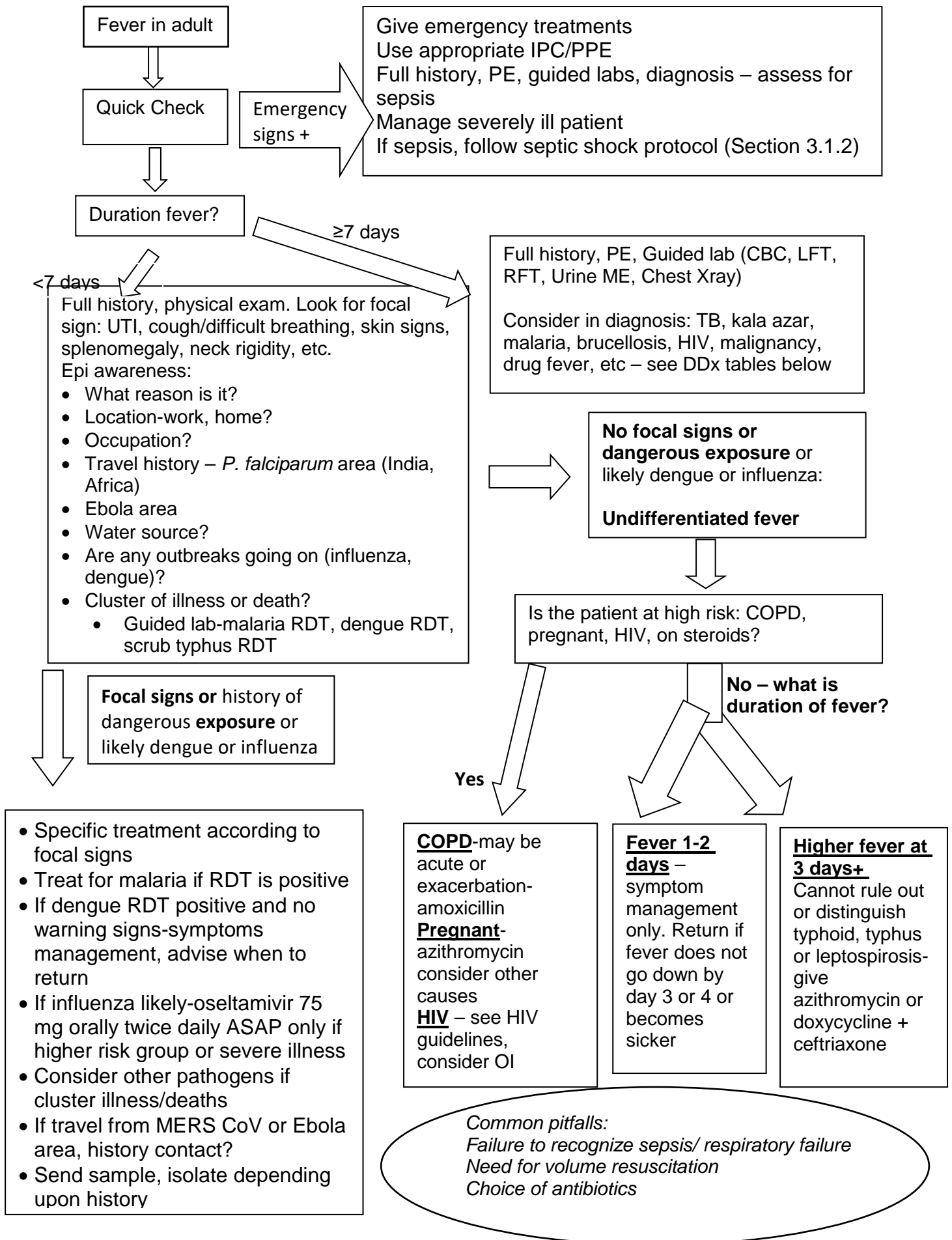
- dengue RDT
- scrub typhus
- full blood count with differential white cell count
- liver function tests
- chest X-ray
- sputum for microscopy, acid fast bacilli, *and sometimes culture*
- other urine tests – if positive findings on dipstick: microscopy, *culture*
- lumbar puncture
- bone marrow, lymph node, or splenic aspirate for microscopy
- serum or whole blood for rapid test
- stool microscopy and culture
- ultrasound
- blood cultures.

**If evidence of focal infection, use the appropriate Section of the manual. If no evidence of focal infection is found, use this Section to assess the patient. Perform investigations**

“Undifferentiated febrile illness (UFI) are an important group of “fevers” seen by health care workers in Nepal. Typhoid, typhus, leptospirosis are 3 common treatable UFIs to keep in mind in Nepal so that treatment can be promptly established without leading to unnecessary complications.... all of the three UFIs mentioned (typhoid, typhus, and leptospirosis) may also present with complications like pneumonia, encephalitis or multi organ failure including renal failure; but in the initial stages before complications set in very often, they will present as UFIs.”<sup>2</sup>

<sup>2</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

## Fever flowchart for undifferentiated febrile illness in adults










## 8.1.2 Consider likely differential diagnosis using the DDx tables and fever flowchart

Classify the fever according to its duration and symptoms or signs found on examination and laboratory investigations:







- fever with obvious focus of infection – see relevant Sections in the manual
- fever 14 days or less without clinically obvious focus (use the first DDx table below)
- fever more than 14 days (use the second DDx table below)
- hyperthermia – temperature >40.5°C (also use third DDx table below)

For the severely ill patient – see Section 3 Approach to the severely ill patient.

### DDx: Fever less than 7 days without clinically obvious focus or site

Condition	In favour
<b>Bacteraemic sepsis</b> see Section 3.1.5	Seriously ill with no obvious apparent cause Hypotension Full blood count (FBC) – leucocytosis, leucopenia, or thrombocytopenia  Risk factors – HIV  , injecting drug use, immunocompromised Blood cultures – positive Any sign of organ dysfunction – confusion, low urine output, respiratory depression Chemistries if available – <i>acidosis</i> , elevated creatinine
<b>Meningococcal septicaemia</b> see Section 3.1.5	Maculopapular haemorrhagic petechial rash Shock, hypotension
<b>Malaria</b>  see Section 11.23	Living in, or travelled to an endemic area Positive malaria test (RDT or microscopy) Absence of other obvious cause of fever
<b>Enteric fever (typhoid and paratyphoid fever)</b>  see Section 8.1.9 below	Headache Constipation or diarrhoea Abdominal pain and tenesmus Hepato- or splenomegaly “Rose spots” pink macules on abdomen
<b>Scrub typhus</b>  see Section 8.1.6 below	Transmitted by mites; more common in rural areas with more shrubs
<b>Murine typhus</b>  see Section 8.1.7 below	Transmitted by rat fleas; more common in cities
<b>Other rickettsial disease</b>	Headache, stupor (or other central neurological sign) Eschar Rash (sometimes petechial) Exposure to ticks, known area of endemicity (note that there have been several case reports of Lyme disease in Nepal- see Section 11.22)
<b>Leptospirosis</b>  see Section 8.1.8 below	Exposure to contaminated fresh water, farming or contact with rodents or dogs Conjunctival suffusion Aseptic meningitis Jaundice, renal failure, haemorrhage (Weil's disease)
<b>Dengue fever</b>  see Section 8.1.10 below	History of travel to endemic area or local outbreak Positive dengue RDT for NS1 or IgM Headache, pain behind the eyes Backache, arthralgia, myalgia Fine macular rash, petechiae







	<p>CBC – leukopenia, thrombocytopenia</p> <p>In severe cases:</p> <ul style="list-style-type: none"> <li>• signs of plasma leakage, shock</li> <li>• severe bleeding, e.g. from GI or orifices, dark urine</li> <li>• organ failure</li> </ul>
<p><b>Chikungunya</b></p>  <p>see Section 11.5</p>	<p>Resembles non-severe dengue fever</p> <p>Severe joint pains with fever and rash</p> <p>No simple test available to confirm the diagnosis</p>
<b>Zika</b>	
<p><b>Influenza</b></p> <p>see Section 8.2</p> 	<p>Sudden onset of fever and cough</p> <p>Sometimes rhinitis or sore throat</p> <p>Frequent systemic symptoms (headache, arthralgia, or myalgia)</p> <p>Local epidemics, or history of travel to epidemic areas</p> <p>Close contact with a person with a similar illness, or contact with person from epidemic area with influenza</p>
<p><b>Yellow fever</b></p>  <p>see Section 11.40</p>	<p>History of travel to endemic area or local outbreak</p> <p>Sudden onset of acute fever and rigors</p> <p>Headache, backache, bone pains</p> <p>Followed by jaundice within 2 weeks</p>
<p><b>Primary HIV</b></p> 	<p>Lymphadenopathy</p> <p>Rash, pharyngitis</p> <p>History of unprotected sexual contact or unsafe injecting drug use in the last 3 months</p>
<p><b>IRIS</b></p> 	<p>ART usually initiated 2–12 weeks previously</p> <p>Worsening of present condition or development of new signs and symptoms</p> <p>More likely if baseline CD4 &lt;50 cells/mm<sup>3</sup></p>
<p><b>Drug-induced fever</b></p>	<p>New drug-initiated days or weeks prior</p> <p>Associated rash</p> <p>Patient on certain drugs – ART (NVP, ABC, EFV) , cotrimoxazole, dapson, B-lactams, INH, anticonvulsants</p>
<p><b>Rheumatic fever</b></p> <p>see Section 11.29</p>	<p>Tachycardia</p> <p>Arthritis, rash – erythema marginatum</p> <p>Recent sore throat</p>
<p><b>Acute strongyloidiasis</b></p> <p>see Section 11.32</p>	<p>Migratory lesions that are serpiginous, erythematous, raised, and pruritic; can migrate 5-15 cm/ hr (“larva currens”)</p> <p>GI manifestations include epigastritis and duodenitis (pain worsens with food ingestion); anorexia, diarrhoea, nausea, vomiting, malabsorption (with high worm burden)</p> <p>Pulmonary manifestations include dry cough, throat irritation, dyspnea, wheezing, hemoptysis; in chronic disease, can manifest as asthma paradoxically exacerbated by steroids</p> <p>Hyperinfection syndrome results from massive dissemination of filariform larvae to end organs and can result in septic shock and acute lung injury</p> <p>Eosinophilia</p>
<p><b>Measles (in adolescents and young adults)</b></p> 	<p>Conjunctivitis, coryza, and cough</p> <p>Koplik’s spots on buccal mucosa (“grains of salt on a red background”)</p> <p>Maculopapular, blanching rash</p> <p>Lymphadenopathy</p> <p>Complications include:</p> <ul style="list-style-type: none"> <li>• respiratory tract infection (pneumonia, tracheobronchitis, bronchiolitis)</li> <li>• encephalitis (acute and chronic)</li> <li>• keratitis</li> </ul>
<p><b>Acute Q fever</b></p>	<p>Exposure to aerosolized fluid from birth products of farm animals (cows, goats, sheep); consumption of raw milk</p> <p>Flu-like illness, pneumonia, hepatitis in acute infection</p>
<p><b>Mononucleosis</b></p>	<p>Lymphadenopathy</p> <p>Pharyngitis</p> <p>More common in adolescents than adults</p> <p>Persistent fatigue (up to 6 months)</p> <p>Splenomegaly</p>







	FBC – >50% of WBC are lymphocytes Rash following antibiotic administration
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### DDx: Fever less than 7 days with focus of infection




Condition	In favour
<b>Urinary tract infection</b>	Burning on urination Flank pain (suspect pyelonephritis)
<b>Meningococcal meningitis</b> see Section 3.1.5	Maculopapular haemorrhagic petechial rash Shock, hypotension
<b>Pyomyositis</b>	Fever with focal muscle pain

### DDx: Fever 7 days or more





Condition	In favour
<b>Tuberculosis</b> 	Loss of weight, night sweats, fever, malaise Cough >2 weeks Signs of extrapulmonary disease – e.g. lymphadenopathy, pallor, abdominal pain Common complication of HIV
<b>Enteric fever (typhoid or paratyphoid)</b>  see Section 8.1.7 below	See description in DDx table: Fever 7 days or less without clinically obvious focus or site
<b>Malaria</b> see Section 11.23	See description in DDx table: Fever 7 days or less without clinically obvious focus or site
<b>Scrub typhus</b>	Fever may persist longer if effective treatment not received (median 14.4 days, range 9-19). See DDx less than 7 days above.
<b>Leptospirosis</b>	Fever may persist longer if effective treatment not received and may be biphasic. See DDx less than 7 days above.
<b>Dengue</b>	Fever may persist longer and may be biphasic. See DDx less than 7 days above.
<b>Osteomyelitis</b>	Limb pain, often worse at night Local limb tenderness and swelling Risk factor may be present (IDU, sickle-cell disease) Contiguous skin infection or chronic ulcer X-ray showing periosteal reaction or bone destruction (after 2 to 4 weeks)
<b>Endocarditis</b> see Section 11.12	Low grade fever, night sweats New heart murmur (or change in old heart murmur) Signs of embolic disease (stroke, petechiae, splinter haemorrhage, abdominal pain) Signs of heart failure (difficulty breathing) Splenomegaly Risk factors: known cardiac valvular disease, IDU, previous rheumatic disease
<b>Liver abscess</b> see Section 11.21	Right upper quadrant pain or tenderness Liver focal lesion at ultrasound
<b>Brucellosis</b> see Section 11.3	Contact with farm animals (infected goats, pigs), consumption of raw milk Acute brucellosis: undulant fever Subacute localized brucellosis: lumbago due to spondylitis, mono or polyarthritis, osteomyelitis
<b>Yellow fever</b>  see Section 11.40	History of travel to endemic area or local outbreak Sudden onset of acute fever and rigors Headache, backache, bone pains Followed by jaundice within 2 weeks
<b>Plague</b> 	History of exposure to rodents or fleas Unwell patient, sudden onset

see Sections 10.4 and 8.2	Rigors Extreme tiredness Large painful, tender lymph nodes-bubo (bubonic plague) Acute dyspnoea, pleuritic chest pain (pneumonic plague)
<b>Cryptococcosis</b>  see Section 11.7	Usually in advanced AIDS, but can rarely occur without HIV Meningo-encephalitis: headache, blindness Elevated intracranial pressure on LP, positive CSF India ink stain Pneumonia: cough, opacities on chest X-ray If available, positive serum or CSF cryptococcal antigen
<b>Mycobacterium avium complex (MAC)</b>  see Section 11.25	Usually in advanced AIDS, but can rarely occur without HIV Localized MAC: tuberculosis-like pneumonia, adenopathy, osteomyelitis Disseminated MAC: generalized lymphadenopathy, diarrhoea and abdominal pain AFB positive sputum, stool, or lymph node aspirate – confirm on culture No response, or partial response to standard anti-tuberculous therapy
<b>Lymphoma</b> 	Weight loss, night sweats Enlarged lymph nodes, hepatosplenomegaly
<b>Rheumatoid arthritis</b>	Bilateral pain and joint inflammation
<b>Deep fungal infections (histoplasmosis, coccidioidomycosis, paracoccidiomycosis)</b>  see Section 11.16	Usually in advanced AIDS, but can occur without HIV Skin lesions Nodular or lobar opacities on chest X-ray Hepatosplenomegaly Endemic areas vary, depending on species
<b>Cytomegalovirus (CMV)</b>  see Section 11.10	Painful swallowing Diarrhoea Visual loss (CMV retinitis on fundoscopy) Complication of advanced AIDS
<b>Toxoplasmosis</b>  see Section 11.35	Headache Focal neurological deficit Complication of advanced AIDS

**DDx: Fever with vesicular or bullous lesions** (from 10.2 Skin in IMAI DCM, Ugandan adaptation)


Condition	In favour
<b>Drug allergy/ drug fever</b>	Hives- can occur soon after taking the drug. History starting a new medication. Other signs and symptoms: fever, swelling, itching, wheezing, itchy watery eyes, runny nose Rarely anaphylaxis
<b>Severe drug reaction – Stevens Johnson syndrome (SJS) and toxic epidermal necrosis (TEN)</b> see Section 10.1.3	History of recently starting a new drug (e.g. sulfas, NVP) Erythematous maculopapular rash with blisters Confluent erythema with sheets of skin peeling and significant oozing Oral, conjunctival, genital mucosal ulceration and crusting Fever Systemic illness
<b>Herpes simplex- oropharyngeal</b> 	Primary infection can present in adults as severe pharyngitis with erythema and exudate, often also with oral exudative and ulcerative lesions (in children, gingivostomatitis) but only some have clear vesicles. Severe mouth pain and fever for 2-8 days then vesicles crust over and heal. May be hard to distinguish from other causes acute pharyngitis. Cervical lymphadenopathy which may persist for weeks Recurrences in the mouth and lips common but without systemic symptoms Deeper and persistent ulcers are more common in immunocompromised patients
<b>Herpes zoster</b>  see Section 11.38	Crops of painful vesicles in dermatomal distribution Do not cross midline Intense pain Less than 20% have systemic symptoms such as fever, headache, malaise, fatigue. <b>In PLHIV:</b> <ul style="list-style-type: none"> <li>recurrent, multidermatomal or disseminated herpes zoster</li> <li>severe and takes longer to heal</li> </ul>
<b>Chickenpox (varicella)</b> see Section 11.38	Fever Discrete (umbilicated) vesicles on an erythematous base Lesions in different stages of development Generalized, but predominantly involving the trunk, cephalocaudal spread Oral lesions <b>In PLHIV</b> , severe disseminated infection including pneumonia
<b>Anthrax- cutaneous</b> 	Evolve from papular lesions through to vesicular lesions over 1-6 days Can appear as a depressed eschar with accompanied oedema Link to other suspected cases or to contaminated animal products. Systemic symptoms including fever, headache and malaise can accompany the cutaneous lesions. May be associated with other clinical forms – gastrointestinal, pulmonary, or CNS
<b>Smallpox</b> 	<b>Major criteria:</b> <i>Febrile prodrome:</i> Fever of $\geq 101^{\circ}\text{F}$ , 1–4 days prior to rash onset with at least prostration, headache, backache, chills, vomiting or severe abdominal pain <i>Classic smallpox lesions:</i> Deep-seated, firm/hard, round well-circumscribed vesicles or pustules; lesions may umbilicate or become confluent <i>Lesions in same stage of development:</i> On any one part of the body all lesions in same stage of development <b>Minor criteria:</b> Centrifugal distribution of lesions First lesions on the oral mucosal palate, face, or forearms Patient appears toxic or moribund Slow evolution of lesions from macule, to papule, to vesicle (1-2 days each stage) Lesions on the palms and soles <b>High risk:</b> Fulfills all 3 major criteria <b>Moderate risk:</b> febrile prodrome + 1 other Major criterion OR febrile prodrome + $\geq 4$ Minor criteria <b>Low Risk:</b> no febrile prodrome OR febrile prodrome + $< 4$ Minor criteria

## DDx: Fever with maculopapular rash

Condition	In favour
<b>Scrub typhus</b>  see Section 8.1.6 below	High grade (>104°F), usually lasts 14 days Transient maculopapular rash may be seen over the trunk around day 7 of fever Site of insect bite (chigger) usually painless; black eschar (scab) seen in only 40% of cases Severe headache Profuse sweating Conjunctival injection Lymphadenopathy Incubation period 5- 20 days (mean, 10-12 days) after the initial bite. Risk groups: Agricultural workers, people living in houses with shrubs/ bush nearby, and travelers in areas with potential exposure to mice and mites, for e.g. camping, rafting, or trekking and people staying in the temporary shelter following earthquake where there is mouse infestation. <sup>4</sup>
<b>Drug eruption/ allergy</b> see Section 10.1.3	History of recently starting a new drug (e.g. sulfas, NVP) Rash generalized or fixed or discrete Red, itchy, maculopapular rash With or without mucosal involvement May have fever Rarely, signs and symptoms of anaphylaxis Uncommon- serum sickness occurring days or weeks after exposure to a drug, with fever, joint pain, rash, swelling and nausea
<b>Measles</b> 	Fever Early rash- head and upper trunk; later generalized maculopapular rash over whole body May have oral lesions- Koplik's spots No documented measles immunization or history measles as child Recent exposure to measles case or local measles outbreak Most common in young children but may occur in any non-immune adult Women infected while pregnant may have severe complications and/or miscarriage or preterm delivery
<b>Rubella</b> 	Rash appears usually 14 to 17 days after exposure. Pinpoint, pink maculopapules. Rash first appears of face then spreads to trunk and extremities; generalized within 24 hours. Persists for about 3 days but up to 8 days is possible. Arthritis and arthralgias in about 70% of teenagers and adult women. Many cases are asymptomatic but infectious. Rubella infection during pregnancy can lead to fetal death, premature delivery, and congenital rubella syndrome which can include hearing loss, developmental delay, growth retardation, and cardiac and ophthalmic defects.
<b>Other viral exanthema</b>	Fever Rash is asymptomatic (non-itchy) maculopapular or papular Starts on the face, spreads later to the neck, trunk, and limbs With or without oral lesions With or without lymphadenopathy Resolves spontaneously
<b>Viral haemorrhagic fevers (e.g. Ebola, Lassa)</b> see Section 11.11 and WHO VHF pocket guide <sup>5</sup> 	Fleeting maculopapular or morbilliform rash on the torso or face may be one early and relatively specific, although insensitive, indicator of infection (rare in EVD) More common in fair-skinned persons, also more difficult to see in dark skin

<sup>4</sup> EDCD interim Guideline on Prevention and Control of Scrub Typhus September 2015 (Updated in August 2016)


<sup>5</sup> Clinical Management of Patients with Viral Haemorrhagic Fever, World Health Organization, Geneva, 2016.

<b>Secondary syphilis</b>	Maculopapular lesions are the most common- often popular and scaling Mucous patches Presents weeks to months after the initial infection Constitutional symptoms can include malaise, fever, headaches, sore throat, and anorexia
<b>Zika</b>	Clinical manifestations occur in ~20% of patients including: Low-grade fever Maculopapular pruritic rash Arthralgia in small joints of hands and feet Non-purulent conjunctivitis
<b>HIV: acute retroviral syndrome</b> 	Mono-nucleosis-like or flu-like syndrome in up to 75% of cases Generalized maculopapular rash (upper chest, neck, face most often involved)- occurs 48-72 hours after onset of fever and persists for 5-8 days (small lesions (5-10mm); well circumscribed; round; pink-red; non-pruritic; can see oropharyngeal involvement) Fever Night sweats, fatigue, malaise, generalized lymphadenopathy, sore throat, arthralgias, myalgias, headache, nausea/vomiting, diarrhoea

### 8.1.3 Initiate treatment(s), monitor response, and reconsider diagnosis

If the cause of fever is found, go to the relevant manual Section for management.

#### Systematic approach to reassessment and empirical treatment if unclear diagnosis

- Re-examine the patient
- Reconsider range of possible diagnoses in the DDx tables
- Does the patient have scrub typhus, murine typhus, leptospirosis? It is important that these patients be treated empirically if these diagnoses are possible.
- Does the patient have an HIV-related condition (undiagnosed OI)? 
  - If the patient is HIV-infected, consider the following:
    - TB is the most common cause of fever without localizing signs.
    - Other opportunistic infections, particularly MAC, cryptococcal infection, and CMV may not present with focal signs and symptoms.
    - If ART has recently been initiated (less than 6 months), the patient may have immune reconstitution inflammatory syndrome (IRIS) – see HIV clinical guidelines.
- Have malaria and tuberculosis been excluded?
  - Consider multi-drug resistant (MDR) TB
  - Treat with antimalarials if RDT or blood smear positive

Has anything been missed?

Some often-missed sites that may cause fever include:

- dental abscesses
- sinusitis – percuss face and forehead
- endocarditis – auscultate for murmur, if possible perform blood cultures
- urinary tract infection
- prostatitis and pelvic inflammatory disease
- intra-abdominal, retroperitoneal, or paraspinal abscess
- cholangitis, liver abscess
- deep venous thrombosis – examine for lower limb swelling
- malignancy – check for breast lumps, cervical nodes, splenomegaly, hepatomegaly, prostate abnormalities

- connective tissue diseases (e.g. lupus, rheumatoid arthritis, small oral aperture, thickening of skin especially on face)
- fever due to medications
- pus that cannot drain (after trauma)
- Has any new symptom or sign developed since presentation? Repeated, thorough examinations may be necessary – full body, roll over, look between the toes and behind the ears.
- Consider nosocomial infections, such as urinary tract infection from a catheter or bed sore with infection.
- Repeat important laboratory tests. Consider the possibility of an initial false negative result, especially if the clinical picture does not correlate with the laboratory result.
- Treat according to the most likely clinical diagnosis based on symptoms and signs.

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### 8.1.4 Management of the severely ill patient with fever

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Treat according to suspected causes, based on clinical examination and Section 3 of the manual.

If the febrile patient has a suspected infection with hypotension (systolic blood pressure <90), treat patient for septic shock (see Section 3.1.5 Manage septic shock).

#### Management of hyperthermia

If the patient has hyperthermia (temperature >40.5°C) after long periods of sun exposure or other causes treat patient for hyperthermia:

- Use Quick Check.
- Assess volume status and hydrate appropriately.
- Perform rapid cooling.
  - Spray naked patient with a mist of lukewarm water while a fan or cool breeze is used to blow air over the moist skin (“evaporative cooling”).
  - Give IV diazepam (5 mg IV) to suppress shivering induced by cooling.
  - Give an antipyretic for infectious causes. Do not use antipyretic agents for heat stroke, intracranial injury, or drug-induced hyperthermia.
  - Continuously monitor core temperature with a rectal probe to monitor for response to cooling therapy. If a rectal probe is unavailable, frequently monitor oral temperature.
  - Cooling therapy should be stopped once the temperature is 38 to 39°C to avoid excessively low body temperatures.
- Treat complications
  - hypotension (see Quick Check page 6 then Section 3.1)
  - seizures (see Quick Check page 8, then Section 3.5)
  - disseminated intravascular coagulation (see Section 10.15)
  - hypoglycaemia (see Quick Check page 27)

Consider differential diagnosis of hyperthermia:

## DDx: Hyperthermia (temperature >40.5°C)

<b>Heat stroke</b>	Exposure to excess amount of sun Central nervous system dysfunction (e.g. anxiety, delirium, seizure, coma) Warm, red skin without sweating Signs of end organ damage: hypotension; hypoglycemia; elevated liver or kidney enzymes; disseminated intravascular coagulation (DIC)
<b>Intracranial injury</b>	Haemorrhage (involving the pons) Stroke (involving the hypothalamus) Status epilepticus Tumor
<b>Drug effects</b>	Toxicity from SSRIs, MAOI, anticholinergics (e.g. diphenhydramine, promethazine, amitriptyline, atropine), fluoxetine or other SSRI – see Section 3.8 Withdrawal from alcohol (delirium tremens) – see Section 3.7 Malignant hyperthermia in response to halothane Neuroleptic malignant syndrome
<b>Endocrine conditions</b>	Thyrotoxicosis Adrenal crisis Pheochromocytoma
<b>Infectious causes</b>	Sepsis Brain abscess Meningitis Typhoid fever Malaria Relapsing fever

### Symptomatic management of fever in hospitalized patients

- Give antipyretics – paracetamol/aspirin/NSAIDs (except in dengue endemic areas, where aspirin/NSAID should not be used).
- Fan the patient and wipe the body with lukewarm water (tepid sponge).
- Hydration (oral or IV, if patient unable to drink fluids).

### 8.1.5 Symptomatic management of fever as an outpatient (not severely ill)

- Give paracetamol or aspirin every 4 hours (no more than 4 g of paracetamol in 24 hours).
- Make sure the patient stays well hydrated. Encourage oral rehydration.
- Home care:
  - Encourage frequent intake of oral fluids such as water, diluted tea, fruit juices.
  - Wipe the body with a damp cloth (tepid sponge) or give a lukewarm bath.
  - Encourage the patient to wear only light clothes.
  - Give paracetamol, aspirin, or ibuprofen to reduce the fever.

**Important:** advise the patient and family to seek help or to return to the health facility if:

- The fever does not improve or comes back after treatment.
- The fever is accompanied by a cough, diarrhoea, severe pain, confusion, night sweats, rigors, stiff neck or change in consciousness.
- A woman has fever in pregnancy, after birth, or after abortion (spontaneous or not).



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## 8.1.6 Scrub typhus<sup>7</sup>

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Scrub typhus is an acute, febrile, infectious disease that is caused by *Orientia tsutsugamushi*. It is also known as *tsutsugamushi disease*. It is an obligate intracellular gram-negative bacterium from the Rickettsiaceae family. Scrub typhus is endemic throughout the “tsutsugamushi triangle”, extending from northern Japan and the far-eastern Russian Federation to northern Australia and Pakistan. This includes Bhutan, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka and Thailand.

Although rickettsial illnesses (typhus fever) had been recognized to be an important cause of fever in Nepal since 2004, this fact had not been well -grasped until post- earthquake 2015. Post-earthquake there were outbreaks of scrub typhus in various parts of Nepal, some of which were fatal.<sup>8, 9</sup>

Scrub typhus is transmitted by mites. Humans acquire the disease from the bite of an infected trombiculid mite (chigger). The mites are both the vector and reservoir of the disease. The mite is very small (0.2 – 0.4 mm) and can only be seen through a microscope or magnifying glass. The larva is the only stage that can transmit the disease to humans and other vertebrates.

