MEDICAL FIRST AID GUIDE FOR USE IN ACCIDENTS INVOLVING DANGEROUS GOODS (MFAG)

Chemicals Supplement
to the
International Medical Guide for Ships
(IMGS)

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IMO

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FOREWORD

The IMO/WHO/ILO MEDICAL FIRST AID GUIDE FOR USE IN ACCIDENTS INVOLVING DANGEROUS GOODS (MFAG) takes into account all amendments to the International Maritime Dangerous Goods (IMDG) Code up to and including Amendment No. 22-84, and revised chapter VII of the 1983 amendments to SOLAS 1974 which enter into force on 1 July 1986. This Guide will be further amended as and when necessary to reflect amendments made to the IMDG Code.

This Guide is the Chemicals Supplement to the International Medical Guide for Ships (IMGS) which is under preparation by the World Health Organization (WHO), Geneva.

ABBREVIATIONS

BC Code	= Code of Safe Practice for Solid Bulk Cargoes
EmS	= Emergency Schedule
ILO	= International Labour Organisation
IMDG Code	= International Maritime Dangerous Goods Code
IMGS	= International Medical Guide for Ships
IMO	= International Maritime Organization
MFAG	= Medical First Aid Guide for Use in Accidents Involving Dangerous Goods
N.O.S.	= Not Otherwise Specified
UN No.	= United Nations number assigned to dangerous goods most commonly carried
WHO	= World Health Organization

CONTENTS

1 INTRODUCTION

1.1 The IMO/WHO/ILO MEDICAL FIRST AID GUIDE FOR USE IN ACCIDENTS INVOLVING DANGEROUS GOODS (MFAG) is supplementary to the ILO/IMO/WHO International Medical Guide for Ships (IMGS). The advice given in this Guide refers to the chemicals, substances and other dangerous goods covered by the IMO International Maritime Dangerous Goods Code (IMDG Code), and the materials covered by Appendix B of the IMO Code of Safe Practice for Solid Bulk Cargoes (BC Code). This Guide should be used in conjunction with the information provided in the IMDG Code, the BC Code and the IMO Emergency Procedures for Ships Carrying Dangerous Goods (EmS). This Guide is intended to provide advice necessary for diagnosis and treatment of chemical poisoning within the limits of the facilities available on board ship.

1.2 Information on the treatment of illnesses which are of a general nature and not predominantly concerned with chemical poisoning may be found in the IMGS.

1.3 Minor accidents involving chemicals do not usually cause severe effects provided that the appropriate first aid measures described in this Guide are taken. Although the number of reported serious accidents is small, accidents involving those chemicals which are toxic or corrosive may be dangerous, and must be regarded as being potentially serious until either the affected person has completely recovered, or medical advice to the contrary has been obtained. Any person suffering from chemical poisoning should be seen by a doctor at the next port of call.

1.4 Within this Guide, the chemicals are grouped into tables according to their chemical properties (section 9). There may be a variable degree of toxicity within a group. In the rare circumstances where a chemical could not be classified in an appropriate table according to its chemical properties, it has been assigned to a table which is consistent with the toxic medical effects to be expected from poisoning by that chemical.

1.5 The tables themselves give general information about the particular group of chemicals, and indicate the toxic effects likely to be encountered. The treatment recommended in this Guide is specified in either the appropriate section or the appropriate table. However, differences exist between countries on certain types of treatment and where these differences occur they are indicated in the relevant national medical guide.

1.6 In those circumstances where it is suspected, but not known for certain, that a patient is suffering from chemical poisoning, reference should be made to section 4 (Diagnosis of Poisoning) of this Guide.

2 HOW TO USE THIS GUIDE

2.1 The General Index (alphabetical) of Dangerous Goods of the IMDG Code includes references to EmS numbers and MFAG Table numbers.

2.2 As the United Nations number (UN No.) has already been assigned to virtually all dangerous goods carried by all modes of transport and is used on shipping documents, an additional numerical index of UN Nos (Table of UN numbers with corresponding IMDG Code Page, EmS and MFAG table numbers) is also included in the IMDG Code.

2.3 If the proper shipping name (correct technical name or chemical name) or the UN No. of the particular chemical is known, reference to either the alphabetical index or the numerical index of the IMDG Code, as appropriate, will give the MFAG Table No. of the chemical.

2.4 If the name or the UN No. is not known but the type of chemical is known, the appropriate MFAG Table No. can be identified by consulting the index of chemical tables in Section 10 of this Guide.

2.5 Examples of the entries for FORMIC ACID in the indexes of the IMDG Code are given hereunder.

GENERAL INDEX

SUBSTANCE or ARTICLE	IMDG CODE PAGE	UN No.	CLASS	Packaging Group	Subsidiary Risk Label(s)	EmS No.	MFAG Table No.
FORMIC ACID	8168	1779	8	II	—	8–05	700

NUMERICAL INDEX

UN No.	...9	
177	8168	IMDG Code Page No.
	8–05	EmS No.
	700	MFAG Table No.

1 The numerical index has been compiled to enable users who know the UN No. of a given chemical to find the corresponding page in the IMDG Code (IMDG Code Page

No.), the Emergency Schedule (EmS No.) and the Medical First Aid Guide Table (MFAG Table No.).

2 For the purposes of the numerical index, the UN No. has been broken down into two parts. The three-digit figures in the left-hand column of the index indicate the first three digits of the UN No. The single-digit figures shown in the top line of the index indicate the last digit of the UN No.

3 The numbers of the IMDG Code Page, the EmS and the MFAG Table where the information for a chemical covered by a given UN No. appears, will be found in the box at the intersection of the horizontal lines and the vertical column corresponding to the two parts of the UN No. as described above.

3 MEDICAL ADVICE RELATING TO THE DANGERS OF THE CARRIAGE OF CHEMICALS BY SHIPS

3.1 The officers and crew of a ship regularly carrying chemicals ought to have been trained in the general hazards involved and should be aware, therefore, of the necessary precautions to be observed. Equally they should have been instructed about the safety rules and the first aid procedures to be used in case of an accident.

3.2 In the case of other ships it is essential that before a chemical is handled, the officers and crew involved should be advised by the master of the hazards of the particular chemical and the action to be taken in the event of an accident. The dangers of smoking, drinking, taking food or being under the influence of alcohol or drugs whilst handling chemicals should be emphasized.

3.3 If during the handling of chemicals, any person shows signs or symptoms suggestive of poisoning, he should be taken off the work, given treatment in accordance with the advice given in this Guide and seen as soon as possible by a doctor. In the case of poisoning whilst at sea medical advice by radio should be sought if so advised in this Guide, but in any event the patient should be seen by a doctor at the next port of call. It should also be remembered that help might also be available from another ship if there is one within the vicinity with a physician or other trained person on board.

3.4 It is important to decide on priorities of treatment when there has been more than one route of exposure. In the tables of section 9 the phrase "**IMMEDIATE ACTION IS REQUIRED**" has been used to indicate the route of exposure that should be treated first. It will rest with the person giving treatment to decide in individual cases whether the effects of another route of exposure has more priority because of threat to the life of the patient.

4 DIAGNOSIS OF POISONING

4.1 GENERAL PRINCIPLES

The diagnosis of poisoning may be simplified if one or more of the following factors point to the probable cause:

- The circumstances of the incident, e.g. a leakage of chemicals
- The nature of the illness, and its relationship in time to recent exposure to a chemical
- More than one person is involved and all develop a similar illness.

It must be realized however that:

- The effects of some poisons resemble those of natural illness, e.g. vomiting and diarrhoea, or collapse.
- Because a ship is carrying a cargo of chemicals it does not follow that the cause of the illness is that cargo, and, unless there is evidence of a leakage, it is improbable.
- Different individuals may be exposed to the poison at different times, or to a different extent during a single episode, and they may as a result become ill at different times or to differing degrees.
- Individuals react differently to poisons according to their health, constitution, and to how much of the poison they were exposed.