**There is no human-to-human transmission.**

**Incubation period:** About 5 to 20 days (mean, 10-12 days) after the initial bite

**Risk groups:** Agricultural workers, people living in houses with shrubs/ bush nearby, and travelers in areas with potential exposure to mice and mites, for e.g. camping, rafting, or trekking and people staying in the temporary shelter following earthquake

### Key clinical features

- Fever is high grade (>104<sup>0</sup>F) and usually lasts 14 days.
- Maculopapular rash is seen over trunk, which is transient, and is seen around day 7 of fever
- Severe headache
- Profuse sweating
- Conjunctival injection
- The site of insect bite is usually painless and a black eschar (scab) is seen in only about 40% of cases in Nepal
- Lymphadenopathy

### Complications:

- Interstitial pneumonia- X-ray evidence of pneumonitis is common and may progress to ARDS
- Pulmonary edema
- Congestive heart failure
- Circulatory collapse
- Diarrhoea and features of acute gastroenteritis is also possible; sometimes GI bleeding can occur

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<sup>7</sup> EDCD interim Guideline on Prevention and Control of Scrub Typhus September 2015 (Updated in August 2016)

<sup>8</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

<sup>9</sup> Bastola et al., Aftermath Earthquake in Nepal: Burden of Scrub Typhus Cases and their Presentations. J Trop Dis 2017,

- Neurological findings may suggest meningo-encephalitis.
- Severe illness and septic shock

Multi-organ failure- severe manifestations usually develop after the first week of untreated illness and may include encephalitis, haemorrhage, septic shock, acute respiratory distress syndrome, pneumonia, renal or liver failure, or myocarditis. Death may occur as a result of these complications

- Spontaneous abortion may occur during pregnancy

This disease is thus suspected in a patient living in or having travelled to an endemic area, with fever and an eschar, or with fever and a rash, or with fever and a history of tick bite. As scrub typhus (and other rickettsioses) do not respond to usual antibiotics and are potentially rapidly fatal, presumptive treatment should be given as soon as the diagnosis is suspected.

In the 2004 study in Patan which enrolled 876 adults  $\geq 14$  years, half the patients with scrub typhus had a clinical diagnosis of enteric fever. “No combination of signs, symptoms, laboratory results, or demographic data could be constructed to reliably distinguish between the different causes of febrile illness. Many cases of murine typhus, scrub typhus, and leptospirosis are undoubtedly diagnosed as enteric fever and treated with ciprofloxacin... patients who fail to respond to the current first line therapy for “enteric fever” or for those with more severe disease or who require admission, the addition of doxycycline is recommended.... Eschar or conjunctival suffusion were not observed in any of the patients with scrub typhus...”<sup>10</sup> 28 patients had scrub typhus in this study.

**Suspect case definition:** Acute undifferentiated febrile illness (UFI) of 5 days or more with or without eschar (If eschar is present, fever of less than 5 days duration should be considered as scrub typhus.)

**Probable case:** A suspected clinical case with an IgM titer  $> 1:32$  and/or a four-fold increase of titers between two sera confirm a recent infection.

**Confirmed case:** The one in which:

- Rickettsial DNA is detected in eschar samples or whole blood by PCR **OR**,
- Rising antibody titers on acute and convalescent sera detected by Indirect Immune Fluorescence Assay (IFA) or Indirect Immunoperoxidase Assay (IPA)

## Investigations

- Scrub typhus RDT
- PCR of samples from eschar or whole blood- if available; may be sent abroad)
- IgM titers
- An indirect immunofluorescence antibody assay (Immunofluorescence Assay, IFA) is a typical assay for tsutsugamushi disease. This assay has an advantage of accurate diagnosis compared with other methods but requires repeated samples. It has many disadvantages—requiring 3 weeks between two samples to demonstrate rising antibody titres so not immediately helpful to patient management; not usually available in Nepal;

<sup>10</sup> Murdoch DR et al: THE ETIOLOGY OF FEBRILE ILLNESS IN ADULTS PRESENTING TO PATAN HOSPITAL IN KATHMANDU, NEPAL, Am. J. Trop. Med. Hyg., 70(6), 2004, pp. 670–675.

expensive to send out for testing;<sup>11</sup> expensive equipment- a fluorescence microscope; slides with all serotype specimens prevalent in each area; and is time-consuming to process many specimens.

Note that suspected diagnosis and urgent treatment need to be based on clinical findings and epidemiologic setting. Treatment should not be withheld pending diagnostic tests.

Other laboratory findings- thrombocytopenia, lymphocytosis or no change, AST/ALT increased.

### **Treatment (adult)**

- antibiotics with regimens active against rickettsial disease include:
  - doxycycline 100 mg orally twice daily for 7 days; OR
  - azithromycin 1 gram first day then 500 mg orally single dose for 3 to 5 daysIn pregnant women, use azithromycin

Scrub typhus is easily treatable when suspected early and effective treatment should be included in empirical treatment even before definite diagnosis. See the fever flowchart above.

Untreated cases can have severe complications. A systematic review suggests a case fatality rate in untreated patients of at least 6% but with a wide range (0 to 70%);<sup>12</sup> however, this review included many patients with a clinical diagnosis only. In a recent study in Chitwan, Nepal on IgM positive scrub typhus patients with disease severe enough to lead to ICU admission, the CFR was 20%.<sup>13</sup>

Supportive care to manage severe complications of scrub typhus- see 3.1.2 on management septic shock; 3.2 on management severe respiratory distress; 3.3 on chest pain from myocarditis; 3.4 on encephalitis.

#### *Give preventive information to the public:*

- Wear protective clothing including boots
- Insect repellents containing 20 to 30% DEET can be applied to the skin and clothing to prevent chigger bites.
- Do not sit or lie on bare ground or grass; use a suitable ground sheet or other ground cover
- Clear vegetation spray insecticides on the soil to break up the cycle of transmission
- Avoid livestock and rice storage near the home.

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<sup>11</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

<sup>12</sup> Taylor AJ, Paris DH, Newton PN: A Systematic Review of Mortality from Untreated Scrub Typhus (*Orientia tsutsugamushi*). *PLoS Negl Trop Dis*. 2015;9(8):e0003971. Epub 2015 Aug 14.

<sup>13</sup> Adhikari S et al: Predictors of Mortality in Scrub Typhus Infection Requiring Intensive Care Admission in Tertiary Healthcare Centre of Nepal. *Interdisciplinary Perspectives on Infectious Diseases*. Volume 2018, Article ID 4867958 <https://doi.org/10.1155/2018/4867958>

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### 8.1.7 Murine typhus<sup>14</sup>

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Murine typhus is transmitted by rat fleas. A recent urban study<sup>15</sup> in Patan Hospital found 17% of undifferentiated fever to be murine typhus case rate with an absence of scrub typhus, to be more common in the cities (for example the Patan area) compared to scrub typhus which seems to be more common in rural areas where there are more shrubs.<sup>16</sup>

Like scrub typhus in the 2004 Patan study,<sup>17</sup> half of those with murine typhus had a clinical diagnosis of enteric fever.

**Investigations:** No RDT, PCR or IFA available at this time.

**Treatment:** doxycycline or azithromycin as for scrub typhus.

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### 8.1.8 Leptospirosis<sup>18, 19, 20</sup>

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Leptospirosis is a cosmopolitan bacterial (spirochetal) infection due to various species and serovars of *Leptospira*. Severe disease is most associated with *Leptospira interrogans* acquired from rodents or dogs in urban and rural settings, especially in flood-prone areas and slums or rice paddy fields. Additionally, cattle, water buffalo, and pigs are important sources of other pathogenic *Leptospira* species in the agricultural setting. Leptospirosis is most commonly acquired percutaneously or by conjunctival exposure from environmental water sources contaminated with the urine of chronically infected animals. Leptospirosis is not known to be acquired by ingestion.

Many areas where leptospirosis is endemic are also endemic areas for rickettsial diseases, malaria, and zoonotic viral infections, thus clinical differentiation may be difficult and require empirical treatment (see fever flowchart above).

#### Key clinical features

Leptospirosis may present with several distinct syndromes:

- non-specific febrile illness – fever, myalgia (especially affecting the legs), headache;
- conjunctival suffusion (dilated conjunctival vessels without purulent exudate) is a quite specific symptom;

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<sup>14</sup> Zimmerman MD, Murdoch DR, Rozmajzl PJ, Basnyat B, Woods CW, Richards AL, et al. Murine typhus and febrile illness, Nepal. *Emerg Infect Dis.* 2008;14:1656–9.

<sup>15</sup> Thompson CV et al: Undifferentiated Febrile Illness in Kathmandu, Nepal. *Am. J. Trop. Med. Hyg.*, 92(4), 2015, pp. 875–878.

<sup>16</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

<sup>17</sup> Murdoch DR et al: THE ETIOLOGY OF FEBRILE ILLNESS IN ADULTS PRESENTING TO PATAN HOSPITAL IN KATHMANDU, NEPAL, *Am. J. Trop. Med. Hyg.*, 70(6), 2004, pp. 670–675.

<sup>18</sup> Excerpt from *WHO recommended standards and strategies for surveillance, prevention and control of communicable diseases*. Available at <http://www.who.int/zoonoses/diseases/Leptospirosis-surveillance.pdf>

<sup>19</sup> *Human leptospirosis: guidance for diagnosis, surveillance and control*. WHO, 2003. Available at [http://whqlibdoc.who.int/hq/2003/WHO\\_CDS\\_CSR\\_EPH\\_2002.23.pdf](http://whqlibdoc.who.int/hq/2003/WHO_CDS_CSR_EPH_2002.23.pdf)

<sup>20</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

- aseptic meningitis – headache (often severe; described as bitemporal, frontal throbbing, retro-orbital pain), fever, photophobia, neck stiffness;

Severe complications can result with cause fulminant, life-threatening disease with multiple organs affected including liver, kidneys, lung, and brain:

- Weil's disease – complications of the non-specific febrile illness include jaundice, renal failure, and haemorrhage (pulmonary most common, but also gastrointestinal and cerebral).
- Acute respiratory distress syndrome (ARDS)
- Renal failure- high- output. Kidneys almost always involved in leptospirosis.
- Bleeding- usually mild (petechiae, ecchymoses, epistaxis) but can have severe GI bleeding (bleeding or hematemesis) or pulmonary hemorrhage
- Myocarditis
- Uveitis

Additional, unusual features that vary by region include myocarditis, uveitis, and biphasic illness (a second episode of fever after the first, which may occur despite antibiotic therapy, characteristically not responding to antibiotics).

### Investigations

Diagnosis is primarily based on clinical features in a patient with risk factors (contact with contaminated water, or farming, or contact with rodents or dogs).

- Gold standard is PCR in acute phase
- RDT for leptospirosis at EDCCD and other centers (not positive until 5 -7 days); earlier need PCR but poorly available.
- MAT serology – acute and convalescent- if available (not now available in NPHL). Reliable tests (such as the MAT serology) may not be sensitive early in the course of the disease; difficult to access. Antibodies will not reach detectable levels until the second week of illness.
- Other blood tests (urea, creatinine and electrolytes, liver function tests, ESR, complete blood counts) may demonstrate organ dysfunction but are not specific. CSF suggests aseptic meningitis (pleocytosis with normal CSF glucose). PT may be prolonged in Weil's syndrome. Elevated CPK in up to 50% of patients in first week
- Direct observation of spirochetes in urine, blood, and cerebrospinal fluid is not recommended because of frequent artifactual findings.
- May be possible to isolate from blood and/or CSF isolation during the first 10 days of illness and from urine for several weeks beginning at around 1 week

### Treatment

Antibiotics are thought to be beneficial in severe disease, and early initiation may prevent some patients from progressing to more severe disease. Mild disease is self-limited. Suggested regimens (oral dosing for mild disease, parenteral for moderate to severe disease) for 7 days treatment include:

- doxycycline 100 mg orally, twice daily (recommended in regions where rickettsial diseases such as scrub typhus are common); OR
- ceftriaxone 1 g IV daily; OR
- cefotaxime 1 g IV every 6 hours; OR
- ampicillin 500 mg to 1 gram IV every 6 hours OR
- *benzylpenicillin 1.5 million units IV every 6 hours.*

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### 8.1.9 Enteric fever (typhoid or paratyphoid)

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Typhoid fever is caused by systemic infection with *Salmonella typhi* or *paratyphi* and is most commonly contracted through consumption of food or water contaminated with faeces. It is endemic throughout Nepal, but cluster epidemics may occur from a source of contaminated food or water.

Typhoid fever is often difficult to diagnose because symptoms and signs are not specific even though the patient may be very sick, and laboratory findings are not conclusive unless cultures are performed. If untreated, the disease may be self-limited. Three percent of these untreated cases become asymptomatic carriers who continue to shed *Salmonella (para)typhi* and may contaminate food and water sources.

History and examination findings are usually non-specific. It is therefore important to have a high index of suspicion of typhoid in the patient who looks ill but does not have an obvious focus of infection. Also always consider malaria and disseminated TB in these cases.

#### Key clinical features

- (para)typhoid has an incubation period of 3 to 60 days;
- prolonged fever;
- a faint maculopapular rash after 2 to 3 days, last only 24 hours (in only 30% of cases and rarely seen if the patient has dark skin) (rose spots)
- abdominal pain and tenderness;
- jaundice;
- enlarged liver and spleen;
- non-specific symptoms include anorexia, mild cough, sore throat, and constipation.

In late or severe disease:

- florid diarrhoea;
- coma or decreased consciousness;
- fulminant sepsis.

#### Complications

- focal salmonella infection in bone, meninges, heart valves, soft tissue, genitourinary tract;
- bowel perforation;
- gastrointestinal haemorrhage.

#### Investigations

- culture of blood (for good yield, 10-15 ml blood), urine, stool – growth of salmonella (para)typhi species occur in 24 to 48 hours and is diagnostic;
- the last generation of good quality rapid diagnostic tests have shown to be 80% sensitive on average and highly specific;
- in the absence of cultures, laboratory results, including the white cell count, are non-specific and typhoid fever is an empirical diagnosis;
- the Widal test has both low sensitivity and specificity and is thus not helpful.

#### Treatment

Nepal has fluoroquinolone-resistant and ceftriazone-resistant enteric fever. Resistance to co-trimoxazole emerged two decades ago, but has subsequently largely disappeared. <sup>21</sup>

Treat according to current antimicrobial sensitivity (from NPHL):

- ceftriaxone 1 gram IV twice daily (bd) for 7-10 days, if susceptible
  - cefixime as oral option
- Other options:
- chloramphenicol (if available) OR
  - amoxicillin OR
  - co-trimoxazole.

### **Supportive care**

- Depending on the severity of the illness, IV fluids may be required.

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<sup>21</sup> Pokharel: Co-trimoxazole versus azithromycin for the treatment of undifferentiated febrile illness in Nepal: study protocol for a randomized controlled trial, 2017- complete ref, insert other refs.

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## 8.1.10 Dengue<sup>22, 23, 24, 25</sup>

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Dengue is the most rapidly spreading mosquito-borne viral disease in the world. In the last 50 years, incidence has increased 30-fold with increasing geographic expansion to new countries and, in the present decade, from urban to rural settings. WHO SEARO has about 50% of the global with many member states experiencing an increase in the number of cases.<sup>26</sup>

Dengue virus is a small single-stranded RNA virus comprising four distinct serotypes. Infection by one serotype provides life-long immunity to that serotype, but only transient immunity to the others. Sequential infection with a different serotype increases the risk of serious disease.

Dengue infections range from symptomatic and undifferentiated fever to severe dengue, as well as unusual complications such as cardiomyopathy, acute liver or renal failure, and encephalitis, even in the absence of severe plasma leakage or shock.

The first dengue outbreak in Nepal was documented in 2006, followed by a handful of sporadic reports, until a large outbreak occurred in central and western Nepal during 2010. Dengue has expanded to hill urban areas, including Kathmandu and Pokhara (infrequent at this altitude, as *A. aegypti* is relatively uncommon). Most cases are from the southern plains. Multiple serotypes are in circulation and elevated secondary infections pose the potential risk of severe outbreaks and deaths.<sup>27</sup>

Currently there are more adult than child cases.

**[Insert figure: Revised dengue case classification by severity- from WHO]**

### Key clinical features

**Dengue fever** clinical case definition:

Criteria include the sudden onset of fever lasting 2 to 7 days, living in or travel to dengue endemic area, and two of the following:

- headache
- anorexia, nausea, vomiting
- rash
- muscle and joint pains
- retro-orbital pain
- tourniquet test positive
- leukopenia with atypical lymphocytosis and thrombocytopenia

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<sup>22</sup> Dengue: guidelines for diagnosis, treatment, prevention and control: new edition. WHO, 2009. Available at [http://whqlibdoc.who.int/publications/2009/9789241547871\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf)

<sup>23</sup> WHO-TDR: Handbook for Clinical Management of Dengue, Geneva 2012. (training manual, not new guidelines)

<sup>24</sup> EDCD: National Dengue Guidelines for Clinical management, prevention and control, 2011 (in revision)

<sup>25</sup> WHO-TDR: Technical handbook for dengue surveillance, dengue outbreak prediction/detection and outbreak response ("model contingency plan"), Geneva, 2016.

<sup>26</sup> WHO, 2011. WHO Regional Office for South-East Asia. 2011. Communicable diseases: Dengue/DHF. Available at: [http://www.searo.who.int/LinkFiles/Dengue\\_Dengue\\_update\\_SEA\\_2010.pdf](http://www.searo.who.int/LinkFiles/Dengue_Dengue_update_SEA_2010.pdf).

<sup>27</sup> Dumre SP et al: Dengue Virus Serotypes 1 and 2 Responsible for Major Dengue Outbreaks in Nepal: Clinical, Laboratory, and Epidemiological Features. *Am. J. Trop. Med. Hyg.*, 97(4), 2017.



- any of the warning signs listed immediately below.  
Also retro-orbital pain, thrombocytopenia,

Dengue is difficult to distinguish from other acute febrile illnesses, such as malaria or typhoid.

**Warning signs include:**

- abdominal pain or tenderness
- persistent vomiting
- clinical fluid accumulation
- mucosal bleed
- lethargy, restlessness
- liver enlargement more than 2 cm
- laboratory: increase in haematocrit concurrent with rapid decrease in platelet count.

**Severe dengue fever:** clinical case definition

Criteria for dengue fever above, and:

- severe plasma leakage leading to dengue shock syndrome and fluid accumulation with respiratory distress; OR
- severe bleeding as clinically evaluated; OR
- severe organ involvement – liver: AST or ALT  $\geq 1000$ ; CNS – impaired consciousness; or heart and other organs.

**Investigations**

In areas endemic for malaria and dengue, dengue is often the next diagnosis to consider when the malaria test is negative.

Blood investigations:

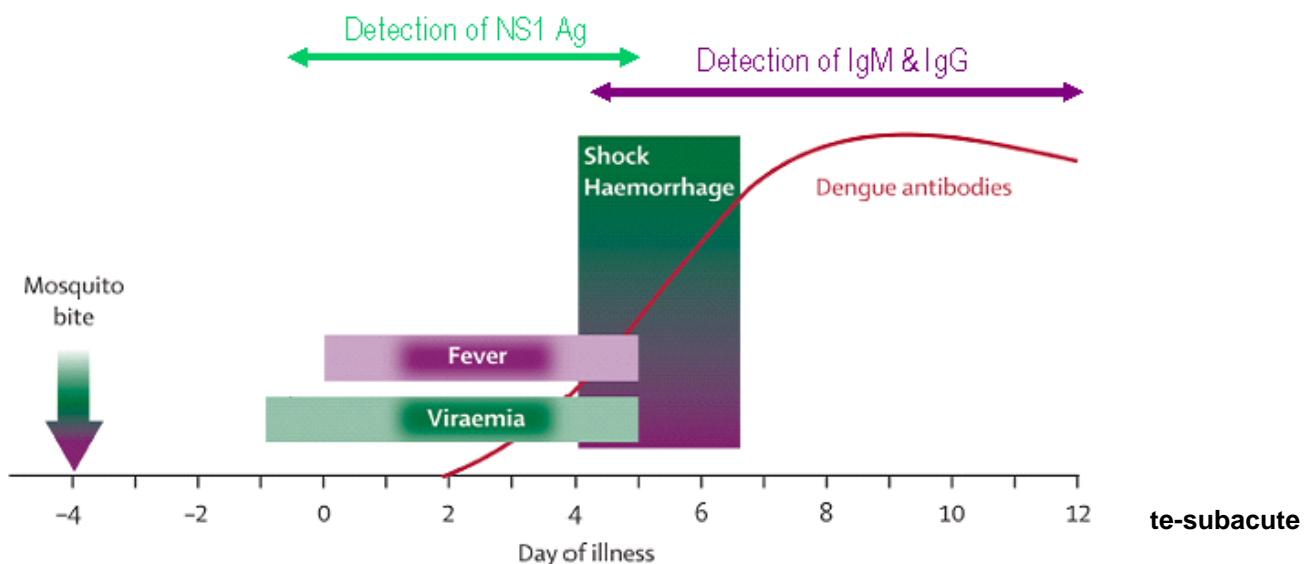
- White cell count, platelets, haematocrit, other organ function tests as necessary
- to confirm dengue infection (see figure below):
  - ◊ detection of NS1 antigen by rapid diagnostic test from day 1 to 6 of illness;
  - ◊ detection of IgM by rapid diagnostic test or ELISA from day 5 onwards;
  - ◊ some rapid diagnostic tests combine the detection of NS1 and IgM/IgG, which increases the chance of confirming the diagnosis in the early stage of illness.

Dengue RDT in Nepal---see 7.2.17.4

Other imaging:

- Chest X-ray (including right lateral decubitus) and abdominal ultrasound can be useful to detect plasma leakage.

**Figure: Laboratory confirmation for dengue virus infection<sup>28</sup>**



## Treatment

### Group A: dengue without warning signs – may be sent home

- Group criteria:
  - Patients do not have warning signs.
- AND
- Are able:
  - ◇ to tolerate adequate volumes of oral fluids
  - ◇ to pass urine at least once every 6 hours.
- Treatment:
  - Advice for:
    - ◇ adequate bed rest
    - ◇ adequate fluid intake
    - ◇ paracetamol, 4 g maximum daily in adults
    - ◇ patients with stable haematocrit can be sent home.

### Group B: dengue with warning signs – refer for inpatient hospital care

- Group criteria:
  - Patients with any of the following features:
    - ◇ coexisting conditions such as pregnancy, old age, diabetes mellitus, renal failure;
    - ◇ social circumstances such as living alone, living far from hospital.
- Treatment:
  - Encourage oral fluids. If not tolerated, start intravenous fluid therapy with NS or LR at maintenance rate.
  - Obtain reference haematocrit before fluid therapy.
  - Monitor closely.

### Group C: severe dengue – require emergency treatment

- Group criteria:
  - Patients with any of the following features:
    - ◇ severe plasma leakage with shock or fluid accumulation with respiratory distress;
    - ◇ severe bleeding;
    - ◇ severe organ impairment.

Decide if compensated shock or hypotensive shock.

From WHO-TDR: Handbook for Clinical Management of Dengue, Geneva 2012:

**Compensated shock in adult:** During the initial stage of shock, the compensatory mechanism that maintains a normal systolic BP produces tachycardia, quiet tachypnoea (tachypnoea without increased effort), and peripheral vasoconstriction with reduced skin perfusion (manifested as cold extremities and delayed capillary refill time of > 2 seconds and weak volume peripheral pulses). As peripheral vascular resistance increases, the diastolic pressure rises towards the systolic pressure and the pulse pressure (the difference between the systolic and diastolic pressures) narrows. The patient is considered to have compensated shock if the systolic pressure is maintained at the normal or slightly above normal range but the pulse pressure is  $\leq 20$  mmHg in children (e.g. 100/85 mmHg) or if they have signs of poor capillary perfusion (cold extremities, delayed capillary refill, or tachycardia). In adults, pulse pressure of  $\leq 20$  mmHg may indicate more severe shock..... Patients who have dengue and are in compensated shock often remain conscious and lucid. The inexperienced physician may measure a normal systolic pressure and a normal pulse oximetry (SpO<sub>2</sub> 95–100%) in a conscious patient and underestimate the critical state of the patient.

**Hypotensive shock:** Worsening hypovolaemic shock manifests as increasing tachycardia and peripheral vasoconstriction. Not only are the extremities cold and cyanosed but the limbs become mottled, cold and clammy. By this stage the breathing becomes more rapid and increases in depth – a compensation for the metabolic acidosis (Kussmaul’s breathing). Finally, there is decompensation, both systolic and diastolic BPs disappear suddenly and dramatically, and the patient is said to have hypotensive or decompensated shock. At this time the peripheral pulses disappear while the central pulse (femoral) will be weak. Hypotension develops when physiologic attempts to maintain systolic BP and perfusion are no longer effective. One key clinical sign of this deterioration is a change in mental state as brain perfusion declines. The patient becomes restless, confused and extremely lethargic. Seizures may occur and agitation may alternate with lethargy. On the other hand, children and young adults have been known to have a clear mental status even in profound shock. Adults have been known to be able to work until the stage of profound shock is reached.”

### Treatment:

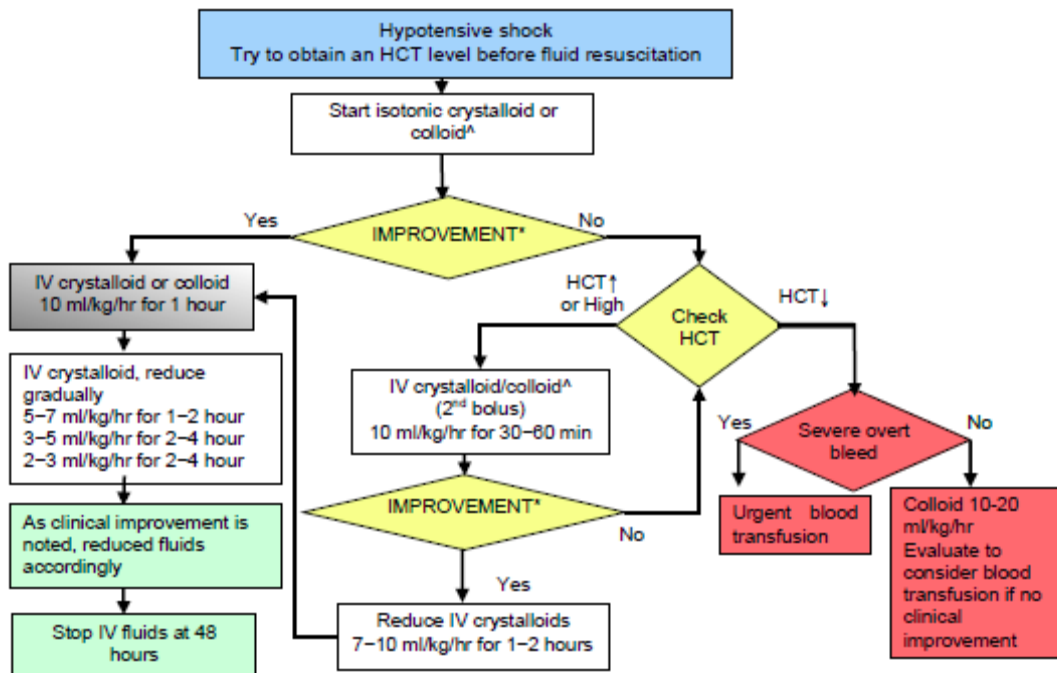
- **Compensated shock:**
  - ◇ Start IV fluid resuscitation with NS or LR at 5–10 ml/kg/hour over 1 hour.
  - ◇ Reassess the patient’s condition.
  - ◇ If the patient improves:
    - reduce IV fluids gradually to 5–7 ml/kg/hour for 1 to 2 hours, then to 3–5 ml/kg/hour for 2 to 4 hours, then to 2–3 ml/kg/hour for 2 to 4 hours and then reduce further depending on haemodynamic status;
    - IV fluids can be maintained for up to 24–48 hours.
  - ◇ If the patient is still unstable:
    - check haematocrit after first bolus;
    - if haematocrit increases or is still high (more than 50%), repeat a second bolus of crystalloid solution at 10–20 ml/kg/hour for 1 hour;
    - if there is improvement after second bolus, reduce rate to 7–10 ml/kg/hour for 1 to 2 hours and continue to reduce as above;
    - if haematocrit decreases, this indicates bleeding and need to cross-match and transfuse blood as soon as possible.
- **Hypotensive shock:**
  - ◇ Initiate IV fluid resuscitation with NS or LR or colloid solution at 20 ml/kg as a bolus for 15 minutes.
  - ◇ If patient improves:
    - give NS or LR or colloid solution of 10 ml/kg/hour for 1 hour, and then reduce gradually as above.
  - ◇ If patient is still unstable:
    - review the haematocrit taken before the first bolus;
    - if haematocrit was low (more than 40% in females, more than 45% in males) this indicates bleeding (see above);
    - if haematocrit was high compared to baseline value, change to IV colloids at 10–20 ml/kg as a second bolus over 30 minutes to 1 hour, reassess after second bolus;
    - if patient is improving, reduce the rate to 7–10 ml/kg/hour for 1 to 2 hours, then back to IV NS or LR, and reduce rates as above;
    - if patient’s condition is still unstable, repeat haematocrit after second bolus;
    - if haematocrit decreases, this indicates bleeding and need to cross-match and transfuse blood as soon as possible;

- if haematocrit increases or remains high (more than 50%), continue colloid infusion at 10–20 ml/kg as a third bolus over 1 hour, then reduce to 7–10 ml/kg/hour 1 to 2 hours, then change back to NS or LR and reduce rate as above.
- Haemorrhagic complications: give 5–10 ml/kg of fresh packed red cells or 10–20 ml/kg of fresh whole blood.