In a typical case of poisoning, three stages of the illness may be distinguished:

1 *The Latent Stage* – This is the interval of time from the moment of entry of a poison into the body until the first symptoms (feelings) or signs are apparent. These usually occur rapidly after exposure, but in some cases there may be a delay of several hours before they develop. In very rare instances with specific chemicals, the symptoms and signs may be delayed for some days. If the latter is the case, it will be indicated in the appropriate table of section 9.

2 *The Active Stage* – The signs and symptoms of the poisoning are apparent. In many cases these are common to a great number of different chemicals which therefore have to be treated in a general way. If there are specific signs and symptoms associated with a particular chemical, these will be mentioned in the appropriate table of section 9. Chemicals can either act locally at the point of contact with the body, or be absorbed from the point of contact causing more general symptoms. This is particularly true of chemicals which can cause local skin irritation, but are also absorbed through the skin to produce general, or specific, toxic symptoms and signs. The same principle is true for other routes of entry into the body, although general symptoms are less likely to occur with eye contact.

The main routes of exposure are:

- Skin contact.
- Eye contact.
- Inhalation – into the mouth, nose, throat and lungs.
- Ingestion – swallowed chemicals.

The general symptoms of poisoning include:

- Headache
- Nausea and vomiting.
- Drowsiness.
- Changes in mental behaviour.
- Unconsciousness.
- Convulsions.
- Pain

Signs of severe poisoning are:

- A rapid and weak pulse.
- Grey or blue colour of the skin
- Severe difficulty in breathing.
- A prolonged period of unconsciousness.

3 *The Late Stage* – The signs and symptoms usually resolve after a few hours in the majority of incidents, particularly if the degree of exposure is small. If a greater amount is absorbed or the period of exposure is prolonged, or the chemical is very toxic, symptoms may persist for some hours or even days. The patient's condition may deteriorate due to complications, the most common of which are:

- Asphyxia (see 6.1.1)
- Pulmonary oedema (see 6.1.2)
- Bronchitis (see 6.1.3)
- Pneumonia (see 6.1.4)
- Heart failure (see 6.2.2)
- Circulatory collapse (see 6.2.1)

- Liver failure (see 6.4.5)
- Kidney failure (see 6.5.1).

Death may occur despite treatment.

4.2 SPECIFIC DIAGNOSIS

It is important, if possible, to identify the chemical involved. If it is known, the appropriate table in section 9 will list the signs and symptoms together with the treatment.

If the chemical is not known, the first thing to do is to look carefully at the patient having determined the main route of exposure (see 4.1.2) and decide whether it was:

.1 *Corrosive (irritant)*

There will be severe pain and redness, blistering or burns where the chemical made contact.

Examine the mouth, lips, chin and underneath contaminated clothing. If a corrosive chemical is suspected, this should be treated as appropriate to the type of exposure.

The patient may develop:

- Pulmonary oedema (see 6.1.2)
- Circulatory collapse (see 6.2.1)
- Bleeding from the intestine (see 6.4.3)
- Severe chemical burns (see 6.7)

.2 *Non-corrosive*

The signs stated above are missing. The chemical may nevertheless be dangerous, and symptoms and signs as described in 4.1 should be looked for.

Remember that many gases, e.g. carbon monoxide, carbon dioxide and refrigerants seldom have a smell to warn you of their presence.

General first aid measures should be used in treatment as appropriate to the area of the body affected (see section 5).

5 FIRST AID

5.1 INTRODUCTION

First aid aboard ship is the treatment necessary for minor casualties or to enable a casualty to be transported to the ship's hospital or to a cabin for further treatment as appropriate to the conditions described in section 6.

Anyone aboard ship may find a casualty. The action priorities, the positioning of an unconscious casualty and the giving of artificial respiration are basic knowledge that any seaman should possess in order to save life until more qualified help arrives. Emergency treatment for the different routes of exposure to a chemical, as set out in section 8, should be studied in order to be familiar with the principles in the event of an accident.

IT IS IMPORTANT THAT EVERY SEAFARER SHOULD KNOW WHAT TO DO AT ONCE IN THE EVENT OF AN ACCIDENT.