When to consider peripheral vasopressor.....see septic shock Section 3.1.5

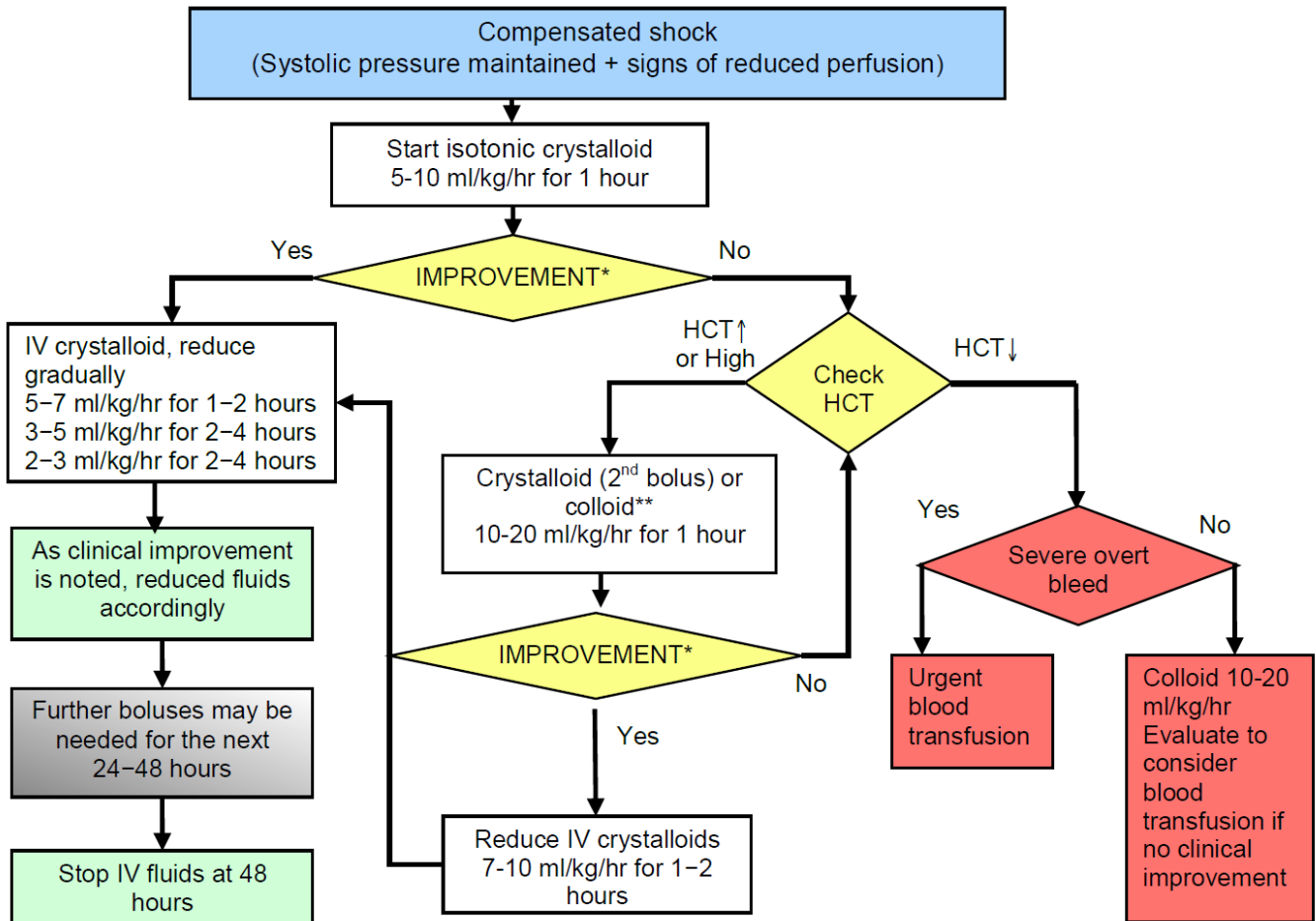
From WHO-TDR: Handbook for Clinical Management of Dengue, Geneva 2012:

**Fig. 7. Algorithm for fluid management in hypotensive shock – infants, children and adults**



<sup>^</sup>Colloid is preferable if the patient has already received previous boluses of crystalloid  
<sup>\*</sup>Reassess the patient's clinical condition, vital signs, pulse volume, capillary refill time and temperature of extremities.  
 IV = intravenous; HCT = haematocrit; ↑ = increased; ↓ = decreased

**Fig. 5. Algorithm for fluid management of compensated shock: in adults**



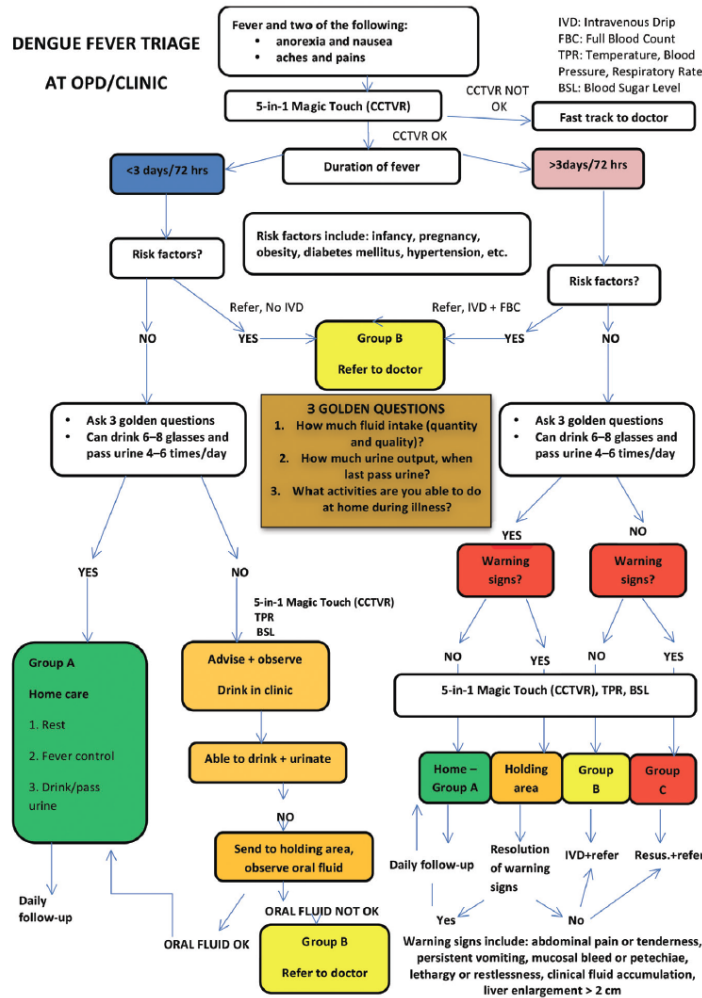
\*Reassess the patient's clinical condition, vital signs, pulse volume, capillary refill time and temperature of extremities.

\*\*Colloid is preferable if the patient has already received previous boluses of crystalloid

-IV: intravenous, HCT: haematocrit, ↑: increased, ↓: decreased.

If a large number of cases occur and triage for severity is necessary, an algorithm such as the following from WHO-TDR: Technical handbook for dengue surveillance, dengue outbreak prediction/detection and outbreak response (“model contingency plan”), Geneva, 2016 may be necessary:

#### Annex 4. Example flowchart for triage



Source: Lum, personal communication (2015).




## 8.2 Chest symptoms: cough and shortness of breath

<p>8.2.1 Clinical approach to a patient with chest symptoms</p> <ul style="list-style-type: none"> <li>– Interpretation of chest X-ray findings</li> </ul> <p>8.2.2 Differential diagnosis of chest complaints</p> <ul style="list-style-type: none"> <li>– DDx: X-ray abnormalities in patients with acute chest symptoms</li> <li>– DDx: Difficult breathing or cough – with fever</li> <li>– DDx: Difficult breathing or cough – without fever</li> <li>– DDx: Chest pain</li> <li>– Evaluation and differential diagnosis of pleural effusion</li> </ul> <p>8.2.3 Pneumonia</p> <ul style="list-style-type: none"> <li>– Determining the need for hospitalization</li> <li>– Outpatient management of non-severe pneumonia</li> <li>– <i>Pneumocystis jirovecii</i> pneumonia</li> </ul>	<ul style="list-style-type: none"> <li>– Varicella pneumonia</li> </ul> <p>8.2.4 Influenza</p> <p>8.2.5 Asthma</p> <ul style="list-style-type: none"> <li>– Classify asthma severity</li> <li>– Table: Examples of increasing dosage and choice of medications by asthma severity</li> </ul> <p>8.2.6 Chronic obstructive pulmonary disease</p> <ul style="list-style-type: none"> <li>– Classify COPD severity</li> <li>– COPD treatment</li> <li>– Management of COPD exacerbations</li> <li>– Palliative care for COPD (or lung cancer or other pulmonary problem)</li> </ul>
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This Section provides an approach to patients presenting with the most frequent chest symptoms: shortness of breath, cough, and chest pain. This approach is intended for patients who **do not have conditions that require emergency management (described in Quick Check)** or have been stabilized after emergency treatment and require more definitive diagnosis and management that can be approached more slowly. This Section should be viewed as part of a continuum of care, beginning with Quick Check, and proceeding through Section 3.2 (Severely ill patient with respiratory distress) for patients who require urgent care.

### 8.2.1 Clinical approach to a patient with chest symptoms

<p><b>Step 1:</b></p> <p><b>Step 2:</b></p> <p><b>Step 3:</b></p> <p><b>Step 4:</b></p> <p><b>Step 5:</b></p> <p><b>Step 6:</b></p>	<p><b>Perform Quick Check</b> on every patient and initiate emergency management as needed. In patients with severe difficulty breathing, proceed with diagnosis and urgent management as described in Section 3.2. In patients with chest pain, proceed as described in Section 3.3.</p> <p><b>Take a history and examine the patient.</b></p> <p><b>Assess HIV status.</b> </p> <p><b>Consider likely differential diagnosis using the DDx table(s).</b> Utilize the appropriate differential diagnosis tables and establish a list of possible diagnoses ranked in order of likelihood.</p> <p><b>Perform investigations as required, based on the possible diagnoses.</b></p> <p><b>Initiate treatment and monitor the response.</b></p>
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The key features of an illness or symptom are its severity and rapidity of progression. Severe or rapidly progressive conditions should be managed as per Quick Check (emergency illness) and Section 3 (severe illness). Occasionally, conditions requiring emergency or urgent management will have been missed in triage, so all patients should have a repeated Quick Check to be certain they have been appropriately evaluated for emergency conditions and treated.

Shortness of breath, cough, and chest pain may occur alone or in combination and may be the result of either infectious or non-infectious diseases. In some patients, particularly those with compromised immune systems, multiple infectious and non-infectious processes may be present at the same time. The clinician should consider additional diagnoses, even after establishing one diagnosis.

#### History

Obtaining a medical history is a critical component of the diagnostic evaluation and should both help direct the physical examination and prompt more targeted questions. The history should be



linked to the physical examination. While taking the history, observe the general status, e.g. whether too short of breath to speak in full sentences or answering questions inappropriately.

For all of the chest symptoms, the history should include certain standard questions:

- What is the nature of the symptoms? Cough? Sputum/ mucus? Shortness of breath? Chest pain/ tightness? Are there other symptoms? Fever? Chills? Night sweats? Fatigue? Weight loss? Nausea/vomiting/diarrhoea? Muscle aches? Headache? Palpitations?
- Ask about onset and progression of symptoms? When did the symptoms begin? Did the symptoms begin gradually or suddenly? What makes the symptoms better/worse? Has anyone at home or work been sick with similar symptoms?
- Has there been any recent trauma or bite?

If shortness of breath, also ask:

- Is the difficulty breathing only with exercise or at rest as well?
- Is it affected by body position (upright or lying down or lying on one side or the other)?
- Is the breathing noisy?

If cough with mucus, also ask:

- If mucus is produced
  - What is the colour (green, yellow, white)?
  - What is the quantity (scanty, profuse)?
  - Is it blood-stained?
- Is there gross blood?
- When is the cough most likely to occur (especially at night or in the morning on arising)?
- Are there any aggravating factors (exertion, particular seasons, particular environments such as the workplace, specific positions, exposure to dust, pollens, or other allergens or irritants such as smoke)?
- Has there been a recent upper respiratory infection or sinus infection?
- Is there a prior history of similar cough?

If chest pain, also ask:

- Where is the pain?
- What is the quality of the pain?
- Has there been any chest trauma?
- Does the pain radiate anywhere? To the jaw, arm, or back?
- How rapidly is it progressing (minutes, hours, days, weeks)?
- What makes it worse (e.g. exercise, taking a deep breath)?
- What makes it better (e.g. certain positions, non-steroidal medications)?
- Does it resolve spontaneously or with antacid medications (may suggest oesophageal spasm)?

Obtain a past medical history and social history to help identify the cause of symptoms:

- history of asthma, COPD, or heart disease;
- medication use currently or in recent past;
- previous TB or lung infection;
- HIV status and latest CD4 count;
- immunisation history, including pertussis, influenza, *Streptococcus pneumoniae*;
- occupational history or environmental exposure (e.g. mining, exposure to dust, fumes or strong odours, farming, animals);
- known close contact with a person with TB;
- smoking and exposure to second-hand tobacco smoke;

- exposure to indoor smoke from cooking or heating, open fires using wood, grass, dung, or other fuels in poorly ventilated structures;
- sinus pain or previous sinus infections;
- substance use including alcohol and inhaled cocaine.

### Examination

The physical examination will help to determine whether the problem is primarily from the lungs, the heart, or another organ system and will be guided by the information obtained in the history.

- Do the Quick Check assessment including vital signs. The initial vital signs serve to quantify the severity of illness and as the baseline for monitoring the response to treatment.
  - temperature (<36°C, >38°C abnormal)
  - blood pressure (systolic blood pressure <90 and diastolic <60 is low)
  - heart rate (>110 beats/minute is abnormally fast and <60 beats/minute abnormally slow)
  - respiratory rate (normal 12 to 16/minute; use Section 3.2 if >25/minute)
  - pulse oximetry (normal: SpO<sub>2</sub> >95%, give oxygen if <90%; SpO<sub>2</sub> <90 is abnormally low but may be normal at high altitude; see 7.2.23).
- General examination
  - How does the patient appear? Acutely ill? Cyanotic (bluish discoloration around lips or under the tongue)? Pale or flushed? Severe pain?
  - Is the patient too short of breath to speak in full sentences?
  - Does the patient respond to questions appropriately or is there confusion or disorientation?
  - Are there visible lymph nodes?
  - Does the patient have digital clubbing?
- Examination of the respiratory system
  - What is the pattern of breathing (deep and sighing or rapid and shallow)? Appear difficult or easy?
  - Is there nasal flaring?
    - Are accessory muscles (especially the muscles in the neck) being used? Is there retraction of the intercostal spaces?
  - Is the trachea in the midline?
  - Do both sides of the chest move evenly?
  - Is any part of the chest tender to the touch?
  - Is there dullness or hyper-resonance when the chest wall is percussed?
  - Listen to the breathing for audible noise and by auscultation.
    - ◇ Is there audible noise with inspiration or expiration, and is it coming from the upper or lower airways?
    - ◇ Is there wheezing (high-pitched breath sounds) or prolonged expiratory phase?
    - ◇ Are breath sounds equal on both sides?
    - ◇ What is the quality of breath sounds? Are there crackles or rales or harsh breath sounds?
    - ◇ Are the abnormal breath sounds localized or diffuse?
  - Are there palpable lymph nodes?
- Examination of the heart and cardiovascular system
  - Are the jugular veins elevated? (This may be difficult to determine in a patient who is breathing rapidly.)
  - Is there swelling of one leg or both legs?
  - Is the apex beat displaced from the left midclavicular line in the fifth intercostal space?
  - Are the heart sounds decreased?

- Is there a heart murmur?
- Is there an extra heart sound (gallop or rub)?
- Is the abdomen swollen?
  
- Is the liver enlarged? (The edge of the liver should not be felt below the rib cage on the right side of the abdomen.)

### Investigations

- If productive cough for 2 or more weeks, send sputum for, acid-fast smear microscopy or other tests to detect mycobacteria.<sup>1</sup> In HIV-positive patients or in HIV-prevalent settings, suspect TB and send sputum test in patients presenting with any cough. See tuberculosis.
- Check Hb (for anaemia) and WBC (if elevated, suspect infection).
- If suspect malaria, check malaria smear or RDT.
- Pulse oximetry (SpO<sub>2</sub>).
- Chest X-ray.
- Peak flow measurements for acute management of asthma (see Section 7.2.22).
- Spirometry, if available by referral, measures forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC). Spirometry is the most accurate means of quantifying the degree of airways obstruction in the chronic management of COPD and asthma. Reversibility of airflow obstruction is defined as either an increase in FEV1  $\geq 12\%$  from baseline AND  $\geq 200$  ml after inhalation of a short-acting bronchodilator such as salbutamol.
- ECG to look for evidence of cardiac disease.

### Interpretation of chest X-ray findings

The chest X-ray can assist in narrowing the differential diagnosis or making specific diagnoses. There are several books available that can guide interpretation of chest X-rays<sup>2</sup> and also describe appropriate quality control for X-ray examination. The table in the Section 8.2.2 (DDx: Chest X-ray abnormalities in patients with acute chest symptoms) presents the X-ray patterns associated with various diagnoses.

#### Common terms for chest X-ray findings

- **Infiltrate or opacity:** A generally ill-defined density on the X-ray film.
- **Lucency:** An area that is less dense than the surrounding tissue, thus appearing dark compared to the surrounding area.
- **Focal infiltrate or opacity:** An area of increased density that is localized to one part of the lung, usually no more than a single lobe.
- **Diffuse infiltrate or opacity:** Increased density that involves multiple areas of the lungs in either a patchy or uniform distribution.
- **Masses and nodules:** Focal densities that are solid and well-defined. Masses are  $\geq 3.0$  cm in size whereas nodules are between 0.2–3.0 cm. Both may be single or multiple. Miliary nodules are tiny,  $\leq 2$  mm in size, and are usually associated with tuberculosis, but may be caused by other infections and occasionally by malignancies.
- **Pleural effusion:** Fluid that has accumulated in the pleural space between the chest wall and the lung. The collection may be on one or both sides of the chest.
- **Pneumothorax:** Air in the pleural space associated with partial or complete collapse of the lung. A tension pneumothorax will cause a shift of the heart and mediastinum to the opposite side of the chest.

<sup>1</sup> Some facilities may have molecular testing with a nationally or WHO-approved test such as Xpert MTB/RIF test

<sup>2</sup> *The WHO manual of diagnostic imaging: Radiographic anatomy and interpretation of the chest and pulmonary systems.* WHO, 2006. Available at [http://whqlibdoc.who.int/publications/2006/9241546778\\_eng.pdf](http://whqlibdoc.who.int/publications/2006/9241546778_eng.pdf)

- **Cavity:** A rim of high density containing an area of decreased density in the lung. Is usually the result of an infection that causes death of lung tissue. Some lung cancers (for example, squamous cell carcinoma) may also present as a cavity. Cavities caused by infection are usually surrounded by an area of infiltrate.
- **Lymphadenopathy:** Enlargement of lymph nodes in the chest (e.g. mediastinal or hilar), may also be associated with tuberculosis or cancer.

### Interpretation and differential diagnosis of pleural effusion

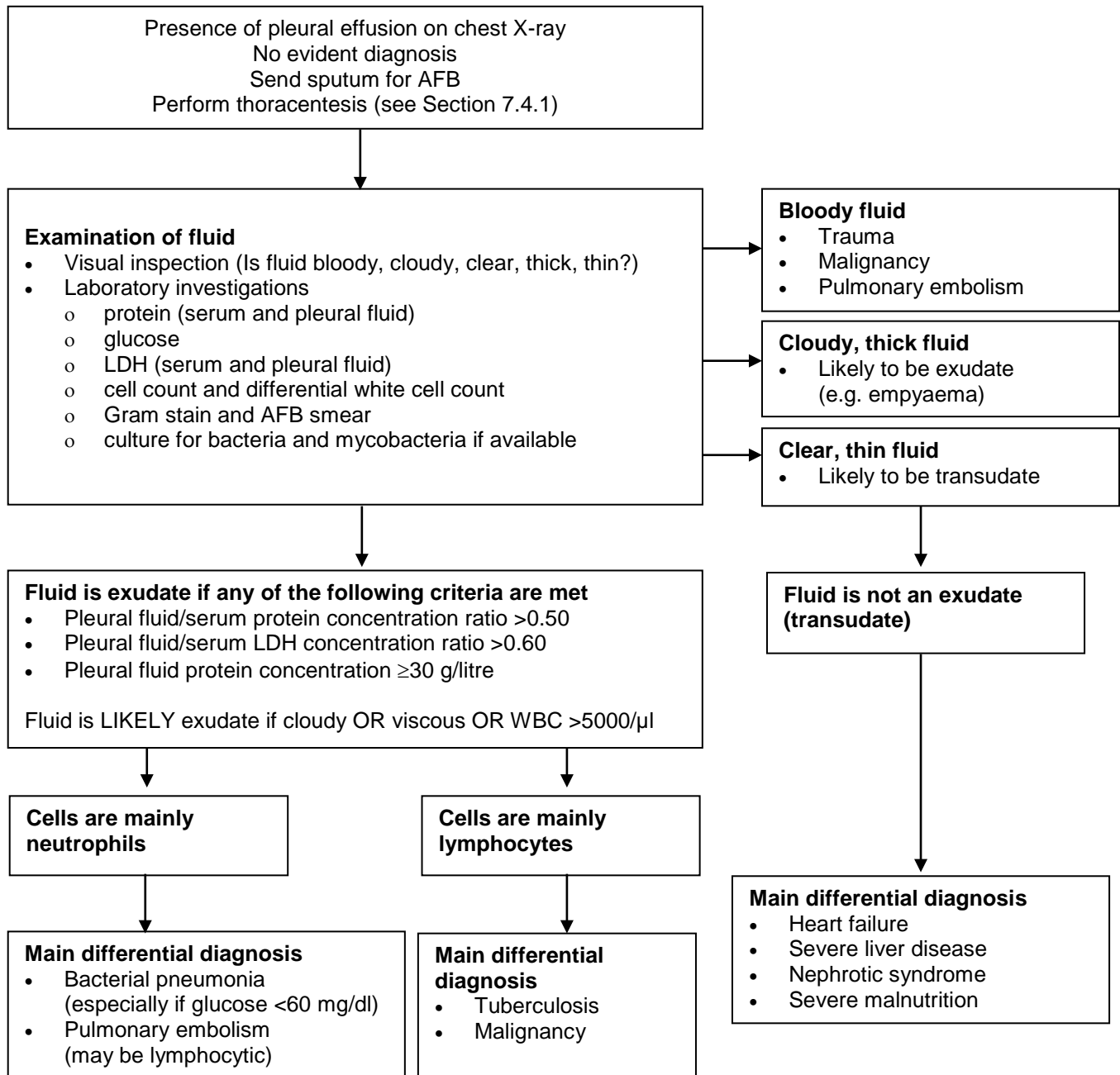
Many diseases and conditions may cause or be associated with pleural effusion. A presumptive cause of the effusion often can be determined based on the underlying condition or disease. For example:

- bilateral effusions in a patient with heart failure are likely caused by heart failure
- an effusion in a patient with bacterial pneumonia is likely associated with the infection.

However, if the cause of the effusion is not a clear presumptive diagnosis, the fluid must be analysed to distinguish if the effusion is due to an infectious or a non-infectious cause.

- First, detect the fluid on a chest X-ray.
- Second, perform a thoracentesis to obtain a sample of the fluid.
- Third, analyse the fluid using the algorithm below.

**Figure: Evaluation of pleural effusion**




If diagnosis is unclear, consider empirical treatment for tuberculosis.





## 8.2.2 Differential diagnosis of chest complaints








A list of possible diagnoses can be developed based on the history, physical examination, chest X-ray, and other investigations and local epidemiological factors, e.g. the prevalence of HIV infection or TB, and the season of the year (is there seasonal influenza circulating). The list will vary according to the patient's age and should be roughly in order of likelihood. Generally, the first diagnosis on the list will be the working diagnosis, for which empirical treatment may be necessary. Other diagnoses lower on the list may be sufficiently likely that treatment may be indicated. However, if more than one disease or condition is treated empirically, the response to treatment cannot be used to infer a diagnosis.

## DDx: Chest X-ray abnormalities in patients with acute chest symptoms







Chest X-ray findings	Most likely causes (may differ in different areas according to the most common conditions)
<b>Focal infiltrate or opacity</b> Figure 1a Right middle lobe infiltrate pneumonia (PA view) and Figure 1b (lateral view)	<ul style="list-style-type: none"> <li>• Pneumonia (bacterial, viral, fungal)</li> <li>• TB</li> </ul>
<b>Diffuse infiltrates or opacities</b> Figure 2	<ul style="list-style-type: none"> <li>• TB</li> <li>• Pneumonia (particularly viruses such as influenza and CMV; PCP)</li> <li>• Fungal infections</li> <li>• Heart failure (pulmonary oedema)</li> <li>• Malignancy (including Kaposi sarcoma and lymphoma)</li> </ul>
<b>Multiple small nodules</b> Figure 3	<ul style="list-style-type: none"> <li>• Infection (especially disseminated TB)</li> <li>• Metastatic malignancy (including from a primary lung cancer)</li> </ul>
<b>Masses and nodules</b> Figure 4	<ul style="list-style-type: none"> <li>• Lung cancer</li> <li>• Metastatic malignancy (especially if multiple masses are present)</li> <li>• Infection (especially TB or fungal)</li> </ul>
<b>Cavity</b> Figure 5	<ul style="list-style-type: none"> <li>• TB</li> <li>• Bacterial infection – especially caused by aspiration pneumonia (associated with alcoholism, epilepsy, poor dentition)</li> <li>• Fungal infection</li> <li>• Malignancy, particularly if wall thickness is &gt;1.5 cm</li> </ul>
<b>Pleural effusion</b> Figures 6a and 6b	<ul style="list-style-type: none"> <li>• Bacterial pneumonia (including empyema)</li> <li>• TB, particularly if there is pleural calcification</li> <li>• Malignancy (including Kaposi sarcoma and lymphoma)</li> <li>• Heart failure (usually bilateral or right-sided)</li> <li>• Chest trauma (haemothorax)</li> <li>• Pulmonary embolism</li> <li>• Any condition associated with a low serum protein concentration (severe liver disease, nephrotic syndrome, renal insufficiency, severe malnutrition – usually bilateral)</li> </ul>
<b>Hilar or mediastinal lymphadenopathy</b> Figures 7a and 7b	<ul style="list-style-type: none"> <li>• TB</li> <li>• Malignancy including Kaposi sarcoma and lymphoma</li> <li>• Fungal infections</li> <li>• Metastatic cancer</li> <li>• Inhalational anthrax </li> </ul>
<b>Pneumothorax</b> Figure 8	<ul style="list-style-type: none"> <li>• Spontaneous pneumothorax (no underlying disease)</li> <li>• TB, PCP</li> <li>• COPD, asthma</li> <li>• Chest trauma</li> </ul>
<b>Normal</b> Figure 9	<ul style="list-style-type: none"> <li>• Asthma</li> <li>• Pulmonary embolism</li> <li>• PCP</li> </ul>
<b>Linear or nodular opacities</b>	<ul style="list-style-type: none"> <li>• Post-primary TB</li> </ul>

## DDx: Difficult breathing or cough with fever

Disease or condition	In favour
<b>Acute bronchitis</b>	<ul style="list-style-type: none"> <li>• Shortness of breath mild, if present</li> <li>• Cough may be productive</li> <li>• Acute onset</li> <li>• Mild or absent fever</li> <li>• No chest findings on physical examination except wheezing in asthmatics</li> <li>• Normal chest X-ray</li> </ul>
<b>Pneumonia</b>	<ul style="list-style-type: none"> <li>• Shortness of breath mild to severe</li> <li>• Productive cough with bacterial pneumonia and non-productive cough with non-bacterial pneumonia (but considerable overlap)</li> <li>• Acute onset hours to a few days</li> <li>• Focal chest pain with deep breaths or coughing</li> <li>• Fever and chills</li> <li>• Fast breathing (&gt;30 breaths/min)</li> <li>• If SBP &lt;90, patient has septic shock (see Section 3.1.5)</li> <li>• Focal signs – bronchial breath sounds, crackles, or rales on auscultation</li> <li>• With pleural effusion, dullness to percussion and decreased breath sounds over affected side</li> <li>• Chest X-ray may show focal or diffuse infiltrates particularly in non-bacterial pneumonia</li> <li>• Most pneumonia is community acquired pneumonia (CAP)</li> </ul>
<b>Uncomplicated influenza (may be pandemic or seasonal)</b> 	<ul style="list-style-type: none"> <li>• Influenza known or suspected to be circulating</li> <li>• Fever</li> <li>• Cough</li> <li>• Sore throat</li> <li>• Rhinorrhoea or nasal congestion</li> <li>• Headache</li> <li>• Muscle pain or malaise</li> <li>• Gastrointestinal illness such as diarrhoea or vomiting</li> <li>• If shortness of breath, consider influenza with pneumonia (below)</li> </ul>
<b>Influenza with pneumonia</b> see above 	<ul style="list-style-type: none"> <li>• Influenza known or suspected to be circulating in community (seasonal influenza A or B)</li> <li>• History/clinical findings of influenza-like illness</li> <li>• Risk factors: age &lt;2 years or ≥65 years, pregnancy (up to 2 weeks postpartum), any chronic disease (pulmonary, cardiac, diabetes, metabolic, renal, hepatic, hematologic, or neurologic) or immunosuppression (HIV, malignancy, chemotherapy)</li> <li>• Shortness of breath, pleuritic pain, cough, coloured sputum, fever</li> <li>• Rapid respiratory rate</li> <li>• Bilateral crackles, possible wheezing</li> <li>• Chest X-ray may show focal or diffuse infiltrates</li> <li>• Absence of travel or exposure history suggesting zoonotic influenza infection (see below)</li> </ul> <p>Note: Both uncomplicated influenza and influenza pneumonia may be complicated by secondary bacterial pneumonia with features of pneumonia as described above.</p>
<b>Zoonotic influenza A/ Avian influenza (due to H5N1, H5N6, H7N9 viruses)</b> 	<ul style="list-style-type: none"> <li>• Signs of pneumonia <u>AND</u></li> <li>• <b>Exposure risk factor present- contact with poultry [H5N1 causes rapid deaths among poultry; H7N9- infected poultry are not sick (asymptomatic)]; or visit to live bird market</b></li> <li>• Severe, fatal human pneumonia has occurred</li> <li>• Human-to-human transmission rare</li> </ul>
<b>MERS-CoV infection</b> 	<ul style="list-style-type: none"> <li>• Rapidly progressive pneumonia, ARDS or septic shock that does not respond to appropriate treatment <u>AND</u></li> <li>• Direct epidemiologic risk: lives in or has travelled to the Middle East or countries where human infections have recently occurred. Especially if visited a farm, market or barn where dromedary camels are present; or consumed milk or undercooked meat from dromedary camel.</li> <li>• Some human-to-human transmission (including nosocomial health worker cases and in the elderly)</li> </ul>
<b>SARS (severe</b>	<ul style="list-style-type: none"> <li>• A coronavirus that emerged in 2003 with spread to 26 countries.</li> </ul>

<p><b>acute respiratory syndrome)</b></p> 	<ul style="list-style-type: none"> <li>• Significant nosocomial human-to-human transmission.</li> <li>• Incubation range of 2-10 days.</li> <li>• Patients initially develop influenza-like prodromal symptoms including fever, malaise, myalgia, headache and rigors. Cough (initially dry), dyspnoea and diarrhoea may be present in the first week but more common in the second week of illness. Up to 70% of the patients develop diarrhoea.</li> <li>• Severe cases develop rapidly progressing respiratory distress. (see standard suspect case definition in Section 9.4)</li> </ul>
<p><b>New, emerging SARI of potential epidemic concern</b></p> 	<ul style="list-style-type: none"> <li>• Spreading cluster of patients with ARI of unknown cause</li> <li>• Unusual clusters of SARI (for example, multiple deaths in a village, more than one death in a family, unusually severe disease in a cluster of patients, spread to health workers)</li> <li>• Recent contact with a SARI patient where the cause is not known</li> <li>• Progressive pneumonia or septic shock that does not <b>respond to appropriate treatment.</b></li> </ul>
<p><b>Scrub typhus</b></p> <p>see Section 8.1.6</p> 	<ul style="list-style-type: none"> <li>• High fever, intense generalized headaches, diffuse myalgias</li> <li>• Painless papule developing into an eschar with black crust in about 46% patients</li> <li>• Maculopapular rash on trunk- may be transient; often around day 7 of fever</li> <li>• Lymphadenopathy</li> <li>• Patients with severe infection can have pneumonia and (rarely) acute respiratory distress</li> <li>• May develop encephalitis, gastroenteritis, bradycardia, myocarditis</li> <li>• May cause spontaneous abortion or stillbirth</li> <li>• Defervescence within 48 hours of receiving appropriate antibiotic (doxycycline, azithromycin or chloramphenicol)</li> </ul>
<p><b>Nipah virus</b></p> <p>see Section 11.26</p> 	<ul style="list-style-type: none"> <li>• Initial symptoms can include fever and shortness of breath</li> <li>• High CFR 40-70% (as high as 100% in some outbreaks)</li> <li>• Has occurred in Malaysia, Bangladesh, and India; risk factors in Nepal</li> <li>• Bronchopneumonia or ARDS with encephalitis, but can occur without</li> </ul>
<p><b>Leptospirosis</b></p> <p>see Section 8.1.8</p> 	<ul style="list-style-type: none"> <li>• In severe leptospirosis, abnormal chest Xray frequently develops 3-9 days after onset of illness (patchy alveolar infiltrates; scattered alveolar hemorrhage)</li> <li>• Severe myalgia localized to calf muscles</li> <li>• Conjunctival congestion/ or subconjunctival haemorrhage with or without oliguria or jaundice</li> <li>• History contact with contaminated water</li> </ul>
<p><b>Enteric fever</b></p> <p>see Section 8.1.9</p> 	<ul style="list-style-type: none"> <li>• Abdominal pain, fever, and chills</li> <li>• Diarrhoea or constipation</li> <li>• Cough in 20 to 45%</li> </ul>
<p><b>Pulmonary tuberculosis</b></p>	<ul style="list-style-type: none"> <li>• Shortness of breath mild to moderate but occasionally severe</li> <li>• Possible history of exposure to a person with TB</li> <li>• Usually gradual in onset</li> <li>• Cough with or without bloody or blood-tinged sputum</li> <li>• Weight loss</li> <li>• Fever, night sweats, occasionally chills</li> <li>• Occasionally, chest pain</li> <li>• Sputum AFB positive (or Xpert MTB/RIF positive or other nationally- or WHO-approved molecular test where available). It is possible for AFB smear to be negative in patients with smear-negative pulmonary TB.</li> <li>• Chest X-ray in patients without immune system compromise: unilateral or bilateral upper lobe infiltrates with or without cavitation; pleural effusion; miliary nodular pattern; other nodular opacities and fibrosis. A normal chest X-ray does not exclude TB.</li> <li>•  Chest X-ray in patients with advanced immune deficiency (advanced immune system compromise, advanced HIV): non-specific pattern, with patchy infiltrates in the lower and mid lung zones; hilar and mediastinal lymphadenopathy may also be seen. Routine chest X-ray is not indicated for the diagnosis of TB.</li> </ul>
<p><b>Paragonimiasis</b></p>	<ul style="list-style-type: none"> <li>• Cough with blood-tinged sputum, chest pain, occasional fever</li> <li>• May be confused with pulmonary TB due to similar symptoms and radiographic findings</li> <li>• Consider if history of eating raw/undercooked crabs or crayfish</li> <li>• Parasite ova on microscopic examination of sputum</li> <li>• Eosinophilia</li> </ul>



<p><b><i>Pneumocystis jirovecii</i> pneumonia (PCP)</b></p> 	<ul style="list-style-type: none"> <li>• Shortness of breath mild initially but may become severe</li> <li>• Subacute onset – days to weeks</li> <li>• Non-productive cough</li> <li>• Low grade to moderate fever</li> <li>• Fast breathing &gt;30 breaths/minute</li> <li>• Nasal flaring</li> <li>• Usually no findings on physical examination of the chest</li> <li>• Chest X-ray bilateral diffuse infiltrates without lymph node enlargement or pleural effusion. In mild cases, X-ray may be minimally abnormal or normal.</li> <li>• CD4 cell count &lt;200</li> <li>• Hypoxaemia (SpO<sub>2</sub> &lt;90) – particularly on exertion</li> </ul>
<p><b>Disseminated fungal infection</b></p>  <p>(endemic fungi vary from place to place)- such as histoplasmosis (Section 11.16), penicilliosis</p>	<ul style="list-style-type: none"> <li>• Shortness of breath is mild to moderate</li> <li>• Subacute or chronic onset</li> <li>• Cough may be productive or non-productive</li> <li>• Generally moderate fever</li> <li>• Weight loss</li> <li>• Mild or no respiratory symptoms</li> <li>• Lymphadenopathy and skin lesions may be present</li> <li>• Enlargement of liver and spleen</li> <li>• Chest X-ray – various abnormalities including focal or diffuse infiltrates, single or multiple masses or nodules, hilar or mediastinal adenopathy, and pleural effusions</li> </ul>
<p><b>Immune reconstitution inflammatory syndrome (IRIS)</b></p> 	<ul style="list-style-type: none"> <li>• Shortness of breath if the lungs are involved</li> <li>• HIV-positive with ART initiated in past 3 months, often with CD4 &lt;50 cells/mm<sup>3</sup> at initiation</li> <li>• Common in patients with tuberculosis</li> <li>• Cough, if present, is generally non-productive</li> <li>• Moderate fever is common</li> <li>• Physical examination of the chest depend on the manifestations of IRIS</li> <li>• Extra thoracic lymphadenopathy commonly increases</li> <li>• Usually an increase in CD4 cell count</li> <li>• Chest X-ray may show worsening of infiltrates, pleural effusion, and increasing intra-thoracic lymphadenopathy</li> </ul>
<p><b>Lung abscess</b></p>	<ul style="list-style-type: none"> <li>• Shortness of breath is mild if present</li> <li>• Onset is subacute, generally over several weeks</li> <li>• Fever is moderate</li> <li>• Cough is productive with copious thick, yellow to brown, foul-smelling sputum</li> <li>• Poor dentition may be present</li> <li>• Chest may reveal crackles and coarse bronchial breath sounds over the involved area</li> <li>• Chest X-ray – focal infiltrate or mass with cavitation</li> </ul> <p>Note: Lung abscess is generally the consequence of a necrotizing pneumonia but may also be secondary to endobronchial obstruction (e.g. from cancer).</p>
<p><b>Strongyloides hyperinfection</b></p>  <p>see Section 11.32</p>	<ul style="list-style-type: none"> <li>• Shortness of breath moderate or severe</li> <li>• Risk factors – use of corticosteroids, other immunosuppressive drugs, or HIV infection</li> <li>• Acute onset</li> <li>• Moderate fever</li> <li>• Cough usually non-productive but may have blood-tinged sputum</li> <li>• Abdominal pain, nausea, vomiting, diarrhoea may be present</li> <li>• Skin rash possible</li> <li>• Chest usually normal but wheezing may be present.</li> <li>• Chest X-ray – diffuse infiltrates</li> <li>• Peripheral eosinophilia may be noted</li> <li>• Larvae on wet mount and Giemsa stain of sputum</li> </ul>
<p><b>Anthrax</b></p>  <p>see Section 10.1</p>	<ul style="list-style-type: none"> <li>• History of exposure to animals</li> <li>• Oropharyngeal anthrax: eschar lesions in mouth, tongue, tonsils, or posterior pharynx. Symptoms of sore throat, dysphagia, regional lymphadenopathy. Swelling of neck and anterior chest wall.</li> <li>• Pulmonary (inhalation) anthrax: fevers, chills, sweats, fatigue, cough, shortness of breath, confusion, nausea and vomiting.</li> <li>• Chest X-ray – mediastinal lymphadenopathy plus pleural effusions and pulmonary infiltrates.</li> </ul>
<p><b>Plague - pneumonic</b></p> 	<ul style="list-style-type: none"> <li>• Sudden onset of fever, chills, headache, severe malaise</li> <li>• Chest pain</li> <li>• Difficulty breathing</li> </ul>

see Sections 10.4	<ul style="list-style-type: none"> <li>• Cough with blood-stained sputum or haemoptysis</li> <li>• Fulminant course (100% case fatality rate if not treated rapidly)</li> <li>• May or may not have painful swelling of lymph nodes</li> </ul>
<b>Varicella pneumonia</b> see Section 11.38	<ul style="list-style-type: none"> <li>• Pneumonia may complicate chickenpox in adults, particularly pregnant women and persons who are immunocompromised</li> <li>• Usually presents 1–6 days after the onset of rash</li> <li>• Associated with cough, dyspnoea, fever, tachypnoea, and chest tightness, although chest signs are often minimal</li> <li>• The diagnosis is usually based on finding skin lesions characteristic of varicella (see Sections 10.1 and 11.45)</li> <li>• Chest X-ray – diffuse interstitial opacities</li> </ul>
<b>Legionellosis</b>	Symptoms typically arise 2 to 10 days after exposure to contaminated water or soil. Outbreaks often associated with water supply contamination in large facilities such as hospitals, hotels, or apartment buildings. Lethargy, headache, fever (can be high and sustained), recurring rigors, anorexia, fatigue, and myalgia are early symptoms Pneumonia is the most common manifestation of <i>Legionella</i> infection (called Legionnaires' disease); clinically and radiographically similar to other forms of pneumonia. Extrapulmonary <i>Legionella</i> disease is rare, with many manifestations; can complicate <i>Legionella</i> pneumonia or occur independently. Kathmandu Valley cases have occurred without travel history <sup>3</sup>
<b>Melioidosis</b> 	Pneumonia is the most common primary presentation with fever, cough, chest pain and, in some cases, haemoptysis. Chest X-ray variable- discrete, diffuse or patchy lobar or multilobar consolidation, necrotizing lesions, and pleural effusions Bacteraemia in more than half patients, many with clinical manifestations at other sites; a quarter of patients have septic shock. Death from septic shock can occur within 48 hours of generalized symptoms. Risk factors for severe clinical disease are diabetes, hazardous alcohol use, chronic renal disease, and chronic lung disease Acute localized infection at site of inoculation, from contaminated soil or surface waters. Culture may show facultative intracellular gram-negative bacterium, <i>Burkholderia pseudomallei</i> (but may be misread as a contaminant). Gram stain of sputum and abscess may show gram-negative bacilli of <i>B. pseudomallei</i> with bipolar staining with a "safety pin" appearance Documented travel to an area endemic for melioidosis (Thailand, Northern Australia, Malaysia, Singapore but cases have also occurred in most of Indian subcontinent, southern China, Vietnam, Indonesia, Cambodia, Laos, Myanmar) Predominant transmission by percutaneous inoculation during exposure to wet season soils or contaminated water; incubation period following inoculating injury ranges from 1 to 21 days (mean 9 days); rarely following ingestion contaminated, unchlorinated water Transmission by inhalation in severe weather tropical storms, cyclones, tsunami Human-to-human and animal-to-human transmission extremely unusual Chronic melioidosis can mimic TB, or a non-healing skin ulcer or abscess

<sup>3</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

## DDx: Difficult breathing or cough – without fever

Disease or condition	In favour
<b>Pneumothorax</b>  see Quick Check page 32 for emergency management of tension pneumothorax	Shortness of breath sudden, rapidly progressive and severe Sudden onset over minutes or hours Chest pain on affected side May be associated with trauma or underlying lung disease such as PCP, COPD Cyanosis may be present If tension pneumothorax, low blood pressure and trachea shifted from mid-line to the side opposite the pneumothorax Hyper-resonance on percussion and diminished or absent breath sounds on the affected side. Subcutaneous emphysema (“crunchy” feel when pressure applied to chest wall or neck) Chest X-ray – completely or partially collapsed lung with no lung markings between collapsed lung and chest wall. If tension – the midline structures (trachea, heart) are shifted away from the affected side
<b>Metabolic acidosis (such as lactic acidosis or diabetic ketoacidosis)</b>	Patients commonly feel short of breath Subacute onset Always an underlying cause – diabetic crisis, renal failure, aspirin toxicity or other poisoning (methanol, ethanol, paraldehyde), lactic acidosis (e.g. side effects of ARV drugs, commonly d4T- or ddl-containing regimens, more common in women or overweight persons) Cough not present Respiratory rate rapid and respirations deep and sighing, in the absence of cough Physical examination – chest is normal Chest X-ray is normal
<b>Asthma</b>	Shortness of breath mild to severe History of previous wheezing episodes associated with chest tightness Identifiable triggers common (upper respiratory infection, allergen exposure, exercise, cold air, extreme emotion) Breathing or cough commonly worse at night Non-productive cough is common Chest examination can be normal between attacks During attacks or when asthma is poorly controlled, wheezing or prolonged expiration (compared to inspiration) throughout all lung fields (not focal) In severe attacks, absent breath sounds, fast breathing, use of neck muscles Chest X-ray may be normal, or show signs of hyperinflation like hyperlucent lung fields and flattened diaphragms, and thickened bronchial walls
<b>Bronchiectasis</b>	Shortness of breath generally mild Often afebrile Cough chronic and copious production of yellow/green sputum is common, occasional blood Often history of recurrent chest infections and worsening symptoms usually associated with infections Examination may reveal crackles and wheezes over the involved area(s) and uncommonly digital clubbing (rounded deformity of the fingernails) Chest X-ray may show streaky peribronchial infiltrates and dilated bronchioles
<b>Chronic obstructive lung disease (COPD)</b>	Shortness of breath is chronic but worsens with exacerbations that may be caused by acute infections or heart failure Unlike asthma, symptoms are usually persistent, not intermittent Chronic productive cough Often a history of tobacco smoking, occupational exposures, or exposure to biomass fuel smoke In an exacerbation, fast breathing with prolonged expiratory phase and wheezing; fever may be present (if infection) Examination shows engorged jugular veins as evidence of right heart failure, often hard to assess if breathing is laboured; decreased breath sounds, prolonged expiratory phase, and wheezing Chest X-ray – hyperinflation (hyperlucent lung fields and flattened diaphragms)
<b>Pulmonary Kaposi sarcoma</b> 	Shortness of breath mild to moderate Subacute or chronic onset over weeks Cough is common often with bloody or blood-tinged sputum

	<p>Characteristic purple lesions or nodules of Kaposi sarcoma on the skin or oral mucus membranes</p> <p>Chest examination generally normal</p> <p>Chest X-ray – perihilar patchy interstitial infiltrates, ill-defined nodular densities</p>
<b>Lung malignancy</b>	<p>Shortness of breath uncommon in lung malignancies unless other disease present (COPD, pneumonia)</p> <p>Tobacco smoking is a common but not universal risk factor</p> <p>Onset insidious – usually over months</p> <p>Cough non-productive but there may be haemoptysis</p> <p>Weight loss, anorexia are common</p> <p>May have enlarged supraclavicular lymph nodes</p> <p>Chest examination normal</p> <p>The chest X-ray usually shows single or multiple nodules or masses often with enlarged hilar or mediastinal lymph nodes; pleural effusion may be present</p>

<b>Heart failure</b>	<p>Shortness of breath may be severe</p> <p>Onset sudden, possibly preceded by shortness of breath on exercise and at night</p> <p>Possible history of an underlying condition (rheumatic heart disease, hypertension, severe anaemia)</p> <p>Chest pain may be present</p> <p>Cough is common and non-productive</p> <p>May have signs of right ventricular failure (elevated jugular venous pressure, liver enlargement, pitting oedema of the both legs) or left ventricular enlargement (displaced apex beat)</p> <p>Gallop rhythm (extra heart sound) or murmur (if associated valve disease) may be present</p> <p>Chest examination shows bibasilar crackles and sometimes wheezing</p> <p>Chest X-ray – an enlarged heart, bilateral pulmonary vascular congestion and diffuse infiltrates; pleural effusions may be present</p>
<b>Severe anaemia</b> see Section 10.14	<p>Shortness of breath is generally less prominent than weakness and tiredness</p> <p>Gradual onset – often influenced by the underlying cause</p> <p>Cough is absent</p> <p>Examination: marked general pallor, pallor of the nail beds and oral mucus membranes</p> <p>Chest examination is normal</p> <p>Chest X-ray may be normal or may show heart enlargement</p> <p>Low Hb (&lt;7 g/dl in pregnancy, &lt;8 g/dl in non-pregnant women, &lt;9 g/dl in men)</p>
<b>Panic attack</b> see Section 10.10	<p>Shortness of breath may be severe</p> <p>Sudden onset</p> <p>Young patients with no underlying disease and have had previous attacks</p> <p>There is no cough</p> <p>Physical examination is normal</p> <p>Chest X-ray is normal</p>

## DDx: Chest pain

Disease or condition	In favour
<b>Pneumothorax</b> see Quick Check page 32	<p>Chest pain on affected side, sudden onset, often severe, and increased with inspiration</p> <p>Shortness of breath rapidly progressive and severe</p> <p>Associated with trauma or underlying lung disease such as PCP or emphysema, but may be primary with no known underlying disease</p> <p>Cyanosis may be present</p> <p>If tension pneumothorax, blood pressure will be low. This requires <b>emergency treatment</b> – see Quick Check page 22</p> <p>Trachea shifted from mid-line away from side of pneumothorax</p> <p>Hyper-resonance on percussion, diminished or absent breath sounds on affected side</p> <p>Subcutaneous emphysema (“crunchy” feel when pressure is applied to the chest wall or neck)</p> <p>Chest X-ray– radiolucent area with no lung markings between the visceral</p>

	(retracted or collapsed lung) and the parietal pleura (chest wall). In tension pneumothorax, midline structures (trachea, heart) shifted away from affected side
<b>Pleuritis, pleurisy without pneumonia</b>	Localized sharp pain worse on inspiration or coughing Acute onset Associated with shortness of breath Fever present, depending on cause Chest exam demonstrates decreased expansion of the affected side Possible pleural friction rub, crackles not heard unless underlying pneumonia Chest X-ray may demonstrate a pleural effusion or atelectasis
<b>Pericarditis</b> see Section 3.3	Pain located in anterior chest, improves with leaning forward Acute onset Fever present depending on cause Examination shows rapid heart rate, pericardial friction rub may be present Chest X-ray – may be normal or show heart enlargement Electrocardiogram – diffuse S-T segment and T wave abnormalities If blood pressure low, consider cardiac tamponade: <b>urgent treatment is required</b>
<b>Acute coronary syndrome, myocardial infarction</b> see Section 3.3	Pain is crushing, substernal pressure, radiating to the left arm or jaw Pain on exertion and sudden in onset Associated with shortness of breath, sweating, and nausea Risk factors – tobacco smoking, hypertension, diabetes, and obesity Examination often normal Chest X-ray is normal Electrocardiogram localized S-T segment and T wave abnormalities
<b>Myocarditis</b> see Section 3.3	Rapid heart rate or arrhythmias Shortness of breath, at rest or during physical activity Fluid retention with swelling of legs, ankles and feet Fatigue Fever, other signs and symptoms suggesting an infectious cause- such as viral infection, severe scrub typhus, Nipah, leptospirosis
<b>Aortic dissection or rupture</b>	<ul style="list-style-type: none"> <li>• Pain sudden and severe radiating to the back</li> <li>• Fainting may occur</li> <li>• Dissection may occur spontaneously (or rupture just distal to left subclavian artery may occur in blunt trauma)</li> <li>• Hypotension possible.</li> <li>• Aortic insufficiency murmur may be heard</li> <li>• Chest X-ray – widened mediastinum</li> </ul>
<b>Costochondritis</b>	<ul style="list-style-type: none"> <li>• Onset of pain – subacute, somewhat worse on inspiration</li> <li>• No cough or fever</li> <li>• Examination – tenderness on palpation of costochondral junctions</li> <li>• Chest X-ray is normal</li> </ul>
<b>Oesophagitis and spasm</b> see Section 10.5b	<ul style="list-style-type: none"> <li>• Pain sub-sternum sudden and severe, like pain of cardiac origin</li> <li>• Pain increased with swallowing</li> <li>• No shortness of breath, cough, or fever</li> <li>• Physical examination is normal</li> <li>• Chest X-ray is normal</li> </ul>
<b>Rib fracture associated with severe cough</b>	<ul style="list-style-type: none"> <li>• Bony crepitation (“grating” feeling ) may be palpated</li> <li>• Chest X-ray may be normal, show the rib fracture or demonstrate the underlying process that caused the coughing</li> <li>• Pain – sudden onset, with vigorous coughing and may be severe; increases with inspiration, coughing, or movement</li> <li>• Focal pain</li> </ul>

### 8.2.3 Influenza

Influenza infection is caused by one of three viruses – influenza A, B, or C – with influenza A and B being responsible for the vast majority of the deaths attributed to annual influenza infections globally.

There are three kinds of outbreaks in humans:

- **Seasonal influenza** is caused by strains of influenza that circulate continuously in the human population. A portion of the population thus has pre-existing immunity due to prior exposure or exposure to similar influenza strains and is, therefore, protected from infection. Currently, there are two influenza A viruses (H1N1 and H3N2) and one influenza B virus that are responsible for annual epidemics.
- An **influenza pandemic** occurs when an influenza A virus strain that is antigenically different from the seasonal virus strains enters the human population. There have been four documented pandemics in the past 100 years (1918, 1957, 1968, and 2009). The lack of pre-existing immunity to the pandemic strain in the human population leads to a substantial increase in the total number of influenza cases and, therefore, the number of influenza-related deaths, even if the newly emerged virus does not cause more severe disease than seasonal influenza. Note that the H1N1 virus that caused the pandemic in 2009 is now a regular human influenza virus and continues to circulate seasonally worldwide.
- **Outbreaks** of influenza occur where limited numbers of humans in defined geographical areas are exposed to novel influenza viruses. The recently known outbreaks in humans caused by zoonotic avian influenza viruses are the avian A(H5N1) virus and A(H7N9) which emerged in humans in 1997 and 2013 respectively.<sup>4</sup>

### Key clinical features

Human infection with influenza virus can vary from asymptomatic infection to uncomplicated upper respiratory tract disease to serious complicated illness that may include exacerbation of other underlying conditions and severe viral pneumonia with multi-organ failure.

#### - Uncomplicated influenza:

- Symptoms include: sudden onset of fever (often preceding respiratory symptoms) and cough, sometimes accompanied by sore throat, nasal congestion, or rhinorrhoea. Systemic symptoms such as headache, muscle or joint pain, and malaise may occur.
- Gastrointestinal illness may also be present, such as diarrhoea or vomiting, especially in children. Dehydration is a sign of severe influenza (see below).
- Some patients may experience atypical symptoms and may not have fever (e.g. elderly or immunosuppressed patients).

#### - Complicated or severe influenza

- Shortness of breath, tachypnoea, hypoxia, or chest X-ray with evidence of pneumonia (primary viral or secondary bacterial-see pneumonia section 8.2.4); central nervous system (CNS) involvement (e.g. encephalopathy, encephalitis), severe dehydration, or presenting secondary complications such as renal failure, multi-organ failure, and septic shock. May include rhabdomyolysis and myocarditis.
- Exacerbation of underlying chronic disease, including asthma, COPD, chronic hepatic or renal insufficiency, diabetes, or other cardiovascular conditions (e.g. congestive cardiac failure).
- Any other condition or clinical presentation requiring hospital admission for clinical management (including bacterial pneumonia with influenza).
- Any of the signs and symptoms of progressive disease listed below.

### Signs and symptoms of progressive disease


Patients who present initially with uncomplicated influenza may progress to more severe disease. Progression can be rapid (i.e. within 24 hours). The following are some of the indicators of progression that would necessitate an urgent review of patient management.

<sup>4</sup> WHO SEARO: Influenza virus infections in humans, August 2017.

- Symptoms and signs suggesting hypoxaemia (SpO<sub>2</sub> <90%) or hypotension (SBP <90), such as shortness of breath (with activity or at rest), difficulty in breathing, tachypnoea, presence of cyanosis, other signs of respiratory distress, bloody or coloured sputum, chest pain.
- Symptoms and signs suggesting CNS complications, such as altered mental status, unconsciousness, drowsiness, or difficulty waking, and recurring or persistent convulsions (seizures), confusion, severe weakness, or paralysis.
- Clinical evidence of sustained virus replication or invasive secondary bacterial infection based on laboratory testing or clinical signs (e.g. persistent or recurrent high fever and other symptoms beyond 3 days without signs of resolution).
- Symptoms and signs of severe dehydration, such as decreased activity, dizziness, decreased urine output, and lethargy.


### Risk factors for complicated or severe disease

Certain patients with influenza virus infection are recognized to be at higher risk of developing severe or complicated illness. These include the following groups:

-  Pregnant women.
- Persons of any age with chronic pulmonary disease (e.g. asthma, COPD), chronic cardiac disease (e.g. congestive cardiac failure), metabolic disorders (e.g. diabetes), chronic renal disease, chronic liver disease, certain neurological conditions (including neuromuscular, neurocognitive, and seizure disorders), haemoglobinopathies or immunosuppression, whether due to primary immunosuppressive conditions, such as HIV infection, or secondary conditions, such as immunosuppressive medication or malignancy.
- Persons aged 65 years and older or infants and young children <2 years old.

### Investigations

- Chest X-ray may show diffuse, bilateral interstitial infiltrates
- Point of care rapid diagnostic test results may have a high false negative rate.<sup>5</sup>
  - For individual patient management, because of low sensitivity, a negative result cannot exclude pandemic or seasonal influenza virus infection. Other information including surveillance data on circulating influenza viruses; symptoms and clinical findings; travel history or exposure to confirmed or probable influenza cases is required to aid interpretation of a result to optimally inform patient management decisions. A true negative result is most likely when influenza is uncommon in the community (in the beginning and end of an outbreak) whereas a false positive is most likely when influenza is common in the community (at the peak of an outbreak) or when the RDT test is damaged.

 For outbreak management, rapid diagnostic tests can help to quickly identify influenza A cases in institutions, schools, or communities with reports of increasing incidence of influenza-like illness. They can also help to facilitate timely implementation of interventions for institutional control of outbreaks and inform public health guidance. Whenever possible, at least some of the positive specimens should be confirmed by one of the more sensitive and specific methods in order to better characterize the virus and monitor viral evolution. Collect nasal, nasopharyngeal and/or throat swab early in the illness as possible. These are usually analyzed with RT-PCR which detects RNA, takes 6-8 hours in the laboratory to get results, and has a high sensitivity and specificity. Nasopharyngeal samples have the highest yield for detection of influenza A or B. To improve the yield for emerging viruses or zoonotic viruses, also collect and send a throat swab (see Section 7.2.21) *Note: A negative test does not exclude influenza virus infection in patients with signs and symptoms of influenza.*

<sup>5</sup> Use of influenza rapid diagnostic tests. WHO and TDR, 2010. Available at [http://whqlibdoc.who.int/publications/2010/9789241599283\\_eng.pdf](http://whqlibdoc.who.int/publications/2010/9789241599283_eng.pdf)

- A markedly elevated white cell count may mean that the patient has a secondary bacterial infection.