It is the responsibility of the master to ensure that NO ONE ENTERS an enclosed space unless he is a trained member of a rescue team acting upon instruction.

Casualties who have been poisoned by a chemical should rest quietly in a cabin and be observed for at least 24 h, in case any complications as listed in section 6 develop.

5.2 PRIORITIES

On finding a casualty:

- Look after yourself; do not become the next casualty.
- If necessary, remove the casualty from danger or remove danger from the casualty (but see note below on a casualty in an ***enclosed space***).
- Use a breathing apparatus if there is any suspicion of toxic gases or fumes in the area.

IF ONLY ONE UNCONSCIOUS CASUALTY (irrespective of the total number of casualties):

- Give immediate treatment to the unconscious casualty only; and
- Then send for help.

IF MORE THAN ONE UNCONSCIOUS CASUALTY:

- Send for help; and
- Then start giving appropriate treatment to the worst casualty in the order of:
  1. stopped breathing/heart; and
  2. unconscious.

IF THE CASUALTY IS IN AN ENCLOSED SPACE

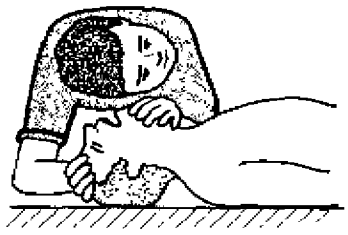
- **DO NOT ENTER** the enclosed space unless you are a trained member of a rescue team acting upon instruction.
- Send for help and inform the master

It MUST be assumed that the atmosphere in the space is hostile The rescue team MUST NOT enter unless wearing breathing apparatus which must also be fitted to the casualty as soon as possible The casualty must be removed quickly to the nearest safe adjacent area outside the enclosed space unless his injuries and the likely time of evacuation makes some treatment ***essential*** before movement.

5.3 UNCONSCIOUS CASUALTY

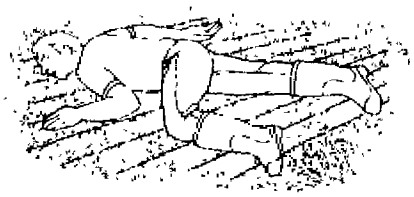
5 3 1 ASSESSMENT OF BREATHING AND HEART FUNCTION

Assessment of breathing



Tilt the head firmly backwards as far as it will go to relieve obstructed breathing Remove dentures if worn Clear out any vomit in the mouth if present Listen and feel for any movement of air, because the chest and abdomen may move in the presence of an obstructed airway, without moving air. The rescuer's face should be placed close to the casualty's nose and mouth so that any exhaled air may be felt against the cheek. Also the rise and fall of the chest can be observed and the exhaled breath heard

If breathing, place casualty in the unconscious position



Turn casualty face down, head to one side or other as pictured.
(NOTE no pillows should be used under the head). Now pull up the leg and the arm on the side to which the head is facing. Then pull up the chin Stretch the other arm out as pictured. The subsequent treatment of an unconscious person is described in 6.3.1.

Assessment of heart function

Feel pulse at wrist and neck.

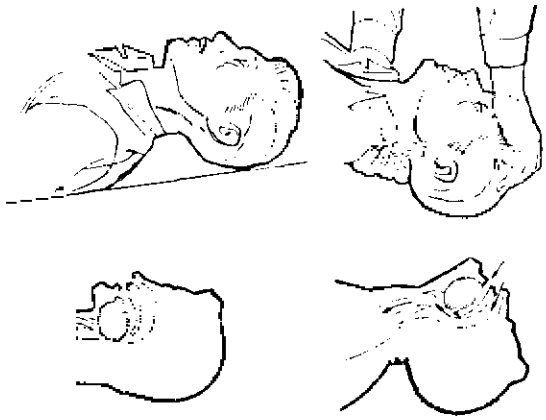
Quickly check the carotid (neck) pulse by placing the tips of the two fingers of one hand into the groove between the windpipe and the large muscle at the side of the neck.