### Treatment<sup>6</sup>

Treatment should be based on clinical diagnosis and suspicion of influenza infection based on local epidemiology and should not be delayed for results of laboratory investigations.

For the management of patients with severe respiratory distress or shock and suspected severe influenza infection, see Sections 3.1.4 and 3.2.1-3.2.3.

### -Treatment for seasonal influenza infection

For patient with mild (uncomplicated) illness AND **NOT from high risk groups** treat symptomatically:

- rest and oral hydration
- paracetamol as needed
- avoid aspirin in patients less than 18 years due to risk of Reye syndrome

Give antiviral treatment with **oseltamivir 75 mg orally twice daily for 5 days** as soon as possible for patients with the following indications:<sup>7</sup>

- patients with acute, uncomplicated illness (within 48 hours of symptom onset)
- patients who are hospitalized or have severe or progressive clinical illness with suspected or confirmed influenza early as possible.
- patients at higher risk for influenza with suspected or confirmed influenza early as possible.

These include:

- children aged younger than 2 years
- adults aged 65 years and older
- persons with chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematological (including sickle cell disease), and metabolic disorders (including diabetes mellitus), or neurologic and neurodevelopment conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle, such as cerebral palsy, epilepsy (seizure disorders), stroke, intellectual disability (mental retardation), moderate to severe developmental delay, muscular dystrophy, or spinal cord injury)
- persons with immunosuppression, including that caused by medications or by HIV infection
- women who are pregnant or postpartum (within 2 weeks after delivery)
- persons aged younger than 19 years who are receiving long-term aspirin therapy
- persons who are morbidly obese (i.e., BMI  $\geq$  40)
- residents of nursing homes and other chronic care facilities

<sup>6</sup> WHO guidelines for pharmacological management of pandemic influenza A(H1N1) 2009 and other Influenza viruses. Revised February 2010. Part I Recommendations. Available at [http://www.who.int/csr/resources/publications/swineflu/h1n1\\_guidelines\\_pharmaceutical\\_mngt.pdf](http://www.who.int/csr/resources/publications/swineflu/h1n1_guidelines_pharmaceutical_mngt.pdf)

<sup>7</sup> EDCD Interim guideline on use of Oseltamivir, 2016



Prophylaxis should be limited to high-risk groups or in case of an epidemic:

- oseltamivir 75 mg orally daily for at least 10 days (for community outbreak, may give up to 6 weeks)  
Clinical benefit is greatest when antiviral treatment is administered early, especially within 48 hours of influenza illness onset.

Other considerations

- Dosing modifications should be made for patients with renal impairment (CrCl 10-30 mL/min)- Prophylaxis: 75 mg orally every other day or 30 mg orally daily; Treatment: 75 mg orally daily for 5 days; If CrCl<10 mL/min, administer with caution
- When the clinical course remains severe or progressive, despite 5 or more days of antiviral treatment, antiviral treatment should be continued without a break until virus infection is resolved or there is satisfactory clinical improvement. *Consider inhaled zanamivir 10 mg twice daily via inhaler if resistant to oseltamivir (not recommended for persons with asthma or COPD).*
- Co-existing pneumonia due to other pathogens may be difficult to exclude in a patient with suspected influenza infection. If you suspect community-acquired pneumonia, or another infectious pneumonia based on local epidemiology, then treat with appropriate antimicrobials for community-acquired pneumonia. Influenza pneumonia and bacterial pneumonia are difficult to distinguish, so empirical treatment of both infections is a common practice until the clinical course and diagnostic tests allow a narrowing of antimicrobial coverage. Bacterial infection by *S. pneumoniae* and *S. aureus*, both methicillin-sensitive and methicillin-resistant, are common (see Section 3.2.3).
- Occasionally, bacterial pneumonia will develop in a person who seems to be recovering from influenza infection. In these instances, the presentation is as described for bacterial pneumonia and empirical treatment for bacterial pneumonia should be started as described above.

#### - Treatment for patients with an avian A (H5N1) or A(H7N9) virus infection<sup>8, 5, 10</sup>

Treat ALL patients with infection (this includes mild infection and regardless of duration of symptoms) because unlike seasonal influenza, H5N1 or H7N9 infections progress rapidly and have a high case fatality rate.

- Give oseltamivir 75 mg orally twice daily (consider dose modification as above for renal impairment).
- Monitor vital signs for signs of clinical deterioration.

#### Prevention

- Influenza vaccine is recommended for high risk groups. This is modified annually based on recent viral strains and currently includes antigen from 2009 pandemic H1N1. Provides partial protection against influenza illness, hospitalization and death. It is not protective against H5N1 avian influenza but may make simultaneous co-infection with human and avian influenza less likely- reduce likelihood of viral genetic reassortment.
- Infection prevention (in health facilities) – see Section 6.
- Prevent human infection from poultry

<sup>8</sup> *Clinical management of human infection with avian influenza A (H5N1) virus*. WHO Updated advice, 15 August 2007. Available at <http://www.who.int/influenza/resources/documents/ClinicalManagement07.pdf>

<sup>10</sup> ECDC Interim guideline on use of Oseltamivir (Tamiflu)

- Oseltamavir prophylaxis 75 mg OD to high risk individuals throughout period of exposure—this may be considered for health care workers caring for patients with suspected avian influenza as well as patients household contacts.[ref Nepal ID guidelines]

### Surveillance<sup>11, 12</sup>

- The National Public Health Laboratory (NPHL) is designated at a National Influenza Centre (NIC) laboratory for Nepal and participates in the WHO Global Influenza Programme. The purpose of NPHL network is to detect the emergence and spread of new antigenic variants of influenza, to use information to update the formulation of influenza vaccine, and to provide as much warning as possible of the next pandemic. The network also participates in ILI and SARI surveillance.
- If there are unusually clustered cases of disease (e.g. more cases of severe pneumonia or ILI), disease patterns (e.g. a shift in age group of severe influenza, or a change in the pattern of influenza-associated diseases) or unexpected deaths (e.g. an increase in apparent mortality from pneumonia), then report to the designated public health official.
- Reporting these events is an important part of the early warning system of surveillance and should trigger an investigation.

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Pneumonia can be caused by many categories of infectious organisms including viruses, bacteria, fungi, certain parasites, and mycobacteria (most commonly *M. tuberculosis*). The relative proportion of the different categories of organisms will depend on factors such as prevalence of HIV infection and tuberculosis, and the season of the year.

Pneumonia is an inflammatory condition that involves the air-containing sacs (alveoli) and the airways. Because the alveoli are predominately involved, most pneumonias interfere with the transfer of oxygen from inspired air into the blood and result in hypoxaemia, which can be severe. The lung inflammation may extend to the outer membrane (pleura) of the lung and cause pleuritis, pleural effusions, and chest pain.

### Key clinical features

Symptoms can vary substantially, depending on the category of infecting organism and severity, but there is considerable overlap.

- Cough and shortness of breath are common. Sharp chest pain on inspiration or cough from pleuritis may occur.
- Virtually all categories cause fever and elevated respiratory rate. However, increased heart rate and low blood pressure should raise suspicion of severe sepsis or shock from the infection or dehydration.
- On examination of the respiratory system, chest inspection may note asymmetry of expansion. Possible findings on auscultation include decreased breath sounds on one side if a pleural effusion is present, and crackles and (increased) bronchial breath sounds over the involved area. A pleural friction rub may also be heard.

### Investigations

- Hypoxaemia is common and can be severe.
- Chest X-ray

## Determining the need for hospitalization

<sup>11</sup> *A practical guide to harmonizing virologic and epidemiological influenza surveillance*. WHO Western Pacific Region, November 2008. Available at <http://www.wpro.who.int/NR/rdonlyres/55E9226F-C588-4618-87FC-0D286C96DA8F/0/GuideToHarmonizingInfluenzaSurveillancerevised2302.pdf>

<sup>12</sup> *Surveillance Recommendations for Member States in the Post Pandemic Period*. WHO, 12 August 2010. Available at [http://www.who.int/csr/resources/publications/swineflu/surveillance\\_post\\_pandemic.pdf](http://www.who.int/csr/resources/publications/swineflu/surveillance_post_pandemic.pdf)

In the first-level IMAI Acute Care guidelines, adult patients will be referred to hospital with severe pneumonia or other very severe disease based on very fast breathing (>30 breaths/minute), pulse 120 or higher, high fever, lethargy, inability to walk unaided, discomfort lying down, or severe chest pain. Second or third trimester pregnant women with signs of non-severe pneumonia (fast breathing >20 breaths/minute, night sweats, or chest pain) are also referred to hospital, rather than receiving oral antibiotics as an outpatient. The same "upgrade" for hospital referral is recommended for PLHIV in clinical stage 4 or with a low CD4 count.

At the district hospital, Quick Check triage will identify patients who have emergency signs of airway and breathing (severe respiratory distress, cyanosis, appears obstructed), count the respiratory rate and measure SpO<sub>2</sub>. If the patient also has a fever, then empirical antibiotics for possible pneumonia will be given.

Suspect severe pneumonia if the following criteria are met and use Section 3.2.3 to guide management:

- fever or suspected infection
- cough
- respiratory rate >30
- signs of severe respiratory distress
- SpO<sub>2</sub> <90.

There are other approaches to determining that a patient may have severe pneumonia and need hospitalization. A large multicentre study in a high-resource setting<sup>14</sup> derived and validated the "CURB-65" prognostic score based on the following factors (each worth one point):

- **C**onfusion (altered mental status)
- **U**rea >7 mmol/litre
- **R**espiratory rate ≥30 breaths/minute
- **B**lood pressure (systolic) <90 mmHg or diastolic <60 mm Hg
- age ≥**65** years.

Increasing CURB-65 scores are associated with increasing mortality. In some professional society guidelines, it is recommended that patients having 2 or more factors be admitted to the hospital. The utility of CURB-65 may be decreased in resource-constrained settings.

Empirical treatment is usually based on a presumptive determination of the likely category of organism causing the pneumonia and on an assessment of severity. It is important to have knowledge of the local epidemiology of community-acquired pneumonia. In high TB prevalence areas, or if HIV infection is known or suspected, TB should always be a consideration in patients presenting with respiratory infection.

**If the patient has severe pneumonia, see Sections 3.2.1–3.2.3 for management.**

#### **Outpatient management of the patient with non-severe pneumonia**

- Patients who have signs and symptoms of pneumonia but do not meet criteria for severe pneumonia can be managed as outpatients.
- Counsel the patient regarding the importance of adherence to the medication regimen and the need for follow-up to determine response.
- The patient should be advised to return for evaluation if there is no improvement or there is a worsening of symptoms.

<sup>14</sup> Lim WS, et al. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation. *Thorax*, 2003, 58:377-82.

- Treatment should be given for 5–7 days, assuming there is a good, prompt response.

### Empirical antibiotic regimens for non-severe pneumonia

- amoxicillin 500–1000 mg 3 times daily; OR
- doxycycline 100 mg 2 times daily (avoid in pregnancy).

Follow national guidelines for alternative antibiotics regimens that may include:

- azithromycin 500 mg once daily; OR
- clarithromycin 500 mg twice daily, OR
- oral respiratory quinolone (for example, *levofloxacin*) – see below for cautions.


Send sputum for AFB if TB is suspected.

It is important not to treat patients suspected of having TB with a respiratory quinolone as it may mask or partially treat underlying tuberculosis. Respiratory quinolones should also be avoided in high-prevalence TB settings unless TB is excluded. Safety of respiratory quinolones in pregnancy has not been established.

If not improving after 3 days and the patient has been adherent to the antibiotic regimen, review and consider switching to an IV regimen (as for severe pneumonia- see Section 3.2.3):

- 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 azithromycin 500 mg once a day and 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 precautions in 3.2.3.

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

 Consider other infections, including TB and, if HIV-positive, consider PCP.

### ***Pneumocystis jirovecii* pneumonia (PCP)**

PCP is caused by a fungus, *Pneumocystis jirovecii* (formerly known as *Pneumocystis carinii*). The organism is present in soil, transmitted through inhalation, and distributed worldwide. Most people have been exposed to it by the age of five. PCP occurs only in immunocompromised patients, particularly those who are infected with HIV and whose CD4 count is <200 cells/mm<sup>3</sup>. It is associated with high mortality in HIV patients. Patients who have recently received steroids or other immunosuppressive therapy are also at increased risk.

### Key clinical features

- PCP can be associated with many of the manifestations described above for pneumonia in general.
- Shortness of breath that is slow in onset (over 1–2 weeks).
- Cough that is non-productive.
- Fast pulse.
- Fast respiratory rate.
- Cyanosis may be present and is a sign of severe hypoxaemia.
- Auscultation of the chest is generally unremarkable, but some crackles may be present.

### Investigations

- SpO<sub>2</sub> is decreased.

- Elevated lactate dehydrogenase (LDH), which is a non-specific marker of pulmonary inflammation.
- *Experienced microscopists with special training may be able to identify the organism in induced sputum samples with special stains: methenamine (Grocot) silver, calcoflour white, and Wright-Giemsa. The sensitivity is diminished in patients using cotrimoxazole prophylaxis.*
- On chest X-ray, bilateral peri-hilar infiltrates are common, but nodular densities, lobar consolidations, and cavitation also can occur. At first presentation, in 25% of cases, the chest X-ray can be (misleadingly) normal. Pleural effusion is rare.

### Treatment

- If patient has severe pneumonia, see Section 3.2.3 for additional management recommendations regarding oxygen and fluid therapy.
- **Treatment should be initiated early and empirically, based on history and clinical presentation, while awaiting definitive diagnosis.**
- Antimicrobial treatment is most effective when started early:
  - cotrimoxazole 400 mg trimethoprim/80 mg sulfamthoxazole tablets (SS): dose based on trimethoprim (TMP) 5 mg/kg divided 4 times daily orally or IV for 21 days (preferred); OR
  - clindamycin 600 mg IV or orally 4 times daily PLUS primaquine 15 mg twice daily orally for 21 days (alternative); OR
  - pentamidine 4 mg/kg IV daily for 5 days, then reduce dose to 2 mg/kg daily IV to complete 21 days (alternative if unresponsive to cotrimoxazole or cotrimoxazole not tolerated).
- If the patient is hypoxaemic with SpO<sub>2</sub> <90 on room air, give IV therapy initially and add prednisone, 40 mg twice daily for 5 days, then 40 mg daily for 5 days, then 20 mg daily for 11 days to complete 21 days of treatment.

### Prophylaxis

- Primary prophylaxis is indicated for HIV-positive patients in WHO clinical stage 2, 3, or 4 irrespective of CD4 count, or with CD4 count <350/mm<sup>3</sup> irrespective of clinical stage. Follow national guideline recommendations.
- Secondary prophylaxis should be given to all patients following treatment of PCP.
- Primary and secondary prophylaxis is the same: cotrimoxazole 1 double strength tablet daily.
- Patients should at least be continued on PCP prophylaxis until there is evidence of immune recovery on antiretroviral therapy (CD4 counts >350 cells/mm<sup>3</sup> after at least 6 months of antiretroviral therapy).

### Varicella pneumonia

Pneumonia may complicate chickenpox in adults, particularly pregnant women and immunocompromised persons. The disease can progress rapidly to fulminant respiratory failure. Varicella pneumonia usually presents 1–6 days after the onset of rash, and is associated with cough, dyspnoea, fever, fast breathing, and chest tightness, although chest signs often are minimal. The diagnosis usually is based on finding skin lesions characteristic of varicella (see Sections 10.1 and 11.38). A chest X-ray shows diffuse interstitial opacities.

Treat with:

- IV aciclovir 10–15 mg/kg 3 times daily for 7–10 days.
- Switch to oral regimen once there is evidence of clinical improvement to complete the 10–14 day course.

## 8.2.5 Asthma

Asthma is an inflammatory disease of the airways causing reversible airways obstruction and characterized by recurrent acute attacks (exacerbations). The inflammation also causes an associated increase in the existing bronchial hyper-responsiveness to a variety of stimuli. The diagnosis is usually established from the episodic history of symptoms and by the finding of wheezing on auscultation of the chest.

### Key clinical features

- Recurrent episodes of cough and shortness of breath often associated with noisy breathing (wheezing) and chest tightness.
- Symptoms may be worse at night and interfere with sleep.
- Episodes commonly occur in response to specific exposures, such as pollens or other allergens, acute respiratory infections, dust, exercise, or cold air.

### Investigations

- Spirometry demonstrating reversibility is consistent with the diagnosis of asthma. However, many patients with asthma have normal spirometry when they are not having an exacerbation. Reversibility of airflow obstruction may be incomplete in some patients with asthma, especially those with long-standing asthma.
- Peak flow can also demonstrate airflow reversibility.

### Classify asthma severity

A classification of chronic asthma severity and examples of its treatment according to severity follow.

**Table: Classification of severity of asthma**

Classification	Intermittent asthma	Mild persistent asthma	Moderate persistent asthma	Severe persistent asthma
Episodes of breathlessness	<1 per week	1 or more per week, but <1 per day	Daily	Continuous daily
Frequency of night symptoms	<2 per month	>2 per month	>1 per week	Frequent
Peak flow or spirometry ( <i>FEV1</i> ), % predicted or personal best	>80%	>80%	Between 60–80%	<60%

WHO and partners are working to support the availability of basic asthma medications at the primary care level. Inhaled salbutamol and beclometasone are on the WHO essential medicine list and WHO guidelines for management of asthma at the primary care level are in development.

District clinicians will often see patients with an acute exacerbation of wheezing (see Section 3.2.3) or with persistent symptoms despite use of these basic asthma medications. There are several schematic approaches (shown in the table below, Examples of increasing dosage and choice of medications by asthma severity) to increasing the intensity of treatments to control asthma. Inhaled salbutamol by metered-dose inhaler (MDI) as needed is used as a reliever medication in all categories. Inhaled steroids (for example, beclometasone) are the most important therapy to control symptoms. All patients should be counselled to stop smoking and referred for specialist care for severe persistent asthma if available.

Refer to national or other local guidelines for specific recommendations. It may be necessary to advise patients to purchase more effective medications that are not on the national formulary to control moderate or severe persistent asthma. Although sustained release (SR) theophylline is not on the WHO essential medicines list, it is widely available; low dose SR theophylline can be used and stopped if there is evidence of toxicity.<sup>16</sup> Theophylline is not as effective or as safe as the other options listed. *Where available, theophylline blood levels should be used to adjust dosing.*

**Table: Examples of increasing dosage and choice of medications by asthma severity**

Asthma severity	Derived from WHO model formulary 2008 <sup>17</sup>	Derived from IUATLD guidelines <sup>18</sup>	Derived from BTS/SIGN guidelines <sup>19</sup>
<b>Intermittent</b>	Inhaled salbutamol as needed (100–200 mcg up to 4 times daily)	Inhaled salbutamol as needed	Inhaled salbutamol as needed
<b>Mild persistent</b>	Inhaled salbutamol as needed  Beclometasone 100–250 mcg twice daily OR SR theophylline OR a leukotriene antagonist	Inhaled salbutamol as needed  Beclometasone 200 mcg daily	Inhaled salbutamol as needed  Beclometasone 200 mcg twice daily
<b>Moderate persistent</b>	Inhaled salbutamol as needed  Beclometasone 100–500 mcg twice daily PLUS if needed EITHER <i>Long-acting beta-agonist</i> or <i>SR theophylline</i> or <i>leukotriene antagonist</i> OR Beclometasone high dose >1 mg/day (divided doses)	Inhaled salbutamol as needed  Beclometasone 200 mcg twice daily	Inhaled salbutamol as needed  Beclometasone 200 mcg twice daily <i>and a long-acting beta-agonist</i> (must always be used with beclometasone) OR Beclometasone up to 400 mcg twice daily
<b>Severe persistent</b>	Inhaled salbutamol as needed  Beclometasone >1 mg/day (divided doses) PLUS <i>Long-acting beta-agonist</i> PLUS if needed <i>SR theophylline</i> or <i>leukotriene antagonist</i> or long-acting beta-agonist or oral prednisolone in lowest dose possible, given once daily in the morning	Inhaled salbutamol as needed  Beclometasone 400 mcg twice daily and prednisolone 0.5 mg/kg/day (reassess weekly; taper when patient stable for 1 week)	Inhaled salbutamol as needed  Beclometasone 1000 mcg twice daily OR Beclometasone 1000 mcg twice daily AND 6 week trial of <i>SR theophylline</i> . OR Beclometasone 1000 mcg twice daily and daily prednisolone at lowest dose needed for adequate control

<sup>16</sup> If theophylline blood levels are available, they should be used to adjust dosing.

<sup>17</sup> WHO model formulary. WHO, 2008. Available at [http://www.who.int/selection\\_medicines/list/WMF2008.pdf](http://www.who.int/selection_medicines/list/WMF2008.pdf)

<sup>18</sup> IUATLD asthma guidelines available at <http://www.theunion.org/index.php/en/resources/scientific-publications/lung-health>

<sup>19</sup> BTS/SIGN guidelines. Available at <http://www.sign.ac.uk/guidelines/fulltext/101/index.html>

## 8.2.6 Chronic obstructive pulmonary disease (COPD)

Chronic obstructive pulmonary disease is characterized by persistent respiratory symptoms and airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response to noxious particles or gases in the lung. The most common inhaled toxin is cigarette smoke, but smoke from other types of tobacco (cigar, pipe) or marijuana, or outdoor pollution, occupational irritants or indoor air pollution (e.g. biomass fuel consumption), and pulmonary infections also play a role.

### Key clinical features

- Symptoms of chronic cough and progressive shortness of breath, with or without sputum production, in a person with an exposure history such as cigarette smoking.
- On examination, patients commonly have a fast respiratory rate, and breath sounds are usually reduced throughout all lung fields on chest auscultation.
- At advanced stages, patients may use accessory muscles to breathe, have clinical signs of heart failure (e.g. elevated JVP, liver enlargement and bilateral leg oedema).

### Investigations

- Spirometry demonstrating fixed airflow obstruction with an FEV1/FVC <70% after inhalation of short-acting bronchodilator confirms diagnosis of COPD.
- Severity of airflow obstruction is based on FEV1 (% predicted).

### Classify COPD severity

Severity can be determined based on refined ABCD assessment tool.<sup>20</sup> Ideally, patients should have an assessment based on both subjective criteria (symptoms) and physiological criteria (spirometry) as well as their history of exacerbations (including prior hospitalizations).

If spirometry not available at district hospital but history is strongly suggestive of COPD, mMRC assessment questionnaire can be used to assess the level of dyspnoea for patients with stable COPD.<sup>21</sup>

**Table: Assessment of COPD dyspnea by Modified British Medical Research Council (mMRC) Questionnaire**

mMRC Grade	Dyspnea scale
0	I only get breathless with strenuous exercise.
1	I get short of breath when hurrying on the level or walking up a slight hill.
2	I walk slower than people of the same age on the level because of breathlessness, or I have to stop when walking on my own pace on the level.
3	I stop for breath after walking about 100 meters or after a few minutes on the level.
4	I am too breathless to leave the house or I am breathless when dressing or undressing.

<sup>20</sup> Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. 2017- permission requested

<sup>21</sup> Fletcher CM. Standardized questionnaire on respiratory symptoms: a statement prepared and approved by the MRC Committee on the Aetiology of Chronic Bronchitis (MRC breathlessness score). *BMJ* 1960; 2: 1662.



**Determine exacerbation history and classify patient based on the refined ABCD assessment tool<sup>22</sup>:**

	Symptoms	
Exacerbation History	mMRC 0-1	mMRC≥2
0 or 1 (not leading to hospital admission)	A	B
≥2 or ≥1 leading to hospital admission	C	D

If spirometry is available, classify the severity of COPD after diagnosis with GOLD criteria and assess symptoms with mMRC questionnaire:

**Table: Classification of severity of COPD<sup>23</sup>**

GOLD classification	COPD severity	FEV1
1	Mild	80% or higher
2	Moderate	between 50–79%
3	Severe	between 30–49%
4	Very severe	less than 30%

### COPD treatment

The main goal of COPD treatment is to reduce symptoms and prevent exacerbations. Chronic COPD management is determined by the following factors:

- symptoms of breathlessness or exercise limitation
- frequency of exacerbations
- severity of airflow obstruction- if spirometry is not available, management can still be based on ABCD classification

In the management of COPD, all patients should be counselled to:

- Stop smoking and avoid indoor air pollution
- Give pneumococcal and annual influenza vaccinations

Commonly used inhaled medications include:

- Short-acting bronchodilators, such as short-acting beta<sub>2</sub>-agonist (SABA) e.g. salbutamol or antimuscarinic agents e.g. ipratropium. These are used as reliever medications in all categories.
- Long-acting bronchodilators- include long-acting beta-agonists (LABA e.g. salmeterol) or long-acting muscarinic antagonist (LAMA, e.g. tiotropium). Regular dose ipratropium (2 puffs 4 times daily) could be substituted for LAMA.

<sup>22</sup> GOLD, 2016

<sup>24</sup> GOLD- copyrighted- permission requested

- Inhaled corticosteroids (ICS) e.g. beclomethasone or budesonide should be used **in combination** with long-acting bronchodilators

Other management considerations:

- Education and training in the inhaler technique is important and should be assessed before concluding that current therapy is not working.
- Refer for specialist care for severe or very severe COPD (Groups C and D-to consider optimize COPD treatment, to consider long-term home oxygen therapy and potential treatment of right heart failure).
- Arrange pulmonary rehabilitation if available

The table that follows provides an example of an approach to the management of chronic COPD. It may be necessary to advise patients to purchase more effective medications that are not on the national formulary to control COPD.

Referral to a specialist would likely be necessary as LAMA and roflumilast are not on the National Formulary or EML as well as to confirm diagnosis. An example of management when these are available follows.

**Table: management of COPD, from GOLD<sup>24</sup> (based on ABCD assessment above)**

Group	Treatment
A	Bronchodilator e.g. salbutamol → evaluate effect → Continue, stop or try alternative class of bronchodilator
B	Long-acting bronchodilator (LABA or LAMA) → if persistent symptoms → LAMA + LABA
C	LAMA → if further exacerbation(s) → LAMA+LABA (alternative LABA+ICS)
D	LAMA+ LABA (or LABA+ICS) → if further exacerbations → LAMA+LABA+ICS → if further exacerbations → consider roflumilast if FEV1 < 50% pred and patient has chronic bronchitis or consider macrolide (in former smokers)

SABA- short-acting beta<sub>2</sub>-agonist; LABA- long-acting beta<sub>2</sub>-agonist; LAMA-long-acting antimuscarinic antagonists; ICS- inhaled corticosteroids

### Management of COPD exacerbations

For treatment of an acute episode of severe wheezing, see Section 3.2.3.

COPD exacerbations present as an acute worsening of respiratory symptoms such as increased shortness of breath and possibly more purulent sputum (increase in the volume and change in colour). Management consists of the following:

#### Mild exacerbation:

- Treat with short acting bronchodilator e.g. salbutamol with or without short-acting anticholinergic (e.g. ipratropium)

#### Moderate exacerbation:

- Give higher dose salbutamol and ipratropium (short acting bronchodilators)
- Give oral corticosteroid for 5-7 days e.g. prednisolone 30 mg/day
- Do chest X-ray to rule out pneumonia, pneumothorax, or pleural effusion. Give antibiotics for 5-7 days: treat with doxycycline or amoxicillin + azithromycin.
- if evidence of pneumonia, treat pneumonia as per pneumonia guidance (Section 8.2.4).

<sup>24</sup> GOLD- copyrighted- permission requested

**Severe exacerbation:**

- Requires hospitalization. May be associated with respiratory failure. See Section 3.2.

**Palliative care for patients with COPD (or lung cancer or other terminal pulmonary problem)**

In addition to specific antimicrobial management (antibiotics for pneumonia; sputum examination if suspect TB and TB treatment as indicated), do the following:

- Control bronchospasm
  - Give bronchodilators by a metered-dose inhaler with spacer or mask, or by nebulizer. In terminal care, stop the use of bronchodilators when the patient is not able to use them anymore or has very shallow or laboured breathing.
  - Give steroids (see Section 3).
- Relieve excessive sputum
  - If there is a cough with thick sputum, give steam inhalations.
  - If more than 30 ml/day, try forced expiratory technique (“huffing”) with postural drainage.
- For a bothersome dry cough, give codeine tablets 5–10 mg 4 times daily.
- If there is hypoxaemia ( $SpO_2 < 90$ ),  $O_2$  can be given continuously in hospital and, depending on availability and affordability of concentrators or  $O_2$  cylinders, at home with training of the patient and family members.

If a patient is terminal and is dying from COPD, lung cancer, drug-resistant tuberculosis, or any other terminal pulmonary problem (but NOT acute pneumonia that can be treated with antibiotics), there are additional measures to relieve dyspnoea.