The carotid pulse normally is a strong one; if it cannot be felt or is feeble, there is insufficient circulation

5.3.2 NOT BREATHING BUT HEART HAS NOT STOPPED

Airway

Establishing an OPEN AIRWAY IS THE MOST IMPORTANT STEP IN ARTIFICIAL RESPIRATION. Spontaneous breathing may occur as a result of this simple measure. Place the patient in a face-up position on a hard surface. Put one hand beneath the patient's neck and the other hand on the forehead. Lift the neck with the one hand, and apply pressure to the forehead with the other to tilt the head backward. This extends the neck and moves the base of the tongue away from the back of the throat. **The head should be maintained in this position during the entire artificial respiration and heart compression procedure.** If only one rescuer is available the head should be fixed in the shown position by means of a rolled blanket or similar object pushed under the patient's shoulders. If the airway is still obstructed, any foreign material in the mouth or throat should be removed immediately with the fingers.



Closed Open

Breathing

If the patient does not resume adequate, spontaneous breathing promptly after his head has been tilted backward, artificial respiration should be given by mouth-to-mouth or mouth-to-nose method or other techniques. Regardless of the method used, preservation of an open airway is essential.

Mouth-to-mouth respiration

- Keep the patient's head at a maximum backward tilt with **one hand** under the neck

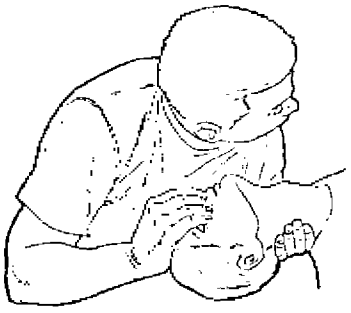
- Place the heel of **the other hand** on the forehead, with the thumb and index finger towards the nose. Pinch together the patient's nostrils with the thumb and index finger to prevent air from escaping. Continue to exert pressure on the forehead with the palm of the hand to maintain the backward tilt of the head.

- Take a deep breath, then form a tight seal with your mouth over and around the patient's mouth.

- Blow four quick, full breaths in first without allowing the lungs to deflate fully. Then, continue the procedure.

- Watch the patient's chest while inflating the lungs. If adequate respiration is taking place, the chest should rise and fall.

- Remove your mouth and allow the patient to exhale passively. If in the right position, the patient's exhalation will be felt on your cheek.

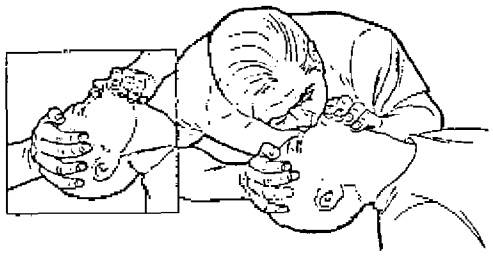


- Take another deep breath, form a tight seal around the patient's mouth and blow into the mouth again. Repeat this procedure 10 to 12 times a minute, once every 5 seconds, for adults and children over 4 years.

- If there is no air exchange, and an airway obstruction exists, reach into the patient's mouth and throat, to remove any foreign matter from there with your fingers; and resume artificial respiration. A foreign body should be suspected if you are unable to inflate the lungs, despite proper positioning and a tight air seal around the mouth, or nose.

Mouth-to-nose respiration

The mouth-to-nose technique should be used when it is impossible to open the patient's mouth, when the mouth is severely injured, or a tight seal around the lips cannot be obtained.



- Keep the patient's head tilted back with one hand. Use the other hand to lift up the patient's lower jaw to seal the lips

- Take a deep breath, seal your lips around the patient's nose, and blow in forcefully and smoothly until the patient's chest rises. Repeat quickly 4 times

- Remove your mouth and allow the patient to exhale passively.

- Repeat the cycle 10-12 times per minute.

Alternative method of artificial respiration (Silvester method)

In some instances, mouth-to-mouth respiration cannot be used. For instance, certain toxic and caustic materials present a hazard to the rescuer. The mouth-to-mouth method should be avoided if the casualty has corrosive burns around his mouth or if he has ingested or inhaled any toxic substance, but especially one of the following.