- For a bothersome cough not responding to codeine, give oral morphine 2.5–5 mg.
- In end-of-life care a small dose of morphine can reduce dyspnoea. Monitor closely but do not let fears of respiratory depression prevent trying this drug. Titrate the dose of the opioid to its effect in relieving dyspnoea using a dyspnoea scale or physical signs of dyspnoea.
  - For a patient not on morphine for pain, start with 2.5 mg 4–6 hourly.
  - For a patient already on morphine, increase the dose by 25%. If this does not work, increase by another 25%.
- If there is heart failure or excess fluid with pitting oedema, give furosemide 40–80 mg orally.
- For anxiety or terminal agitation, consider giving small doses of diazepam 2.5–5 mg.

## 8.3 Diarrhoea

8.3.1	Clinical approach to diarrhoea	8.3.3	Approach to persistent or chronic diarrhoea in PLHIV (with DDx table)
8.3.2	Classify and manage diarrhoea (with DDx tables) <ul style="list-style-type: none"><li>– Acute diarrhoea (&lt;14 days), with no blood</li><li>– Cholera</li><li>– Drug-induced diarrhoea</li><li>– <i>Clostridium difficile</i> colitis</li><li>– Diarrhoea with blood</li></ul>		<ul style="list-style-type: none"><li>– Protozoan infections</li><li>– HIV enteropathy</li></ul>

This Section discusses an approach to managing patients with:

- acute diarrhoea (<14 days) including cholera
- diarrhoea with blood
- chronic or persistent diarrhoea (14–30 days) in an immunocompromised patient.

### 8.3.1 Clinical approach to diarrhoea

<b>Step 1:</b>	<b>Use Quick Check.</b> Use Quick Check to ensure that there are no serious or life-threatening conditions.
<b>Step 2:</b>	<b>Take a history and examine the patient.</b>
<b>Step 3:</b>	<b>Assess the patient's HIV status.</b> 🚫
<b>Step 4:</b>	<b>Classify dehydration and diarrhoea to work through differential diagnosis.</b> Table: Classify and treat dehydration <ul style="list-style-type: none"><li>• Acute diarrhoea, no blood</li><li>• Acute diarrhoea with blood</li><li>• Persistent diarrhoea in immune compromised patients</li></ul>
<b>Step 5:</b>	<b>Perform investigations.</b>
<b>Step 6:</b>	<b>Initiate treatment and monitor the patient's response.</b>

#### History

Ask about:

- diarrhoea
  - frequency of stools
  - duration of diarrhoea
  - blood or mucous in stool
- nausea, vomiting
- abdominal pain
- fever
- recent antibiotic or other drug treatment
- other co-morbid conditions, especially HIV status (and CD4 count)
- travel history or local outbreaks of disease
- food history.

## Examination

Assess the severity of the dehydration.

- Targeted general exam:
  - What is severity of dehydration?
  - Is the patient lethargic?
  - Does the patient have sunken eyes?  
Do the eyes appear unusually sunken in their sockets?  
Ask the family if the patient's eyes are more sunken than usual.
  - Does a skin pinch go back very slowly (more than 2 seconds)?  
Pinch the inner skin of the forearm for 1 second, then release and observe.  
Does it go back very slowly, more than 2 seconds?  
Note: The inside of the forearm is suggested because it is still feasible in a pregnant woman, and because it does not require the adult patient to get undressed.
  - Is the patient not drinking, drinking poorly, or drinking eagerly?
  - Are there signs of severe malnutrition or wasting?
  - Are there signs of chronic illness or immune compromise?
- Abdominal exam.
  - Is there tenderness or masses?
  - Is there abdominal distension with increased bowel sounds?
  - In a rectal examination, note characteristics of the stool, including blood.

### Assess the patient's HIV status

HIV infection will change the differential diagnoses for diarrhoea, and should be considered in all patients presenting with diarrhoea. If the patient is HIV-infected, what is the CD4 count?

## Investigations if diarrhoea is persistent or severe

- FBC – anaemia or leucocytosis
- electrolytes
- stool for macro and microscopic examination, and occult blood
- pregnancy test in women
- liver profile – AST, ALT, bilirubin
- abdominal X-ray
- ultrasound – hepatomegaly, gallstones, thickened gallbladder wall, dilated common bile duct
- urinalysis – dipstick, macroscopic, and microscopic examination (WBCs, RBCs).

### 8.3.2 Classify and manage diarrhoea<sup>1</sup>

Dehydration should be assessed, classified, and treated in all patients with diarrhoea. Empirical treatment algorithms are suggested for the management of acute diarrhoea and diarrhoea with blood. Most patients will respond to empirical treatment, so diagnostic tests often are not necessary. If the situation is different, follow national guidelines and use clinical judgement.

**Table: Classify and treat dehydration in the adolescent or adult**

Signs	Classify as	Treatments
Two of the following signs: <ul style="list-style-type: none"> <li>• Lethargic or unconscious</li> <li>• Sunken eyes</li> <li>• Not able to drink or is drinking poorly</li> <li>• Skin pinch goes back very slowly</li> </ul>	<b>SEVERE DEHYDRATION</b>	Rehydration with IV (or NG if IV not possible) – Plan C. Then with ORS when dehydration is no longer severe. Consider causes and treat. If there is cholera in your area, give appropriate antibiotic for cholera (according to sensitivity data). Report suspect cholera cases (see Section 9 in Nepal IMAI DCM)
Two of the following signs: <ul style="list-style-type: none"> <li>• Sunken eyes</li> <li>• Drinks eagerly, thirsty</li> <li>• Skin pinch goes back slowly</li> </ul>	<b>SOME DEHYDRATION</b>	Give fluid and food – Plan B Rehydrate with ORS and monitor patient Advise patient when to return. Follow up in 5 days if not improving.
Not enough signs to classify as severe or some dehydration	<b>NO DEHYDRATION</b>	Treat diarrhoea at home with ORS– Plan A Advise when to return. Follow up in 5 days if not improving

#### Acute diarrhoea (<14 days), with no blood

Acute diarrhoea with no blood is most commonly due to viral infections, but may be due to bacterial infections. In an outbreak, consider cholera. Patients may present with fever although fever is very unusual in cholera.

#### Diagnosis

- Diarrhoea generally of limited duration and does not require investigations.
- Cholera should be suspected if there are cases of diarrhoea with severe dehydration in the community (see management of cholera below).

#### Treatment

- Usually no antimicrobial therapy is needed.
- Manage dehydration according to severity (see table above):
  - Use an appropriate fluid plan (see below) depending on the classification of dehydration.
  - Give adequate oral fluids and oral rehydration salts.
  - If severe dehydration, give intravenous therapy.
- In addition to fluids, in all cases of diarrhoea it is important to continue eating.

<sup>1</sup> *The treatment of diarrhoea: A manual for physicians and other senior health workers.* WHO, 2005. Available at [www.who.int/child\\_adolescent\\_health/documents/9241593180/en/](http://www.who.int/child_adolescent_health/documents/9241593180/en/)

## Reporting

- Report 5 or more cases acute gastroenteritis
- Report even one case suspected cholera

### DDx acute watery diarrhoea<sup>2</sup>

Viruses	
Rotavirus	Fever common Highly contagious Important cause of dehydrating diarrhoea in children under 5 years
Adenovirus (group F)	Fever and respiratory symptoms common; mustard yellow or tan watery stools Most common among children and PLHIV
Norovirus (astrovirus, sapovirus are similar)	Prominent nausea and vomiting; fever reported in 20-35% cases Food- or water-borne or person-to-person transmission in people of all age groups
Viral Hemorrhagic Fever- Ebola or Lassa Fever)	Sudden onset of fever with severe diarrhoea (occasionally watery or bloody), vomiting, asthenia, myalgias, arthralgias, abdominal pain (often right upper quadrant), occasional encephalopathy; contagious with risk for nosocomial amplification.
Bacterial enterotoxins of Gram-positive bacteria	
<i>Staphylococcus aureus</i> , <i>Clostridium perfringens</i> , or <i>Bacillus cereus</i> food poisoning	Nausea and vomiting predominate in <i>S. aureus</i> and early-onset <i>B. cereus</i> illness; cramps and diarrhoea predominate in <i>C. perfringens</i> and late-onset <i>B. cereus</i> illness Foodborne outbreak
Bacteria	
Enterotoxigenic/ Enteropathogenic <i>E. coli</i> (ETEC, EPEC)	Watery diarrhoea (may resemble cholera, but typically milder); fever reported in 15%-30% of cases
Enterohemorrhagic/ Shiga toxin-producing/ Enteroinvasive/ Enteroaggregative <i>E. coli</i> (EHEC, STEC, EIEC, EAEC)	Watery or bloody diarrhoea, vomiting, fever, abdominal cramps; EAEC associated with persistent diarrhoea in patients with malnourishment or HIV
<i>Campylobacter species</i>	Fever and watery diarrhoea [bloody stools in 4% of cases (range <1%–32%)]; complications include reactive arthritis and Guillain Barré syndrome
<i>Listeria monocytogenes</i>	Watery diarrhoea, vomiting, fever, myalgias, abdominal cramps May be complicated by sepsis, meningitis, encephalitis in immunocompromised patients
<i>Salmonella species</i>	Fever common; bacteremia in 5-10%
<i>Vibrio cholera</i> 01 and 0139 with cholera toxin gene	Acute, profuse watery diarrhoea; “painless”; “rice water stools”; fishy odor; vomiting, muscle cramps, and dehydration. Fever very rare in adults.
<i>Vibrio cholera</i> 01 and 0139 without cholera toxin gene	Typically, a milder illness than cholera; some may cause wound infection
<i>Shigella species</i>	Fever, nausea and sometimes bloody stools, vomiting, tenesmus. Severity may be species specific: <i>S. dysenteriae</i> (type 1) often associated with epidemics, complications like toxic megacolon and hemolytic uremic syndrome, and high CFR (~20%); <i>S. sonnei</i> associated with self-limited milder disease

<sup>2</sup> Chapter excerpts from: Centers for Disease Control and Prevention (CDC). Global Disease Detection (GDD) Manual “Rapid Diagnostic Tests for Epidemic Diseases” 2011 (draft).

<i>Vibrio parahemolyticus</i> , <i>non-cholerae vibrios</i>	Increasingly common cause of acute watery diarrhoea
<i>Clostridium difficile</i>	Watery, self-limiting diarrhoea usually associated with previous antibiotic use Complications include potentially life-threatening pseudomembranous colitis
<b>Parasites</b>	
<i>Giardia species</i>	Diarrhoea, flatulence, greasy foul-smelling stools, abdominal cramps, nausea, malabsorption. Symptoms may be intermittent/ relapsing. May lead to dehydration and weight loss.
<i>Cryptosporidium spp</i>	Watery diarrhoea, abdominal cramps, N&V, may lead to dehydration and weight loss. Acute self- limiting diarrhoea in immunocompetent hosts, although symptoms may be intermittent/relapsing. Persistent/chronic diarrhoea in immunocompromised.
<i>Entamoeba histolytica</i>	Bloody diarrhoea, vomiting, fever, abdominal pain; complicated by extra-intestinal manifestations like liver abscess
<i>Isoospora belli</i> , <i>Cyclospora cayetanensis</i>	Similar presentation to Cryptosporidiosis. Chronic disease with malabsorption and weight loss can occur in immunocompetent person; immunosuppressed may have prolonged and severe diarrhoea. <i>I. belli</i> is considered an AIDS-defining illness.
<i>Strongyloides stercoralis</i>	GI manifestations include epigastritis and duodenitis (pain worsens with food ingestion); anorexia, diarrhoea, nausea, vomiting; malabsorption (with high worm burden) Migratory lesions that are serpiginous, erythematous, raised, and pruritic; can migrate 5-15 cm/ hr (“larva currens”) Pulmonary manifestations include dry cough, throat irritation, dyspnea, wheezing, hemoptysis; in chronic disease, can manifest as asthma paradoxically exacerbated by steroids Hyperinfection syndrome results from massive dissemination of filariform larvae to end organs and can result in septic shock and acute lung injury (immune suppression is a risk) Eosinophilia (less common in immune compromised)
<i>Cyclospora cayetanensis</i>	Intestinal protozoal pathogen that is highly endemic in Nepal Transmission occurs almost exclusively from May through October, with a peak in June and July. Watery diarrhoea, profound anorexia and fatigue <sup>3</sup>

<sup>3</sup> CDC Yellow Book 2018- Nepal. <https://wwwnc.cdc.gov/travel/yellowbook/2018/select-destinations/nepal>



## Fluid plans A, B and C (fluid and food)- for all diarrhoea based on dehydration status

### Plan A: Treatment of diarrhoea at home

Counsel the patient on the 3 rules of home treatment.

1. Drink extra fluid.
2. Continue eating.
3. Advise the patient when to return to the health facility.

#### 1. Drink extra fluid

- Drink extra fluid:
  - as much as the patient will take
  - safe fluid that is clean or has been boiled or disinfected
  - ORS or other fluid (except fluids with high sugar or alcohol)
  - drink at least 200–300 ml after each loose stool
  - continue drinking extra fluid until the diarrhoea stops.
- It is especially important to provide ORS for use at home if the patient cannot return to the clinic if the diarrhoea worsens.
- If ORS is provided:
  - teach the patient how to mix and drink ORS
  - give 2 packets to take home.
- If the patient is vomiting, they should continue to take small sips. Anti-emetics are usually not necessary.

#### 2. Continue eating

#### 3. Return to the health facility when:

- diarrhoea becomes worse
- the patient has persistent diarrhoea or a large volume.

### Home care advice for patients with diarrhoea

- Increase fluid intake.
  - Encourage the patient to drink plenty of fluids to replace lost water.
  - Ensure safe water for the patient – boiled or disinfected.
  - Give the patient frequent drinks in small amounts, such as rice soup, porridge, water (with food), other soups or oral rehydration solution (ORS), but avoid sweet drinks.
- The patient should continue eating.
- Advise the patient when to return to the clinic, and to seek help from a health worker if:
  - The patient is vomiting and has fever.
  - There is blood in the stool.
  - The diarrhoea continues more than 5 days.
  - The patient becomes even weaker.
  - There is broken skin around the rectal area.

#### To prevent dehydration

- The patient should drink extra fluids frequently – see Fluid Plan A for adults.
- The patient should use ORS if there is a large volume of diarrhoea or there is persistent diarrhoea.
- Advise the patient to continue eating.

## Plan B: Treatment of patient with some dehydration using ORS\*- adolescent, adult

### 1. Determine amount of ORS to give during first 4 hours.

- The approximate amount of ORS required (in ml) can be calculated by multiplying the patient's weight (in kg) times 75.
- Use the patient's age if you do not know the weight.
- If the patient wants more ORS than shown, give more.
- Give the recommended amount of ORS in the clinic over a 4-hour period.
- If the patient is weak or vomits:
  - give frequent small sips from a cup.

After a vomit, wait 10 minutes then continue, but more slowly.

PLAN B in first 4 hours (75 ml/kg)		
Age or size of adult	Weight	From WHO fluid plan- IMCI/IMAI
	20-29 kg	1500-2200
Adult small	30- 39 kg	2300-3000
Adult medium	40- 49 kg	3000-3700
Adult large	50- 59 kg	3700-4400

### 2. After 4 hours

- Reassess the patient and classify for dehydration.
- Select the appropriate plan to continue treatment.
- Begin feeding the patient in the clinic.
- Only give zinc in children under 5 (see IMNCI for this and fluid management in children with and without severe malnutrition)

### 3.If the patient must leave before completing treatment

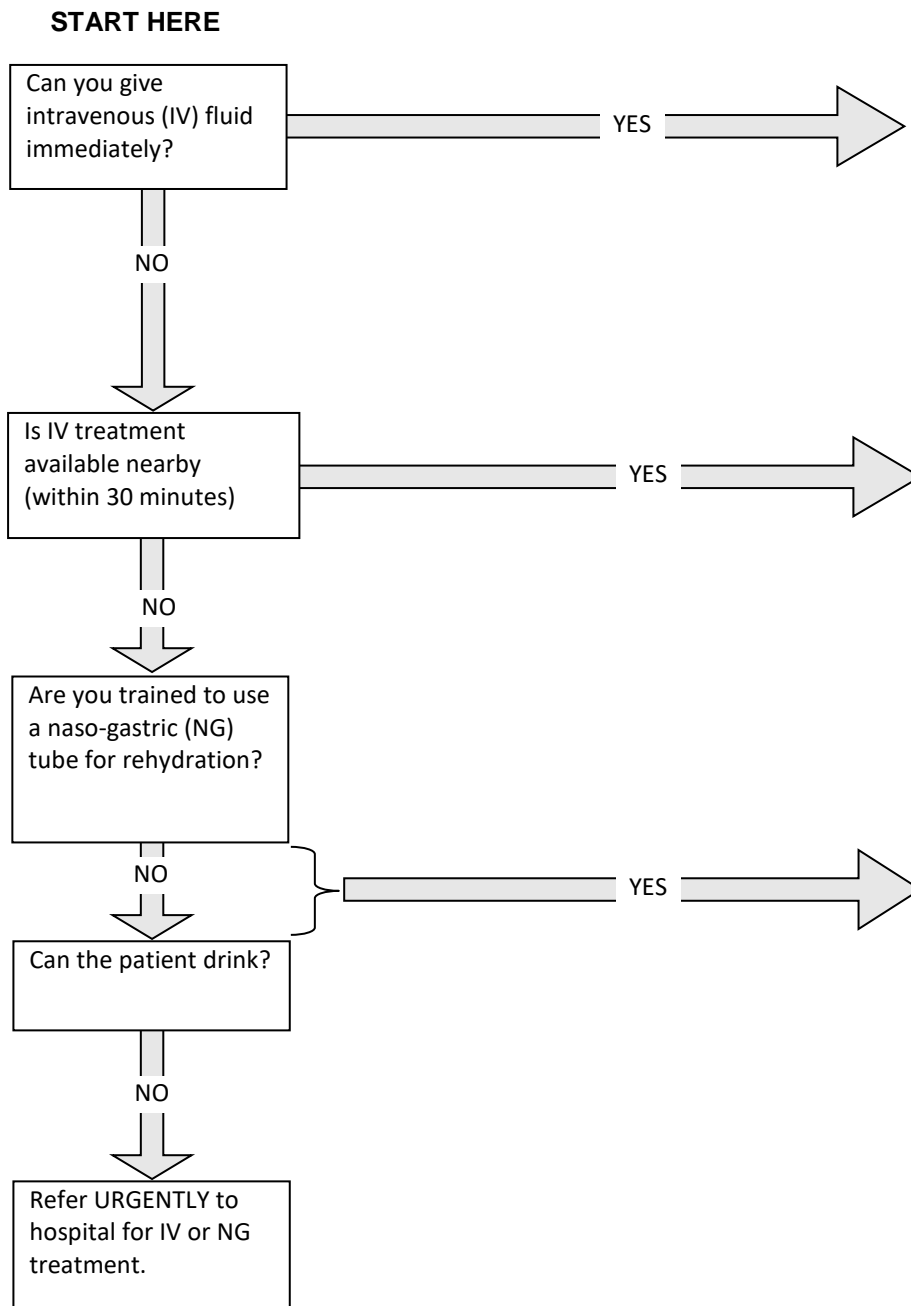
- **Show the patient how to prepare ORS solution at home.**
- **Show the patient how much ORS is needed to finish a 4-hour treatment at home.**
- **Give enough ORS packets to complete rehydration.**  
Give 2 packets as recommended in Plan A.

### 4. Explain the 3 rules of home treatment

- **Drink extra fluid.**
- **Continue eating.**
- **Return to the health facility if needed.**

**Plan C: Treat severe dehydration quickly**

Follow the arrows. If the answer is “yes” go across. If “no”, go down.



- Start IV fluid immediately. If the patient can drink, give ORS by mouth while the drip is set up. Give 100 ml/kg Ringer's lactate solution (or, if not available, normal saline), divided as follows (See IMCI and ETAT for children less than 5 years):

Age	First give 30 ml/kg in:	Then give 70 ml/kg
Older children, adolescents and adults	30 minutes*	2½ hours

\*Repeat once if radial pulse is very weak or not detectable.

- Reassess the patient every 1–2 hours. If hydration status is not improving, give the IV drip more rapidly. Also give ORS (about 5 ml/kg/hour) as soon as the patient can drink, usually after 1–2 hours for older children, adolescents, and adults.
- Reassess at least every 3 hours. Classify dehydration again. Then choose the appropriate plan (A, B, or C) to continue treatment.

- Refer URGENTLY to hospital for IV treatment.
- If the patient can drink, provide a relative or friend with ORS solution and show how to give frequent sips during the trip.

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

## Cholera<sup>4,5, 6</sup>

### Key clinical features

It is most important to ascertain whether all patients thought to have cholera do in fact have the same disease.

- Cholera may occur as an outbreak or be locally endemic.
- Signs and symptoms include:
  - profuse watery stools (rice-water stools)

<sup>4</sup> Cholera, WHO, 2011. Available at <http://www.who.int/topics/cholera/en/>

<sup>5</sup> Nepal MOH- EDCD National Preparedness and Response Plan for Acute Gastroenteritis/Cholera Outbreaks in Nepal July 2017 to July 2022 AD

<sup>6</sup> *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>

- large volumes of fluid are vomited
- severe dehydration
- abdominal pain not marked.
- According to the WHO case definition, a case of cholera should be suspected if:
  - in an area where the disease is not known to be present, a patient aged 5 years or more develops severe dehydration or dies from acute watery diarrhoea; OR
  - in an area where there is a cholera epidemic, a patient aged 5 years or more develops acute watery diarrhoea, with or without vomiting.
- Cholera is confirmed if *Vibrio cholerae* O1 or O139 is isolated from a patient with diarrhoea.
- Stool samples should be sent for culture in Cary Blair (see 7.2.12). Currently the RDT for cholera is not supplied or being used at district hospital level.
- Laboratory confirmation of the first 10–20 cases is essential to determine an outbreak of cholera.
  - It is not necessary to take a sample from every patient with acute diarrhoea, once the cholera outbreak is confirmed.
- If tests to confirm a diagnosis are not available, start empirical treatment. The clinical case definition allows detection and treatment of cholera.
- Stool samples should be taken before giving antibiotics to the patient. See Section 7.2.12 on taking stool samples in Cary-Blair medium for cholera.

**Incubation period:** 2 hours to five days, usually 2-3 days

### Treatment

- Rehydration is the mainstay of treatment. Rehydration therapy can reduce mortality to less than 1%.
  - Assess and classify dehydration and follow fluid plan A, B or C above
  - 80- 90% of cases can be treated with ORS.
  - Patients requiring IV can soon switch to ORS
  - When IV rehydration is not possible, and the patient cannot drink, ORS solution can be given by nasogastric tube. However, nasogastric tubes should not be used for patients who are unconscious.
  - Ringers lactate is the recommended IV fluid
  - Normal or ½ normal saline are less effective, but can be used
- Provide antibiotics for patients with severe disease (according to antimicrobial sensitivity- this should be determined in each outbreak). Give antibiotics particularly for those passing large volumes of stools and all hospitalized patients. Appropriate antibiotics can reduce:
  - Fluid losses
  - Duration of illness
  - Duration of carriage

Note that antibiotic resistance pattern can change over time, between outbreaks and during outbreaks. Choice of antibiotics for an adult should reflect antibiotic sensitivity and whether the patient is pregnant:

- For adolescents and adults who are not pregnant:
  - doxycycline 300 mg in a single dose; OR
  - tetracycline 500 mg (or 25 mg per kg) 4 times daily for 3 days; OR
  - ciprofloxacin 1 g in a single dose.

For pregnant women, use azithromycin 500 mg- 2 tablets stat or erythromycin 250 mg 4 times daily for 3 days.

Antibiotic prophylaxis is **not** recommended- for family, community or health workers.

- **Only give zinc in children for cholera, not adults.** This reduces the severity and duration of cholera in children by ~10%. The effect of zinc supplementation on duration of diarrhoeal illnesses in adults has not been studied, and its use is not the standard of care. Some zinc studies included older children/young adolescents up to age 14.

Summary of rehydration treatment in cholera in adolescents and adults (see Fluid plans A, B and C above)	
<b>SEVERE DEHYDRATION</b>	<p><b>Give IV fluids (Lactated ringers) rapidly</b></p> <ul style="list-style-type: none"> <li>• Hang infusion bag high</li> <li>• Use 2 intravenous lines if necessary</li> <li>• For adults, give a liter in the first 15 minutes</li> </ul> <p><b>Monitor</b> pulse and stay with patient until strong radial pulse Reassess hydration status at 30 minutes, then every 1-2 hours until rehydration is complete Check for rapid respiratory rate, a sign of possible overhydration</p> <p><b>Add ORS as soon as possible</b> (must be conscious); discontinue and remove IV when patient is stable and drinking ORS</p>
<b>SOME/MODERATE DEHYDRATION</b>	<p><b>Plan B: ORS: 75 ml x weight in kg over first 4 hours, if able to drink.</b> <b>(ORS can be given by NG tube)</b> <b>Reassess then reclassify</b></p>
<b>NO DEHYDRATION</b>	<p><b>ORS to maintain hydration</b></p>

**Monitoring- regular reassessment of all patients:**

- state of consciousness: AVPU
- pulse
- signs of dehydration
- number and appearance of stools
- respiratory rate and rhythm
- temperature (cholera usually provokes hypothermia. If fever, suspect an additional problem such as malaria)
- urine (present or not)

**Is rehydration adequate?** Repeat assessment of dehydration.

## Monitor for complications:<sup>7</sup>

- **Hypoglycemia- usually only in young children**
  - Lethargy and convulsions
  - Early ORS and feeding will prevent
  - Treat with glucose
- **In elderly and young children: pulmonary edema**
  - Cough, rapid breathing while on IV fluids
  - Slow down IV fluids and sit patient up
- **In patients not receiving ORS: hypokalemia**
  - Painful leg cramps
  - Provide ORS
- **No or little urine**
  - May indicate not volume repleted
  - In patients with prolonged shock: renal failure (anuria)
  - Urine output should resume within 6 to 8 hours
  - May require dialysis
- **In pregnant women: miscarriage**
  - Stillbirth and miscarriage common in third trimester with severe cholera
  - Treatment remains the same
- **Infection at IV site (especially if IV > 3 days)**
  - Redness, swelling, and pain at IV site
  - Remove IV line and continue with ORS

## Infection prevention in the health facility

Cholera is not likely to spread directly from one person to another, but it is possible.

- Direct person-to-person transmission (separate from transmission by food or water) is uncommon if basic handwashing is carried out.
- Transmission to health workers during an outbreak is very uncommon if there is good handwashing and other IPC practices.
- Good management of cholera cases will reduce the risk of nosocomial infection within the health facility/cholera care centers.

### **Cholera requires contact precautions, in addition to standard precautions.**

- Isolate patients in a separate ward from other patients, with dedicated latrines.
- Wash hands with soap before and after taking care of the patient (see Section 6).
- If no water and soap are available, use an alcohol-based hand cleaner (with at least 60% alcohol)
- PPE use (all the time, for each patient, each patient care) for cholera- contact plus standard precautions:
  - Gloves- change between patients
  - Apron
  - Footwear (clean or leave at work)
  - To perform activities like cleaning and waste management staff should also wear a face mask.
- Cut nails (health worker).

<sup>7</sup> CDC: Training-of-Trainers on Cholera Epidemic - Short Course, Haiti, 2010

- Stools, vomit, and soiled clothes of patients are highly contagious.
- Wash and disinfect latrines and patients' buckets with chlorine.
- Provide a supply of nutritious food (small frequent meals). Supervise careful preparation of food and drinks.
- Ensure a safe water supply.

### Drug-induced diarrhoea

#### Clinical features

Diarrhoea is a common side-effect of many medications, especially antibiotics. In patients who have a history of antibiotic therapy or hospitalization, consider *Clostridium difficile* (see below).



Patients on antiretroviral therapy have an increased likelihood of drug-induced diarrhoea:

- protease inhibitors (PI) such as LPV/ritonavir;
- AZT and ddl (buffered).

#### Treatment

Treatment in these patients is symptomatic.

In cases of severe ARV-induced diarrhoea, a switch of treatment regimen should be considered – see Section 13.8 ARV toxicity and management.

### *Clostridium difficile* colitis

*Clostridium difficile* may be underestimated as a cause of diarrhoea. It may cause severe abdominal pain, fever, megacolon, and rupture. *C. difficile* colitis is also called pseudomembranous colitis.

#### Key clinical features

- Leucocytes and blood in stool supports the diagnosis.
- Frequent hospitalization and prior exposure to antibiotics are risk factors for *C. difficile* colitis.
- Severe cases may present with toxic megacolon.
- *Toxin assay may be available in a referral laboratory.*



**Table: Antibiotics associated with *C. difficile* colitis**

Frequently associated	Occasionally associated	Rarely associated
<ul style="list-style-type: none"> <li>○ Ciprofloxacin, moxifloxacin, levofloxacin</li> <li>○ Clindamycin</li> <li>○ Amoxicillin, ampicillin, amoxicillin-clavulanic acid</li> <li>○ Ceftriaxone, cefixime</li> </ul>	<ul style="list-style-type: none"> <li>○ Erythromycin, azithromycin</li> <li>○ Trimethoprim</li> <li>○ Sulfonamides</li> <li>○ Cotrimoxazole</li> <li>○ Cloxacillin</li> </ul>	<ul style="list-style-type: none"> <li>○ Aminoglycosides - gentamicin, streptomycin</li> <li>○ Tetracycline, doxycycline</li> <li>○ Chloramphenicol</li> <li>○ Metronidazole</li> <li>○ Vancomycin</li> </ul>

**Treatment**

- Stop any other antibiotics if possible.
- Metronidazole 500 mg orally 3 times daily for 10 days.
- Relapse occurs in 5% to 30% of the patients diarrhoea associated with *C. difficile*.
- In very severe cases, colonic perforation may require surgical intervention.

**Prevention**

- Take contact isolation precautions if the patient is hospitalized; advise strict hand hygiene for the patient and caregiver.

**Diarrhoea with blood<sup>8,9</sup>**

Diarrhoea with blood is most commonly due to an infection. *Shigella* is the most common cause. Fever may be present and is more likely associated with shigellosis than amoebiasis. The patient's stool generally contains blood and mucous, is of relatively low volume, and may be associated with abdominal pain and tenesmus. Non-infectious inflammatory causes of bloody diarrhoea are significantly less common.

Acute presentation is more likely in:

- *Shigella*
- Other bacteria: *Campylobacter*, *Salmonella*, certain strains of *E. coli*
- *Entamoeba histolytica* (amoebiasis)
- *Schistosoma*
- *Balantidium coli*
- *Clostridium difficile* – post-antibiotic
- Viral haemorrhagic fevers such as Ebola
- other causes.

Persistent diarrhoea is more likely and (except for inflammatory bowel disease) more common in immunosuppressed patients. This includes:

- CMV
- mycobacterial infections including TB, MAC
- disseminated fungal infections
- Kaposi sarcoma
- inflammatory bowel disease.

<sup>8</sup> Guidelines for the control of shigellosis, including epidemics due to *Shigella dysenteriae* type 1. WHO, 2005. Available at <http://whqlibdoc.who.int/publications/2005/9241592330.pdf>

<sup>9</sup> Antibiotics in the management of shigellosis. *WHO Weekly Epidemiological Record*, 2004, 79:355–356. Available at <http://www.who.int/wer/2004/en/wer7939.pdf>

### Management of acute presentation of diarrhoea with blood (dysentery)


- Assess and manage fluid status and need for hospitalization (use the appropriate Fluid Plan A, B, or C above depending on the classification of dehydration).
  - The use of an effective antimicrobial against shigellosis alleviates the dysenteric syndrome, fever, and abdominal cramps, reduces the duration of pathogen excretion, interrupts disease transmission, and reduces the risk of potential complications. In ideal situations, a stool or rectal swab sample should be processed for laboratory confirmation of diagnosis and drug sensitivity testing before institution of antimicrobial therapy. However, this is rarely possible, and empirical antimicrobial therapy is instituted based on the knowledge of the antimicrobial resistance pattern of *Shigella* strains circulating locally.
  - Initiate treatment with an antibiotic with good local activity against *Shigella* (adjusting for local sensitivities and national guidelines). Possible antibiotics include:
    - ciprofloxacin 500 mg orally twice daily for 5 days (the oral form can be used for outpatients and hospitalized patients because of its excellent bioavailability).
    - If the patient is unable to take oral medications:
      - ◇ ciprofloxacin 400 mg IV twice daily for 5 days; OR
      - ◇ ceftriaxone 1 g IV daily for 5 days.
- Note: Widespread resistance has been reported to cotrimoxazole, ampicillin, and nalidixic acid.
- Reassess the patient 2 days after they start antibiotics, but advise them to return immediately if the diarrhoea becomes worse.
  - If there is no improvement:
    - consider resistance to first line *Shigella* treatment and amoebiasis. Give second antibiotic usually effective against *Shigella* locally.
  - If there is no improvement or the diarrhoea becomes worse, consider other causes. Obtain a stool culture and do stool microscopy for parasites and AFB.
  - After giving 2 different antibiotics that are usually effective against *Shigella* locally, but without clinical improvement, consider treating empirically for amoebiasis. See Section 11.1. If diarrhoea persists in PLHIV, see management below.
  - If the patient is severely ill and no definitive diagnosis is possible, start treatment for both amoebiasis and *Shigella*.






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### 8.3.3 Approach to persistent or chronic diarrhoea in PLHIV

Persistent diarrhoea is defined as having 3 or more loose stools a day, intermittently or continuously, for 14 days or more. It is a very frequent and frustrating problem in immunocompromised patients, and has a significant impact on quality of life. It is considered WHO clinical stage 3.

#### DDx: Persistent or chronic diarrhoea in HIV

Condition	In favour
<b>Protozoan infections</b>  <i>Isospora belli</i>	<ul style="list-style-type: none"><li>• Profuse watery diarrhoea</li><li>• Sudden onset of fever, abdominal pain, vomiting</li></ul>

cryptosporidiosis see sections 11.8	<ul style="list-style-type: none"> <li>• Weight loss</li> <li>• Might present as IRIS</li> <li>• Diagnosis by modified AFB of stool specimen</li> </ul>
<b>Microsporidiosis</b>  see Section 11.24	<ul style="list-style-type: none"> <li>• Chronic, watery, non-bloody diarrhoea; sometimes abdominal pain and cramping, nausea, vomiting, and weight loss</li> <li>• Can be associated with disseminated disease: cholecystitis and biliary tract infections, hepatitis and peritonitis, keratoconjunctivitis; infections of the lungs, muscles, and brain</li> </ul>
<b>Strongyloidiasis</b>  see Section 11.39	<ul style="list-style-type: none"> <li>• Diarrhoea associated with epigastric pain aggravated by food</li> <li>• Nausea, vomiting, constipation</li> <li>• GI bleeding, weight loss</li> <li>• Large worm loads and hyperinfection syndrome can occur in immunocompromised patients</li> </ul>
<b>HIV enteropathy</b> 	<ul style="list-style-type: none"> <li>• Only if all investigations are inconclusive</li> <li>• Diagnosis of exclusion</li> </ul>
<b>CMV</b>  see Section 11.10	<ul style="list-style-type: none"> <li>• Abdominal pain, weight loss, and (bloody or non-bloody) diarrhoea</li> <li>• Can be associated with other system involvement (oesophagitis, pancreatitis, gastritis, retinitis, CNS)</li> </ul>
<b>Mycobacterium</b>  MTB, MAC see Section 11.25	<ul style="list-style-type: none"> <li>• Can be associated with disseminated disease – prolonged fever and night sweats, wasting, enlarged liver and spleen, abdominal pain, symptoms of anaemia</li> <li>• Or with localized disease - generalized lymphadenopathy, papulo-pustular eruption on trunk and extremities</li> </ul>

### Key clinical features

- Generally watery with no blood or mucus.
- Accompanied by nausea, weight loss, abdominal cramps, fever, and dehydration.
- Identified infectious agent in about 50% of patients with HIV-associated diarrhoea.
- Causes in HIV patients include: *Cryptosporidia*, *Isospora*, microsporidia, and *Giardia*.
- In addition, mycobacteria, CMV, and disseminated fungal infections can cause persistent diarrhoea that may or may not be bloody.
- Invasive bacterial pathogens, such as *Campylobacter*, *Shigella*, and *Salmonella* species can cause severe and prolonged illness in immunocompromised patients, but are not a frequent cause of persistent diarrhoea.
- Intestinal tuberculosis can cause diarrhoea, especially in severely immunocompromised individuals who may also have constitutional symptoms such as fever and weight loss.

### Investigations

It is difficult to distinguish the different causative agents of persistent diarrhoea without stool culture. Therefore treat empirically.

- Stool microscopy and culture
- If you suspect tuberculosis infection, obtain a chest X-ray and an abdominal ultrasound.

## Empirical management

If there is persistent diarrhoea in immunocompromised patients, treat empirically with the 2-step approach below.

### Step 1

- Give cotrimoxazole 2 double strength (800/160 mg) or 4 single strength (400/80 mg) twice daily for 14 days, followed by 1 double strength twice daily for 3 weeks, then cotrimoxazole prophylaxis with 1 double strength daily; PLUS
- Give metronidazole 500 mg 3 times daily for 7 days.

### Step 2

- If no response, do stool investigations.
  - stool microscopy – 3 specimens on separate days
    - ◇ wet mount
    - ◇ ova and parasites stain (Giemsa)
    - ◇ modified AFB smear
    - ◇ AFB smear
  - stool culture.
- Give albendazole 400 mg twice daily for 5 days OR mebendazole 500 mg twice daily for 5 days.
- If appropriate investigations do not lead to the diagnosis of a specific cause in patients with HIV, start the patient on ART. Most patients will improve.
- Look for evidence of tuberculosis – consider empirical anti-tuberculosis treatment.
- Provide supportive and symptomatic care:<sup>10</sup>
  - Increase fluid intake to prevent dehydration.
  - Advise on special care of the rectal area. To prevent soreness, especially if incontinent, protect the perianal area with a simple ointment containing zinc oxide 15–20%; alternatively, protect the area with petroleum jelly (white soft paraffin).<sup>11</sup>
  - Advise on nutrition.
  - Monitor weight.

### Prevention

- The patient needs to pay attention to personal hygiene (hand washing), drink boiled water, eat thoroughly cooked meat, and eat cooked or thoroughly washed fruit and vegetables.
- The patient should take cotrimoxazole prophylaxis.

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<sup>10</sup> If there is still debilitating, chronic, or repeated severe diarrhoea in PLHIV, consider a constipating drug (do NOT give if there is blood in stool, if the patient has fever, is a child younger than 5, or is elderly). Although these indications are not included in the WHO EML, and do not have the support of randomized trials, patient and palliative health workers' experience support considering codeine 10 mg 3 times daily (up to 60 mg every 4 hours); or even morphine 2.5–5 mg orally every 4 hours in an ill patient, on an individual basis.

<sup>11</sup> *Palliative care: symptom management and end-of-life care*. WHO, 2004. Available at <http://www.who.int/hiv/capacity/modules/en/index.html>

## Protozoan infections

*Isospora belli* and cryptosporidiosis are the most common protozoal infections that cause persistent diarrhoea in immunocompromised patients, and are clinically indistinguishable. However, these infections have a different response to empirical therapy. Both organisms can be detected in the stool by using a modified acid-fast stain. See Section 11.18 for the management isosporiasis. ART for immune reconstitution is recommended for both and is the only effective treatment for cryptosporidiosis (see Section 11.8).

For *Strongyloides stercoralis*, see Section 11.32.

## HIV enteropathy

### Clinical features

Symptoms may be diarrhoea and weight loss. This is a diagnosis of exclusion.

### Treatment

AIDS enteropathy responds to ART.

## 8.4 Jaundice

Introduction	– DDx hepatic jaundice
8.4.1 Clinical approach to a patient with jaundice	– DDx post-hepatic jaundice
– Table: Laboratory findings used to classify jaundice	
– DDx pre-hepatic jaundice	8.4.2 When to report


Yellow discoloration of the skin, eyes, and mucous membranes is called jaundice or icterus. Jaundice occurs when levels of bilirubin in the blood are too high and it is deposited in the tissue. Bilirubin is a yellow pigment formed from the breakdown of haemoglobin. Jaundice can be detected clinically once bilirubin levels exceed 3 mg/dl (51.3 µmol/l).

This section discusses how to approach a patient presenting with jaundice and how to establish a differential diagnosis. Jaundice is always the result of an underlying process, and it is always important to evaluate for the underlying disease.

Bilirubin metabolism occurs in a 3-step process. Problems in any of these steps can lead to jaundice. The approach to a patient with jaundice requires an understanding of this process, as the 3 steps are used to categorize jaundice into 3 types, each with its own differential diagnosis.

- **Pre-hepatic/haemolytic** – Most bilirubin is produced from the breakdown of red blood cells. Bilirubin is then transported to the liver for conjugation.
  - Problems here include red blood cell haemolysis, resulting in increased unconjugated (indirect) bilirubin levels.
- **Hepatic** – Unconjugated (indirect) bilirubin is metabolized to conjugated (direct) bilirubin in the liver. Conjugation is required for the removal of bilirubin from the body.
  - Problems here include direct liver injury (hepatitis) resulting in a decreased capacity to metabolize bilirubin.
- **Post-hepatic/obstructive** – Once conjugated, bilirubin passes through the biliary ductal system to the gall bladder or is excreted into the intestine.
  - Post-hepatic problems (e.g. gall stones) may obstruct the flow of bile through the common bile duct causing conjugated hyperbilirubinaemia.

### 8.4.1 Clinical approach to a patient with jaundice

<b>Step 1:</b>	<b>Use Quick Check to assess the patient.</b> Make sure that the patient has no emergency or life-threatening conditions. Check for any signs or symptoms requiring urgent attention. Exclude shock and the complications of severe anaemia. If abdominal pain and fever are present, consider cholangitis. <i>Consider referral to or consultation with a specialist if urgent surgical intervention or further investigation is needed.</i>
<b>Step 2:</b>	<b>Take a history and examine the patient</b> looking for signs and symptoms of underlying or co-morbid disease.
<b>Step 3:</b>	<b>Assess HIV status.</b> 
<b>Step 4:</b>	<b>Classify jaundice – pre-hepatic, hepatic, or post-hepatic</b> (mixed pictures may occur).
<b>Step 5:</b>	<b>Perform investigations.</b>
<b>Step 5:</b>	<b>Initiate treatment and monitor the response.</b>

## History


- Duration of jaundice- recent (how long)?, chronic or recurrent (ever been jaundiced before?)
- associated symptoms:
  - itching of the skin
  - fever, pain (dull or colicky)
  - dark urine and pale stool – associated with post-hepatic jaundice
  - abdominal pain
  - anorexia, nausea, vomiting.
- Contact with a jaundiced patient:
  - viral hepatitis.
- Constitutional symptoms (fever, night sweats, weight loss, and loss of appetite) (these may be indicative of TB or malignancy)
- Symptoms of underlying infection suggesting sepsis as the cause.
- History indicating cardiac failure or ischaemic hepatitis
- History of a blood disorder- sickle cell disease or thalassemia
- History of travel to malaria endemic area
- Blood transfusions:
  - malaria, HBV, HCV, and HIV can be transmitted through unsafe blood transfusion.
- Tattoos and body piercing are risk factors for HCV
- Medications can be a cause- ask about both prescribed medicines (especially TB medications, ART) and over-the-counter (pain) medications, bush tea, traditional remedies, substance abuse (injecting pethidine, heroin, phenergan etc). Note: The time of onset of jaundice in relation to the start of the medication can be helpful in determining whether a drug can be the cause.
- Alcohol consumption- how much, for how long? Harmful alcohol use?
- Intravenous drug use or rituals like blood sucking - HBV, HCV
- Any past surgical or medical interventions especially biliary surgery
- Sexual activity-HBV
- Family history of jaundice
- Current or recent pregnancy.
- History of eating raw (minced) crab to cure jaundice (a local belief in some villages of Nepal that eating raw crab helps in healing bone fracture and to cure jaundice; associated with cases of paragonimiasis- see 8.2). Healthcare worker exposure after needlestick

## Examination

- Do a thorough examination of the liver:
  - Check for hepatomegaly (liver span of more than 12 cm along right mid-clavicular line or a palpable left lobe of the liver under the epigastrium).
  - Feel for tenderness (may indicate the presence of hepatitis or cholangitis or TB-IRIS of the liver).
  - Feel the consistency (soft or hard) and the surface of the liver (smooth or nodular). (Hard consistency is usually consistent with tumours and end stage cirrhosis).
  - Check for palpable gall bladder (suggestive of obstruction).
- Signs of chronic liver disease, including:

Note: It is not uncommon to see jaundice in the early stages of chronic liver disease.

  - white nails
  - clubbing
  - palmar erythema
  - large or small liver
  - spider angiomas
  - gynaecomastia
  - pedal oedema, ascites

- Signs of hepatic encephalopathy, including:
  - altered mood and behaviour
  - sleep disturbance
  - confusion, slurred speech, restlessness, and coma
  - hepatic foetor
  - asterixis (hand flap, flapping tremor).
- Generalized lymphadenopathy
- Associated splenomegaly
- Skin: scratch marks, bruises, pigmentation ulcers
- Assess nutritional status
- Signs of sepsis
- Signs of HIV infection (oral candida, oral hairy leukoplakia, lymphadenopathy) 
- Signs of cardiac failure: increased central venous pressure, cardiac rub, cardiac murmurs, tachycardia (could be a sign of shock), ascites, peripheral oedema
- To establish jaundice, inspect the sclerae under natural light. In dark-skinned individuals, the mucous membrane below the tongue can show jaundice and in fair-skinned individuals the skin can be yellow-coloured.
- Signs of anaemia – pale conjunctivae
- If anaemia or signs of chronic liver disease are present, consider gastrointestinal blood loss and perform a rectal examination and test stool for blood (see 7.2.17).

### Laboratory investigations

- Liver function tests (direct and indirect bilirubin, ALT, AST, ALP, GGT; *albumin and INR* to assess synthetic function).
  - Marked elevations of transaminases are seen in viral hepatitis and toxic liver injuries.
  - ALP usually increases in obstructive jaundice.
- Urine dipstick, urinalysis (to check for bilirubin and urobilinogen).
- FBC
  - Anaemia can indicate a GI bleed; also consider stool occult blood if this is a concern.
  - The platelet count can be low in patients with portal hypertension and splenomegaly, or in patients with severe sepsis and haemolysis.
- A blood smear looking for schistocytes or malaria.
- Rapid test for malaria

### Serologic tests for viral hepatitis A, B, C and E.

<b>Hepatitis A</b>	Anti-HAV IgM antibodies present within 10 days of the start of illness			
<b>Hepatitis B</b>	<b>Different serologic “markers” for hepatitis B are used to identify the different phases of the HBV infection such as acute or chronic HBV.</b>			
		HBs Ag (surface antigen)	anti-HBc (total core antibody)	anti-HBs (surface antibodies)
	Acute infection	+	+/-	-
	Chronic infection (carriage)	+	+	-
	Past infection (cured)	-	+	+
	Vaccinated	-	-	+
	Susceptible to infection*	-	-	-
HBs Ag (antigen) is a marker of carriage and thus contagiousness. Anti-HBc total antibodies is a marker of infection; Anti-HBs antibodies is a marker of recovery from a past infection or immunity due to vaccination. If there the Hepatitis B surface antigen (HBsAg) is positive, it is compatible with infection and it is helpful to check IgM anti-HBc. IgM positivity indicates acute infection (within past 6 months) as compared to chronic infection(IgM are negative, anti-HBc positive).				



	Anti-HBs antibodies is a marker of recovery from a past infection or immunity due to vaccination. * Vaccination for those susceptible to infection should be considered.
<b>Hepatitis C</b>	Anti-HCV antibodies can be detected within 6–8 weeks of the onset of illness.
<b>Hepatitis E</b>	Anti-HEV IgM

See Section 11.15 for further detail.

- Check *alpha-fetoprotein (AFP)* (increases in hepatocellular carcinoma and cirrhosis).
- An ultrasound, which can detect:
  - hepatomegaly, gallstones, dilatation of the bile duct, mass in the liver or pancreas, ascites, obstructed hepatic or portal circulation, features of abdominal TB, e.g. lymphadenopathy and splenic lesions.
  - look for normal collapsing of the inferior vena cava – absent in heart failure.

### Classification

A combination of liver function tests is needed to arrive at a possible diagnosis as no one of the individual tests can differentiate between the various diseases. The table below displays the results of liver function tests in jaundice. Nevertheless, it is important to remember that definitive diagnosis might require some additional work.

**Table: Laboratory findings used to classify jaundice**

	Pre-hepatic jaundice	Hepatic jaundice	Obstructive (post hepatic jaundice)
<b>Total bilirubin</b>	normal/increased	increased	increased
<b>Unconjugated (indirect) bilirubin</b>	<b>increased</b>	normal/increased	normal
<b>Conjugated (direct) bilirubin</b>	normal	normal/decreased	<b>increased</b>
<b>ALT and AST levels</b>	normal	<b>increased</b>	normal
<b>ALP level</b>	normal	normal	<b>increased</b>
<b>Serum albumin level</b>	normal	decreased	normal
<b>Urobilinogen</b>	increased	normal/increased	decreased/absent

Hepatitis E (HEV) has become the predominant type of acute hepatitis in Nepal both in adults and children, in sporadic and epidemic forms. Hepatitis E (HEV) outbreaks occur sporadically due to faecal contamination of water and poor sanitation, with a relatively high mortality rate (0.2–4%), which is particularly high in pregnant women (10–25%).<sup>1</sup> In Nepal, Hepatitis E outbreaks have occurred in 1973, 1981–1982, 1987, 1995 and 2014.<sup>2</sup> Outbreaks are either focal (a large number of cases occur over days to weeks in a well-defined small population) or epidemic<sup>3,4</sup>. During these outbreaks, a maternal mortality rate of 21–25% was reported. During an epidemic in Biratnagar in 2014, HEV IgM prevalence was as high as 94–100% in acute hepatitis patients.<sup>5</sup>

<sup>1</sup> Kamar N, Bendall R, Legrand-Abravanel F, Xia N-S, Ijaz S, Izopet J, Dalton HR. Hepatitis E. *Lancet*. 2012;379(9835):2477–88.

<sup>2</sup> Shrestha et al. Hepatitis E virus seroepidemiology: a post-earthquake study among blood donors in Nepal. *BMC Infectious Diseases* (2016) 16:707.

<sup>3</sup> Shrestha SM. Hepatitis E in Nepal. *Kathmandu Univ Med J*. 2006;4(4):530–44.

<sup>4</sup> Shrestha A, Lama TK, Karki S, Sigdel DR, Rai U, Rauniyar SK, et al. Hepatitis E Epidemic, Biratnagar, Nepal, 2014. *Emerg Infect Dis*. 2015;21(4):711–713. <https://dx.doi.org/10.3201/eid2104.141512>


<sup>5</sup> Ananta S, Thupten KL, Sneha K, Deepak RS, Utsav R, Shyam KR, Mamun A-M, Kazuaki T, Masahiro A, Sheikh MFA, et al. Hepatitis E Epidemic, Biratnagar, Nepal, 2014. *Emerg Infect Dis*. 2015;21(4):711.


Only the blood-borne viruses (B, C and D) cause chronic liver disease, leading to cirrhosis and liver cancer.



### DDx: Jaundice



Pre-hepatic	In favour
<b>Severe malaria</b> see Section 11.23	Fever Positive rapid test or blood smear Living in or travelled to an endemic area Lab – low Hb, low platelet, high bilirubin (mostly unconjugated)
<b>Haemolysis</b>	Evidence of haemolysis on blood smear (schistocytes) Predisposing conditions such as sickle-cell disease, G6PD, recent blood transfusion Urine – blood or urobilinogen Lab – low Hb, high bilirubin (mostly unconjugated), high LDH, low haptoglobin (Hp) <b>Inherited:</b> sickle-cell disease (may be mixed direct or indirect), G6PD deficiency, thalassaemias <b>Red blood cell destruction:</b> valvular and splenic disorders Medications causing haemolysis: e.g. AZT dapsone, ribavirin
<b>Inherited disorders:</b> Gilbert's syndrome, Crigler-Najjar syndrome	No other signs Increased bilirubin only – no other increased liver function tests
<b>Congestive heart failure</b>	History of right-sided heart failure, e.g. cor pulmonale May have massive hepatomegaly Lab – mild unconjugated hyperbilirubinaemia (although may be very high if CHF acute), high ALT and AST, but no more than 2–3 times ULN*
<b>HELLP syndrome (haemolysis, elevated liver enzymes, low platelets)</b>	Occurs in pregnancy, mostly in women with pre-eclampsia; usually in third trimester but may occur before or postpartum Abdominal pain, nausea, vomiting, malaise; may present with severe disease (DIC, abruption) Lab – haemolysis with characteristic helmet cells (schistocytes), platelets <100 000, LDH >600, AST >70


\* ULN = upper limit of normal

Hepatic jaundice	In favour
<b>Viral hepatitis A, B, C, or E</b> see Section 11.15 for prevention and management of acute hepatitis and, for B and C, chronic hepatitis  In PLHIV consider Herpes simplex virus and CMV- (see Sections 11.10), Epstein-Barr virus or medication	The clinical features of acute hepatitis are similar for all types of viral hepatitis: <ul style="list-style-type: none"> <li>• First: nausea, anorexia, vomiting, fatigue, malaise, headaches, muscle aches, sometimes fever.</li> <li>• Clinical jaundice develops 1–2 weeks later (yellow skin and eyes and dark urine)</li> <li>• Tender hepatomegaly</li> <li>• Lab: <ul style="list-style-type: none"> <li>○ High ALT and AST &gt;10 times ULN, predominantly conjugated bilirubin, positive hepatitis serology. The degree of elevation does not correlate well with the severity of disease.</li> <li>○ Elevated PT (prothrombin time). The degree of prolongation reflects the severity of the liver damage present.</li> <li>○ Low WBC at first, followed by an increase in lymphocytes.</li> </ul> </li> </ul>
- <b>Hepatitis A</b>	<b>Transmission:</b> Faecally contaminated water Person-to-person
- <b>Hepatitis B and C</b>	<b>Transmission:</b> Exposure to infected blood or body fluids through sexual contact, blood transfusions, reuse of contaminated needles and syringes, and transmission from mother to child

- <b>Hepatitis E</b> -	<b>Transmission:</b> Faecally contaminated water Person-to-person Acute hepatitis E can be severe, and results in fulminant hepatitis (acute liver failure) with risk of death.  Fulminant hepatitis occurs more frequently when hepatitis E occurs during pregnancy, particularly those in the second or third trimester, with increased risk of acute liver failure, fetal loss and mortality. Case fatality rates as high as 20–25% have been reported among pregnant women in their third trimester. There is a high risk of mother-to-child transmission.
<b>Scrub typhus- severe, untreated</b>	Untreated scrub typhus can cause multiorgan failure include liver and renal failure, pneumonitis/ARDS, encephalitis, hemorrhage. Jaundice is not listed as a feature in early disease.
<b>Leptospirosis- severe with complication “Weil’s disease”</b> - see Section 8.1.9	Leptospirosis may be complicated by jaundice and renal failure ("Weil's disease")
<b>Yellow fever</b> see Section 11.40	History travel to country with yellow fever (no history cases in Nepal)- Africa and South America Transmitted through bite of infected mosquito Fever, myalgia, severe headache, jaundice, bleeding
<b>Drug-induced liver injury</b>	Recent initiation of new medication, e.g. NVP, EFV, anti-TB treatment, fluconazole; paracetamol overdose Nausea, vomiting, abdominal pain Lab – high ALT >3 times ULN, conjugated bilirubin
<b>Toxin-induced liver injury</b> see Section 3.8	Recent consumption of a potentially toxic substance including mushrooms, herbs, traditional remedies, arsenic or grains contaminated with aflatoxin Nausea, vomiting, abdominal pain Lab – high ALT >10 times ULN
<b>Alcoholic liver disease</b>	History of alcohol use Stigmata of chronic liver disease Lab – conjugated bilirubin, AST/ALT ratio >2, elevated MCV and disproportionately high GGT Ultrasound may show small cirrhotic liver
<b>Non-alcoholic steatohepatitis (NASH)</b>	History of obesity, diabetes mellitus, medications including amiodarone, glucocorticoids, tetracycline, d4T Frequently asymptomatic Lab – AST/ALT ratio <1

<b>Bacterial sepsis</b> see Section 3.1.5	Fever, hypotension, sepsis Should rule out other causes: viral hepatitis, drug-related Lab – high ALT and AST >1000 along with very high LDH
<b>Hepatocellular carcinoma</b>	History of HBV, HCV, iron overload, or any other form of cirrhosis Hepatomegaly Wasting, cachexia Chest X-ray – pulmonary metastases Ultrasound – liver mass Lab – <i>high AFP</i>
<b>Metastases</b> in PLHIV consider  Kaposi sarcoma or lymphoma	Hard, irregular enlarged liver Evidence of primary tumour (breast lump, skin lesions) Lab – high ALP, mixed hyperbilirubinaemia Ultrasound – multiple masses
<b>Tuberculosis</b> In PLHIV also consider  atypical mycobacteria and periportal TB. Lymphadenopathy may also	Loss of weight, night sweats, malaise Pallor Hepatomegaly Lab – increased bilirubin, high ALP (obstructive or infiltrative lesions) Positive TB contact Ultrasound – hepatic abscesses, intra-abdominal lymphadenopathy

cause obstructive jaundice.	
<b>Ischaemic hepatitis</b>	Concurrent congestive heart failure, especially right-sided Symptoms similar to those of acute hepatitis Lab – increased ALT and AST >1000 along, with very high LDH
<b>Portal vein thrombosis –</b> decreased blood flow into the liver	History of cirrhosis, recent abdominal surgery, or hypercoagulable state Commonly presents with oesophageal or gastric variceal haemorrhage; massive splenomegaly may also be present Lab – liver function tests may be normal, low albumin
<b>Acute fatty liver of pregnancy</b> 	Usually during second half of pregnancy, third trimester most common; many women have preeclampsia Nausea, vomiting, abdominal pain, anorexia Lab – AST and ALT may be as high as 1000, may have decreased platelets, distinguishable from HELLP by increased coagulation studies, low glucose, high ammonia
<b>Intrahepatic cholestasis of pregnancy</b> 	Occurs in the second and third trimesters Intense pruritis; abdominal pain, and signs of liver failure are uncommon Lab – high ALP, normal GGT, AST and ALT may be >1000, high serum bile acids: increased cholic acid and chenodeoxycholic acid, increased cholic acid or chenodeoxycholic acid ratio Ultrasound usually normal
<b>Benign hyperbilirubinemia secondary to sickle-cell anaemia</b> see Section 10.15	History of recurrent episodes that resolve spontaneously Known sickle-cell disease Very high conjugated hyperbilirubinemia Lab – mild elevation of ALT

<b>Post-hepatic (obstructive)</b>	<b>In favour</b>
<b>Cholangitis, cholecystitis, or pancreatitis</b> see Section 10.5a	Right upper quadrant abdominal pain that is worse after eating Fever, chills, rigors Tender hepatomegaly Lab – high WBC, increased ALP, high AST and ALT, high amylase, high conjugated bilirubin Ultrasound – hepatomegaly, gall stones, thickened gall bladder wall, dilated common bile duct
<b>Cholestasis –</b> gallstone, head of pancreas tumour	Pruritis and dark urine Epigastric mass or palpable gall bladder Lab – high conjugated bilirubin, high ALP Ultrasound – dilated common bile duct, enlarged gall bladder, mass
<b>AIDS cholangiopathy –</b>  cryptosporidium. Also CMV, microsporidium, and cyclospora.	Right upper quadrant or epigastric abdominal pain, diarrhoea Lab – CD4 <100, high ALP, high GGT, mildly increased AST and ALT Ultrasound useful, but <i>cholangiography</i> is diagnostic
<b>Biliary parasitosis</b> (some may also be intrahepatic): <i>Ascaris lumbricoides</i> , <i>Clonorchis sinensis</i> , <i>Fasciola hepatica</i> , <i>Echinococcus granulosus</i> , schistosomiasis)	High index of suspicion in all patients in endemic areas presenting with biliary colic Lab – eosinophilia Stool microscopy may detect eggs or parasites Abdominal X-ray may reveal large collections of worms Ultrasound can image the biliary tree
<b>Budd-Chiari syndrome</b> (hepatic vein or inferior vena cava thrombosis) – decreased blood flow out of liver	Associated with haematological malignancies Commonly present with ascites, hepatomegaly Variable increased AST and ALT, high ALP <i>Ultrasound with Doppler</i> most useful

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## 8.4.2 When to report

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Report suspect viral hepatitis  
Report suspect yellow fever  
See Section 9 for suspect case definitions.