Cyanide (Tables 215 and 645)

Hydrogen sulphide (Table 640)

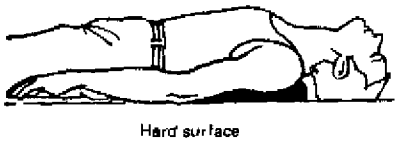
Hydrocarbons (Table 310)

Petroleum and petroleum products (Table 311)

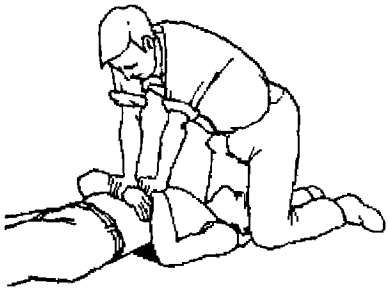
Chlorinated hydrocarbons (Table 340)

This section describes an effective alternative method of artificial respiration, the Silvester Technique. However, this method is much less effective than those previously described, and it should only be used when "mouth-to-mouth" technique cannot be used.

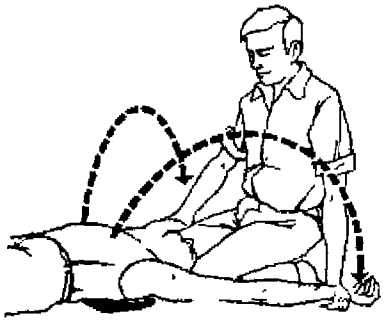
- Lay the patient on his back on a firm surface. Raise his shoulders under a cushion, folded jacket or in some other way



– Kneel astride the patient's head. If necessary, turn his head to one side to clear out the mouth. Grasp his wrists, cross them over the lower part of his chest



– Rock your body forward and press down on the patient's chest. Release the pressure and, with a sweeping movement, draw the patient's arms backwards and outwards as far as possible. Repeat this procedure rhythmically (12 times per minute). Keep the mouth clear.



Artificial respiration should be continued for 2 hours if necessary; longer if there are signs of life.

533 NOT BREATHING AND HEART STOPPED

Heart compression (external cardiac compression) should be applied together with artificial respiration throughout any attempt to resuscitate a patient whose breathing and heart have stopped. Unless circulation is restored the brain will be without oxygen and the person will suffer cerebral damage within 4-6 minutes, and may die.

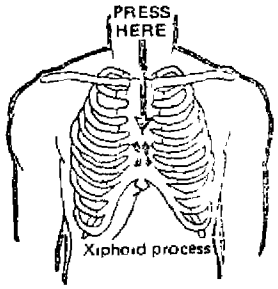
Artificial respiration will bring oxygen-containing air to the lungs of the victim. But from there, oxygen is transported with circulating blood to the brain and to other organs. And the effective heart compression will – for some time – artificially restore the blood circulation, until the heart starts beating.

Technique for heart compression

Compression of the sternum produces some artificial ventilation, but not enough for adequate oxygenation of the blood. For this reason, artificial respiration is always required whenever heart compression is used

Effective heart compression requires sufficient pressure to depress the patient's lower sternum about 4-5 cm (in an adult). **For heart compression to be effective, the patient must be on a firm surface. If he is in bed, a board or improvised support should be placed under his back However, chest compression must not be delayed to look for a firmer support.**

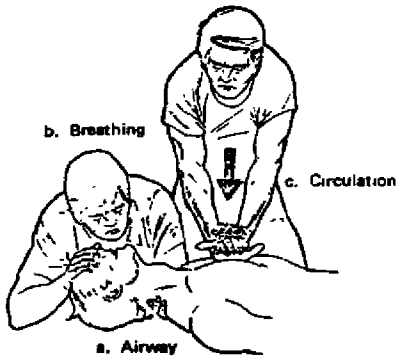
Kneel close to the side of the patient and place only the heel of one hand over the lower half of the sternum. Avoid placing the hand over the tip (xiphoid process) of the breastbone which extends down over the upper abdomen Pressure on the xiphoid process may tear the liver and lead to severe internal bleeding.