Also report any cluster of cases of acute jaundice of unknown cause.

## 9. Notifiable diseases- identification, reporting and response

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## 9. Notifiable diseases- identification, reporting and response

### 9.1 Surveillance systems in Nepal

There are 5 sources for Nepal surveillance of acute diseases. This manual emphasizes preparing clinician's for event reporting:

1. EWARS
2. **Event reporting of diseases requiring immediate reporting**
3. Immunizable disease surveillance system for 5 conditions: acute flaccid paralysis, measles, neonatal tetanus, Japanese encephalitis/acute encephalitis syndrome, diphtheria
4. HMIS
5. Malaria disease information system (SMS based)

In addition, there are surveillance systems for diseases which may have an acute presentation but require long-term treatment with longitudinal patient monitoring over time:

6. Tuberculosis
7. HIV
8. Non-communicable diseases

#### Suspected diseases or conditions for immediate (event) reporting to EDCD

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>• Influenza/influenza-like illness</li><li>• SARI</li><li>• SARI- suspect MERS CoV, human avian influenza</li><li>• Encephalitis- suspect Nipah</li><li>• Pneumonic plague</li><li>• Acute gastroenteritis- 5+ cases</li><li>• Cholera</li><li>• Meningococcal meningitis</li><li>• Dengue</li><li>• Viral hemorrhagic fever- severe dengue, possible CCHF</li></ul> | <ul style="list-style-type: none"><li>• Leptospirosis</li><li>• Brucellosis</li><li>• Kala azar</li><li>• Hepatitis- Acute jaundice</li><li>• Yellow fever</li><li>• Anthrax</li><li>• Rabies</li><li>• Animal bites</li><li>• Food poisoning</li><br/><li>• Any unusual cluster of illness or deaths or<ul style="list-style-type: none"><li>• Illness/death followed by illness/death of a health worker</li></ul></li></ul> |
|--|--|

These overlap with diseases or events of international concern which are specified by International Health Regulations (2005) for immediate notification by Nepal and all other countries which have signed the IHR treaty:

- *human influenza due to a new subtype*<sup>†</sup>
- *SARS*<sup>†</sup>
- *smallpox*<sup>†</sup>
- *Any public health event of international or national concern (infectious, zoonotic, food-borne, chemical, radio nuclear, or due to an unknown condition).*

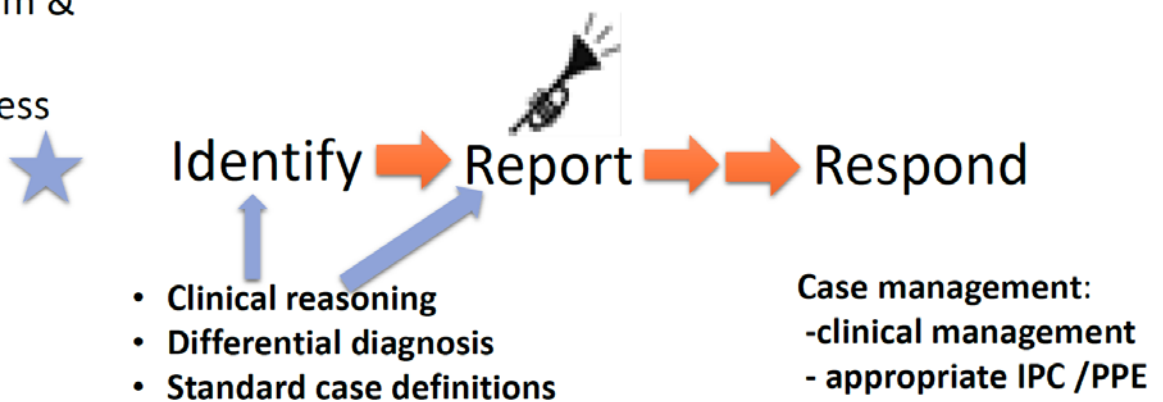


## 9.2 Clinician's role in disease surveillance and response

The hospital clinical team plays a crucial role in early identification of reportable diseases and should be able to report findings in a consistent, timely, and clear manner, and then assist as needed in the outbreak investigation and responding to surveillance feedback. As the primary health care providers for patients requiring hospitalization in a district, the district hospital clinical team will be first to notice patients presenting in **unusually large numbers** or with **unusually severe disease** or **the first case of a disease that has epidemic potential**. In conjunction with community health workers and health centers, information gained from district hospitals is a crucial part of surveillance systems.

Notifiable diseases with epidemic potential are particularly important to identify promptly and report. Clinicians need to consider the patient's signs and symptoms, but also history of exposure and risk factors and whether an outbreak is occurring.

Clinical team &  
hospital  
preparedness



## Case management flowchart

### Clinical screening, triage for severity, full exam

- **Screening** before triage- if Ebola or other epidemic-prone disease in district
- **Triage** assessment for severity- ETAT for children, Quick Check for adolescents and adults
- **Full exam** for signs/symptoms, according to findings, and history:
- **History of exposure, risk factors.**
- Ask: Is anyone else in your family sick?

### Local epidemiology awareness:


- **What is happening in your district/nearby?**
- Is there an **outbreak? Any other unusual clinical cases?**



### Differential diagnosis (DDx)- what are the possible diagnoses?

Further clinical exam

#### Laboratory tests

- Point of care
- Hospital lab
- Lab tests to send out
- **How does patient compare to standard case definitions?**
- **Discuss/report if possible immediately reportable notifiable disease** 



### Clinical management


- Choice of empirical treatment(s)
- Standardized management of shock and severe respiratory illness
- **Clinical monitoring** using severely ill patient monitoring form

### Infection prevention and control:

- Always use standard precautions.
- **Add additional precautions as appropriate (such as contact, droplet, or airborne precautions; appropriate PPE; isolation)**



### Reassess:

- **Clinical progression, response to treatment**
- **Lab results**
- **Further information** (discuss with other clinicians, district staff)
- **Possible/probable diagnoses—**  **report if this is a notifiable disease**


CORE SURVEILLANCE AND RESPONSE FUNCTIONS AND ACTIVITIES IN HEALTH FACILITIES- see clinical activities marked with asterick\*\*

<p><b>STEP 1: IDENTIFY**</b></p>	<ul style="list-style-type: none"> <li>• Know when to suspect notifiable diseases; perform a differential diagnosis**</li> <li>• Use standard case definitions to detect, confirm, and record priority diseases or conditions**</li> <li>• Collect and transport specimens for laboratory confirmation**</li> <li>• Use local laboratory capacity to confirm cases or initiate confirmation of cases if possible**</li> </ul>
<p><b>STEP 2: REPORT**</b></p>	<ul style="list-style-type: none"> <li>• Report case-based information for immediately notifiable diseases- call EDCD**</li> <li>• Report summary EWARS data</li> <li>• Report laboratory results from screening of sentinel populations</li> <li>• Report laboratory results to next level</li> </ul>
<p><b>STEP 3: ANALYZE AND INTERPRET</b></p>	<ul style="list-style-type: none"> <li>• Prepare and periodically update graphs, tables, and charts to describe time, person, and place for reported diseases and conditions.</li> <li>• From the analysis, report immediately any disease or condition that             <ul style="list-style-type: none"> <li>• Exceeds an action threshold**</li> <li>• Occurs in locations where it was previously absent**</li> <li>• Presents unusual trends or patterns**</li> </ul> </li> <li>• Interpret results, initiate public health actions with local authorities.**</li> </ul>
<p><b>STEP 4: INVESTIGATE AND CONFIRM</b></p>	<ul style="list-style-type: none"> <li>• Take part in investigation of reported outbreaks</li> <li>• With lab staff, appropriately and safely collect, package, store, and transport specimens for laboratory confirmation** (see Section 7.1)</li> </ul>
<p><b>STEP 5: RESPOND**</b></p>	<ul style="list-style-type: none"> <li>• Manage cases and contacts according to standard case management guidelines (use the Nepal IMAI DCM and Child Hospital Book)**</li> <li>• Link with contact tracing</li> <li>• Take relevant infection prevention and control measures**</li> </ul>
<p><b>STEP 6: COMMUNICATE (FEEDBACK)</b></p>	<ul style="list-style-type: none"> <li>• Communicate with community members about outcome of reported cases and prevention activities</li> <li>• Risk communication</li> </ul>
<p><b>STEP 7: EVALUATE</b></p>	<ul style="list-style-type: none"> <li>• Assess community participation</li> <li>• Conduct self-assessment on the surveillance and response activities</li> <li>• Monitor and evaluate programme targets and indicators for measuring quality of the surveillance system.</li> <li>• Monitor and evaluate timeliness of response to outbreaks</li> <li>• Monitor and evaluate prevention activities and modify them as needed</li> </ul>
<p><b>STEP 8: PREPARE**</b></p>	<ul style="list-style-type: none"> <li>• Participate in disaster and emergency preparedness and management committees</li> <li>• Participate in Rapid Response training**</li> <li>• Prepare hospital- prepare to manage cases and infection control, by season**</li> <li>• <b>Prepare a set up for screening and an isolation ward**</b></li> <li>• Conduct risk mapping of potential hazards</li> <li>• Conduct training of community</li> <li>• Participate in simulation exercises**.</li> </ul>

## 9.3 Identifying and reporting notifiable diseases<sup>1,2</sup>; Nepal priority diseases list

In the table, suspected diseases for ***immediate reporting*** are **bolded and in italics**. The 5 Immunization Preventable Diseases with IPD surveillance are followed with an asterick.\*

All priority diseases in Nepal for surveillance and reporting- draft from 23 September 2018 adaptation workshop		
Epidemic prone diseases	Diseases targeted for eradication or elimination	Others of public health importance
<ul style="list-style-type: none"> <li>• <b><i>Dengue</i></b></li> <li>• <b><i>Acute haemorrhagic fever syndrome- severe dengue, CCHF, imported Ebola</i></b></li> <li>• <b><i>Anthrax</i></b></li> <li>• Chikungunya</li> <li>• <b><i>Cholera</i></b></li> <li>• <b><i>Acute gastroenteritis- 5+ cases</i></b></li> <li>• Encephalitis*</li> <li>• <b><i>Encephalitis- like Nipah</i></b></li> <li>• <b><i>Leptospirosis</i></b></li> <li>• Enteric fever</li> <li>• Scrub typhus</li> <li>• <b><i>Meningococcal meningitis</i></b></li> <li>• <b><i>Pneumonic plague</i></b></li> <li>• <b><i>Influenza like illness</i></b></li> <li>• <b><i>SARI</i></b></li> <li>• <b><i>SARI-- like MERS CoV</i></b></li> <li>• <b><i>Yellow fever</i></b></li> <li>• Diphtheria*</li> <li>• Whooping cough</li> <li>• Mumps</li> </ul>	<ul style="list-style-type: none"> <li>• <b><i>Kala-azar</i></b></li> <li>• Leprosy</li> <li>• Lymphatic filariasis</li> <li>• Malaria falciparum- <b><i>immediate if severe and complicated</i></b></li> <li>• Malaria vivax</li> <li>• Neonatal tetanus*</li> <li>• <b><i>Acute flaccid paralysis*</i></b></li> <li>• <b><i>Measles*/measles like illness</i></b></li> </ul>	<ul style="list-style-type: none"> <li>• <b><i>Hepatitis- acute jaundice syndrome</i></b></li> <li>• <b><i>Brucellosis</i></b></li> <li>• <b><i>Food poisoning</i></b></li> <li>• <b><i>Rabies</i></b></li> <li>• <b><i>Animal bite</i></b></li> <li>• Snake bite</li> <li>• Tetanus</li> </ul> <div style="margin-top: 20px;"> <ul style="list-style-type: none"> <li>• TB</li> <li>• HIV</li> </ul> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 20px;">                     Separate longitudinal reporting systems                 </div> </div>

Immediate notification of suspicion or diagnosis of epidemic-prone disease, followed by weekly reporting during the epidemic period, is very important. The district clinician should diagnose and manage the patient, use available data to initiate action at the local level, and immediately notify regional and national authorities. Nurse- or health assistant-led clinical teams at the health centre level may call the district clinician to report suspicious cases that require further investigation and reporting. The differential diagnosis tables throughout this manual present case definitions that can help to identify reportable diseases, as well as a reference to this Section. In this manual, notifiable diseases are marked with a trumpet:  .

<sup>1</sup> *Technical guidelines for integrated disease surveillance and response in the African Region*. WHO and Centers for Disease Control and Prevention, 2010. Available at <http://www.afro.who.int/en/clusters-a-programmes/dpc/integrated-disease-surveillance/ids-publications.html>

<sup>2</sup> EDCD surveillance guidelines [insert reference]

Some Nepal priority notifiable diseases have never occurred in Nepal. Yellow fever is yet to be reported from any country in SEARO but the vector (*Aedes aegypti*) is present plus a large susceptible population, so the “risk of disease emergence and spread is real.”<sup>3</sup>

CCHF has occurred in India and Bangladesh (and in nearby Pakistan and Afghanistan) and the vector (different species of the *Hyalomma* tick) occurs in Nepal as well as Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Myanmar and Thailand. Some overlap in the clinical presentation and laboratory abnormalities between dengue with hemorrhagic signs and CCHF could delay diagnosis.<sup>8</sup>

New infections such as SARI due to human avian influenza and MERS-CoV remain a concern. Movement of human populations to the Middle East for Haj pilgrimage and Umrah and back; and tourism between the Middle East and the SEA Region could aid in spread of MERS-CoV infection. Limited human–human transmission has been reported, usually with nosocomial clusters.<sup>8</sup>

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<sup>3</sup> WHO SEARO: Roots for resilience: a health emergency risk profile of the South-East Asia Region, 2017.

## 9.4 Suspect standard case definitions for some Nepal notifiable diseases (several also include confirmed case definitions)

<b>Cholera (d)</b>	Any person aged 3 years or more with moderate or severe dehydration from 3 or more episodes of acute watery diarrhoea per day (24 hours), with or without vomiting.
<b>Acute Gastroenteritis (AGE) (a)</b>	Acute watery diarrhoea (passage of 3 or more loose or watery stools in 24 hours) with or without dehydration
<b>Enteric fever (typhoid) (a)</b>	High fever with diarrhoea
<b>Influenza-like illness (n) <sup>5</sup></b>	an acute respiratory illness with a measured temperature of $\geq 38^{\circ}\text{C}$ and cough, with onset within the past 10 days
<b>Severe Acute Respiratory Infection (SARI) (n) <sup>6</sup></b>	an acute respiratory illness with a history of fever or measured fever of $\geq 38^{\circ}\text{C}$ and cough, with onset within the past 10 days, requiring hospitalization
<b>SARS-CoV</b>	<ul style="list-style-type: none"> <li>• Fever <math>&gt;38^{\circ}\text{C}</math> <b>PLUS</b></li> <li>• One or more symptom of lower respiratory tract illness- cough, breathlessness <b>PLUS</b></li> <li>• Radiological infiltrate consistent with pneumonia or ARDS, or autopsy finding consistent with pneumonia or ARDS without identifiable cause <b>PLUS</b></li> </ul> No alternate diagnosis to explain the illness
<b>MERS-CoV</b>	Above with travel history to the Middle East or Korea
<b>Nipah virus (NiV) disease (b)</b>	A person fulfilling both of the following criteria. <ol style="list-style-type: none"> <li>1. Features of acute encephalitis:               <ol style="list-style-type: none"> <li>a. Acute onset of fever AND</li> <li>b. Evidence of acute brain dysfunction manifested as                   <ol style="list-style-type: none"> <li>i. Altered mental status OR</li> <li>ii. New onset of seizures OR</li> <li>iii. Any other neurological deficit</li> </ol> </li> </ol> </li> <li>2. Epidemiological linkage               <ol style="list-style-type: none"> <li>a. Drinking raw date palm sap OR</li> <li>b. Occurring during Nipah season OR</li> <li>c. Patient from Nipah endemic area</li> </ol> </li> </ol>
<b>Crimean Congo Hemorrhagic Fever (CCHF) (b)</b>	A person with sudden onset of illness with high grade fever $>38.5^{\circ}\text{C}$ for $>72$ hours and $<10$ days especially in endemic area and among those in contact with sheep and other livestock.
<b>Brucellosis (i)</b>	<b>Clinical case definition:</b> An illness characterized by acute or insidious onset of fever and one or more of the following: night sweats, arthralgia, headache, fatigue,

<sup>5</sup> J Fitzner et al: Revision of clinical case definitions: influenza-like illness and severe acute respiratory infection. *Bull World Health Organ* 2018;96:122–128.

<sup>6</sup> J Fitzner et al: Revision of clinical case definitions: influenza-like illness and severe acute respiratory infection. *Bull World Health Organ* 2018;96:122–128.

	<p>anorexia, myalgia, weight loss, arthritis/spondylitis, meningitis, or focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly).</p> <p><b>Suspected case:</b> a case that is compatible with the clinical description and is epidemiologically linked to suspected/confirmed animal cases or contaminated animal products.</p>
<b>Plague (k)</b>	<p><b>Suspected case:</b> Any person with sudden onset of fever, chills, headache, severe malaise, prostration and very painful swelling of lymph nodes, or cough with blood stained sputum, chest pain, and difficulty in breathing.</p> <p><b>Confirmed case:</b> Suspected case confirmed by isolation of <i>Yersinia pestis</i> from blood or aspiration of buboes, or epidemiologic link to confirmed cases or outbreak.</p>
<b>Scrub typhus (a)</b>	<p><b>Suspect case definition:</b> Acute undifferentiated febrile illness of 5 days or more with or without eschar should be suspected as a case; if eschar is present, fever of less than 5 days duration should be considered as scrub typhus.</p> <p><b>Probable case:</b> A suspected clinical case with an IgM titer &gt; 1:32 and/or a four-fold increase of titers between two sera confirm a recent infection.</p>
<b>Leptospirosis (h)</b>	High fever with severe myalgia localized to calf muscles with conjunctival congestion/ or subconjunctival haemorrhage with or without oliguria or jaundice in a person with history of contact to contaminated water.
<b>Kala-azar (visceral leishmaniasis) (a)</b>	<p>A person from an endemic area with fever of more than two weeks duration and with splenomegaly.</p> <p>(Confirmed case: by an RDT or a biopsy).</p>
<b>Dengue (a)</b>	An acute febrile illness of 2-7 days duration with 2 or more of the following: headache, retro-orbital pain, myalgia, arthralgia, rash, haemorrhagic manifestations, leucopenia
<b>Chikungunya (h)</b>	<p>Acute onset of fever &gt;38.5°C and severe arthralgia/arthritis not explained by other medical conditions</p> <p>(probable if also meets epidemiological criteria: Residing or having visited epidemic areas, having reported transmission within 15 days prior to the onset of symptoms)</p>
<b>Malaria (a)</b>	<p>An acute febrile case from malaria endemic area or with travel history within a month.</p> <p>Confirmed—with malaria microscopy or RDT</p>
<b>Severe malaria (a)</b>	A person requiring hospitalization for signs and/or symptoms of severe malaria (hyperpyrexia, prostration, severe anaemia, a change of behavior or confusion, convulsions or coma), who receives anti-malarial treatment
<b>Meningococcal meningitis (k)</b>	<p><b>Suspect case:</b> Any person with sudden onset of fever (&gt;38.5°C rectal or 38.0°C axillary) and one of the following signs: neck stiffness, altered consciousness or other meningeal signs.</p> <p><b>Confirmed case:</b> A suspected case confirmed by isolation of <i>N. meningitidis</i> from CSF or blood.</p>
<b>Invasive meningococcal disease (IMD) (l)</b>	<p>PROBABLE IMD CASE: Clinical diagnosis of meningitis or septicemia and at least one of the following:</p> <ul style="list-style-type: none"> <li>• purpuric rash where IMD is considered the most likely cause (linked to confirmed cases with other causes of haemorrhagic rash excluded or considered less likely)</li> <li>• gram-negative diplococci identified from any normally sterile site (blood, CSF) or from a purpuric skin lesion</li> <li>• <i>N. meningitidis</i> antigen detection (for example, by latex agglutination testing) from any normally sterile site or from a purpuric skin lesion.</li> </ul>

	(IMD surveillance is based on laboratory findings or a characteristic haemorrhagic rash, there is no suspected case definition.)
<b>Yellow fever (k)</b>	<p><b>Suspected case:</b> Any person with acute onset of fever, with jaundice appearing within 14 days of onset of the first symptoms.<sup>7</sup> (From WHO surveillance: Haemorrhagic manifestations and signs of renal failure may occur.)</p> <p><b>Probable case:</b> A suspected case <b>AND</b> One of the following</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Epidemiological link to a confirmed case or an outbreak</li> <li><input type="checkbox"/> Positive post-mortem liver histopathology</li> </ul>
<b>Viral hepatitis (k)</b>	<p><b>Suspected case:</b> Any person with acute illness typically including acute jaundice, dark urine, anorexia, malaise, extreme fatigue, and right upper quadrant tenderness. (Note: infected children are often asymptomatic.)</p> <p><b>Confirmed case:</b> A suspected case that is laboratory confirmed</p>
<b>Acute flaccid paralysis (c)</b>	<p>An AFP case is any case of acute flaccid paralysis in a person under 15 years of age for any reason other than severe trauma. Paralytic illness in a person of any age in which polio is suspected should also be reported.</p> <p>“Acute flaccid paralysis means that paralysis is of acute onset (&lt; 4 days from onset of weakness to paralysis) and the affected limb or limbs are flaccid, i.e. floppy or limp. Tone is diminished as evidenced by examination by palpation or passive movement of joints, but sensation is not affected.</p> <p><b>Acute</b> : Rapid evolution from onset of weakness to paralysis. <b>Flaccid</b> : Floppy, not stiff or spastic. <b>Paralysis</b> : Inability to move affected part.</p> <p>This excludes adults, spastic paralysis, old cases or cases with obvious causes (trauma). However, “Occasionally, poliomyelitis may occur in older children or adults. AFP surveillance focuses on children aged &lt;15 years. In order to capture the occasional case that may occur in older children, any case of AFP regardless of age should be reported and investigated if poliomyelitis is suspected.”</p>
<b>Measles (usually child but case definition includes adolescent and adult) (c)</b>	<p>Any person with <b>generalized maculo-papular rash and fever</b> plus one of the following: <b>cough</b> or <b>coryza (runny nose)</b> or <b>conjunctivitis (red eyes)</b> <b>OR</b> Any person in whom a clinician suspects measles</p>
<b>Acute encephalitis syndrome (AES) (c)</b>	<p>a person of any age, in any geographical region, at any time of year with the acute onset of fever and a change in mental status (including symptoms such as confusion, disorientation, coma, or inability to talk) AND/OR new onset of seizures (excluding simple febrile seizures). (Surveillance identifies patients with AES—amongst these, lab tests for JE infection)</p>
<b>Neo-natal tetanus (c)</b>	<p><b>Suspect care:</b> Any neonatal death between 3-28 days of age in which the cause of death is unknown <b>OR</b></p> <ul style="list-style-type: none"> <li>• Any neonate reported as having suffered from neonatal tetanus between 3-28 days of age and not investigated</li> </ul> <p><b>Confirmed case:</b></p> <ul style="list-style-type: none"> <li>• Any neonate with normal ability to suck and cry during first two days, AND</li> </ul>

<sup>7</sup> WHO AFRO and CDC Atlanta: Technical guidelines for integrated disease surveillance and response in the African region, 2010



	<ul style="list-style-type: none"> <li>• Who between 3-28 days of age cannot suck or cry normally, AND</li> <li>• Who has convulsions or spasms triggered by minimal stimuli such as light, noise, or touch OR who has signs of stiffness and rigidity, which include any of the following: trismus, clenched fists or feet, continuously pursed lips, curved back (opisthotonus)</li> </ul>
<b>Non-neonatal tetanus-maternal, older children and adults (m)</b>	<p>any person &gt; 28 days of age with acute onset of at least one of the following:</p> <ul style="list-style-type: none"> <li>• trismus (lockjaw),</li> <li>• risus sardonicus (sustained spasm of the facial muscles) or</li> <li>• generalized muscle spasms (contractions).</li> </ul>
<b>Diphtheria (e)</b>	<p><b>Suspect:</b> an illness of the upper respiratory tract characterized by the following:</p> <ul style="list-style-type: none"> <li>• pharyngitis, nasopharyngitis, tonsillitis or laryngitis</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• adherent pseudomembrane of the pharynx, tonsils, larynx and/or nose.</li> </ul> <p>A diphtheria pseudomembrane is an exudate that is greyish, thick, firmly adherent and patchy to confluent. Dislodging the pseudomembrane is likely to cause profuse bleeding.</p>
<b>Whooping cough (f)</b>	<p><b>Suspect:</b> a person of any age with a cough lasting <math>\geq 2</math> weeks, or of any duration in an infant or any person in an outbreak setting, without a more likely diagnosis and with at least one of the following symptoms, based on observation or parental report:</p> <ul style="list-style-type: none"> <li>• paroxysms (fits) of coughing</li> <li>• inspiratory whooping</li> <li>• post-tussive vomiting, or vomiting without other apparent cause</li> <li>• apnea (only in &lt; 1 year of age)</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• clinician suspicion of pertussis.</li> </ul>
<b>Mumps (g)</b>	<p><b>Suspect:</b> a person with acute onset of unilateral or bilateral tender, swelling of the parotid or other salivary gland that lasts two or more days and without other apparent cause (parainfluenza virus, Epstein Barr virus, influenza A virus, HIV and non-infectious causes), or clinical suspicion of mumps because of other mumps-associated symptoms (aseptic meningitis, encephalitis, hearing loss, orchitis, oophoritis, mastitis, pancreatitis) unexplained by another more likely diagnosis.</p>

Sources:

- a) EDCD EWARS guidelines
- b) *Infectious Disease Control Guideline*. Government of Nepal and Ministry of Health of Population, 2016. Available at <http://www.edcd.gov.np/resources/download/infectious-disease-control-guideline>
- c) Government of Nepal Ministry of Health and Population, Department of Health Services and World Health Organization Programme for Immunization Preventable Diseases (IPD): *Field Guide for Surveillance of Vaccine Preventable diseases*. Kathmandu Nepal 2010

Where no suspect case definitions were available in EWARS, the Nepal Infectious Diseases guideline or the IPD:

- (d) Nepal MOH- EDCD National Preparedness and Response Plan for Acute Gastroenteritis/Cholera Outbreaks in Nepal July 2017 to July 2022 AD
- (e ) Diphtheria in WHO Vaccine-Preventable Diseases Surveillance Standards, 2<sup>nd</sup> edition, 2018
- (f) Pertussis in WHO Vaccine-Preventable Diseases Surveillance Standards, 2<sup>nd</sup> edition, 2018
- (g) Mumps in WHO Vaccine-Preventable Diseases Surveillance Standards, 2<sup>nd</sup> edition, 2018
- (h) WHO SEARO Chikungunya
- (i) WHO and UNAIDS: WHO Recommended Surveillance Standards. Second edition. WHO/CDS/CSR/ISR/99.2
- (j) WHO SEARO: Roots for resilience: a health emergency risk profile of the South-East Asia Region, 2017.
- (k) WHO AFRO and CDC Atlanta: Technical guidelines for integrated disease surveillance and response in the African region, 2010.
- (l) Meningococcus in WHO Vaccine-Preventable Diseases Surveillance Standards, 2<sup>nd</sup> edition, 2018
- (m) Non-neonatal tetanus in WHO Vaccine-Preventable Diseases Surveillance Standards, 2<sup>nd</sup> edition, 2018
- (n) Influenza in WHO Vaccine-Preventable Diseases Surveillance Standards, 2<sup>nd</sup> edition, 2018

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## 9.5 When to report (single case or cluster), to whom, how to send reports

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- diseases where a single suspected case should be reported urgently (and to whom);
- diseases where a cluster of cases should be reported (and to whom);
- how reports are sent, e.g. telephone call, text message, email, radio, messenger, paper, web site.

Contacts for reporting and samples:

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