Feel the tip of the sternum and place the heel of the hand about 4 cm toward the head of the patient. Your fingers must never rest on the patient's ribs during compression. This increases the possibility of rib fractures.

- Place the heel of the other hand on top of the first one.
- Rock forward so that your shoulders are almost directly above the patient's chest.
- Keep your arms straight and exert adequate pressure almost directly downward to depress an adult's lower sternum 4-5 cm.

  Depress the sternum 60 times per minute for an adult (when two rescuers are used). This is usually rapid enough to maintain blood flow, and slow enough to allow the heart to fill with blood. The compression should be regular, smooth, and uninterrupted, with compression and relaxation being of equal duration. **Under no circumstance should compression be interrupted for more than 5 seconds.**



Two-rescue heart compressions and artificial respiration:

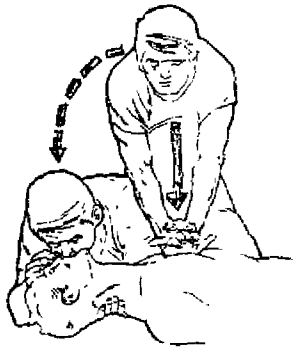
- Five heart compressions:
  - At rate of 60 per minute
  - No pause for ventilation
- One respiration:
  - After each 5 compressions
  - Interposed between compressions

Two rescuers preferred

It is preferable to have **two rescuers** because artificial circulation must be combined with artificial respiration The most effective artificial respiration and heart compression are achieved by giving one lung inflation quickly after each five heart compressions (5:1 ratio). The **compression rate should be 60 per minute for two rescuers.** One rescuer performs heart compression while the other remains at the patient's head, keeps it tilted back, and continues rescue breathing (artificial respiration) **Supplying the breaths without any pauses in heart compression is important, because every interruption in this compression results in a drop of blood flow and blood pressure to zero.**

Single rescuer

A **single rescuer** must perform both artificial respiration and artificial circulation using a 15:2 ratio The head should be kept in the shown position by means of a rolled blanket or similar object pushed under the patient's shoulders. **Two very quick lung inflations should be delivered after each 15 chest compressions, without waiting for full exhalation of the patient's breath A rate equivalent to 80 chest compressions per minute must be maintained by a single rescuer** in order the achieve 50 to 60 actual compressions per minute because of the interruptions for the lung inflations



One rescuer cardiopulmonary resuscitation (CPR):

- Fifteen heart compressions at rate of 80 per minute.
- Two very quick lung inflations

Checking effectiveness of heart compression: pupils and pulse

Check the reaction of the pupils: a pupil that narrows when exposed to light indicates that the brain is receiving adequate oxygen and blood. If the pupils remain widely dilated and do not react to light, serious brain damage is likely to occur soon or has occurred already. Dilated but reactive pupils are less threatening.

The carotid (neck) pulse should be felt after the first minute of the heart compression and artificial respiration and every 5 minutes thereafter. The pulse will indicate the effectiveness of the heart compression or the return of a spontaneous effective heartbeat. (See 5.3 1)

Other indicators that show this effectiveness are the following:

- Expansion of the chest each time the operator blows air into the lungs.
- A pulse which can be felt each time the chest is compressed.
- Return of colour to the skin.
- A spontaneous gasp for breath.
- A return of a spontaneous heartbeat.

Terminating heart compression

Deep unconsciousness, the absence of spontaneous respiration, and fixed, dilated pupils for 15 to 30 minutes indicate cerebral death of the patient, and further efforts to restore circulation and breathing are usually futile.

In the absence of a physician, artificial respiration and heart compression should be continued until

- the heart of the patient starts beating again and breathing is restored,
- the patient is transferred to the care of a doctor, or other health personnel responsible for emergency care;
- the rescuer is unable to continue because of fatigue

5 3 4 SUMMARY OF POINTS TO BE REMEMBERED WHEN APPLYING ARTIFICIAL RESPIRATION AND HEART COMPRESSION

Don't delay. Place patient on his back on a hard surface.

Step 1. ***Airway*** – If unconscious, open the airway; thereafter make sure it stays open

Lift up neck.

Push forehead back.

Clear out mouth with fingers.

Step 2 ***Breathing*** – If not breathing, begin artificial respiration.

Mouth-to-mouth or mouth-to-nose respiration.

Before beginning artificial respiration check carotid pulse in neck. It should be felt again after the first minute of artificial respiration and checked every 5 minutes thereafter. Give four quick breaths and continue at a rate of 12 inflations per minute.

Chest should rise and fall. If it does not, check to make sure the patient's head is tilted as far back as possible. If necessary, use fingers to clear airway.

Step 3. ***Circulation*** – If pulse is absent, begin heart compression.

If possible, use two rescuers. **Don't delay.**

One rescuer can do the job.

Locate pressure point (lower half of sternum).

Depress sternum 4-5 cm (60 to 80 times per minute)

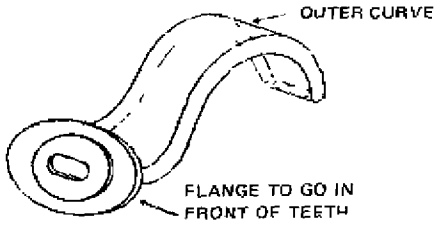
If **one rescuer** – 15 heart compressions and 2 very quick lung inflations

If **two rescuers** – 5 heart compressions and 1 lung inflation.

Pupils of eyes should be checked during heart compression. A pupil that constricts on exposure to light shows that the brain is getting adequate blood and oxygen.

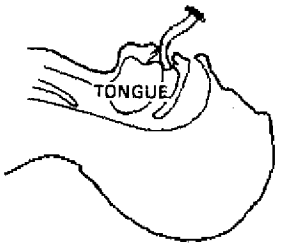
5.4 INSERTION OF GUEDEL AIRWAY

This airway is for use in an unconscious patient who is breathing on his own, but with great difficulty. The function of the airway is to ensure a clear passage between the lips and the back of the throat.



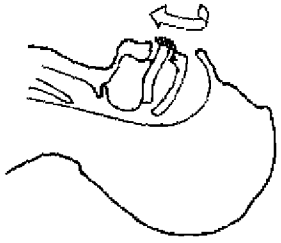
First remove any dentures and suck or swab out any blood or vomit which is in the mouth in order to clear the air passage. Then, with the head fully back, slide the airway gently into the mouth with the outer curve of the airway towards the tongue. This operation will be easier if the airway is wetted.

If there is any attempt by the patient to gag, retch or vomit, it is better not to proceed with the insertion of the airway. If necessary, try again later to insert it.

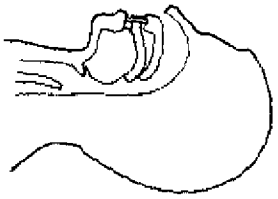


HEAD TILTED
RIGHT BACK

Continue to slide the airway in until the flange of the airway reaches the lips. Then, rotate the airway through 180° so that the outer curve is towards the roof of the mouth.



Bring the jaw upwards and push the airway in until the flange at the end of the airway is outside the teeth (or gums) and inside the lips. If necessary tape one or both lips so that the end of the airway is not covered by them.



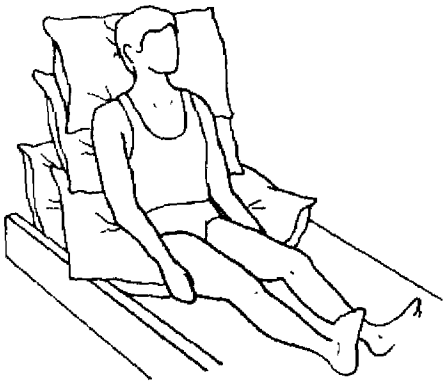
Check now that the patient's breath is coming through the airway. Continue to keep the jaws upwards and the head fully back so that the airway will be held in place by the teeth or gums and by its shape.

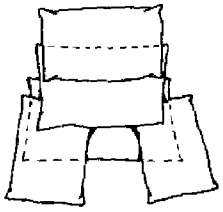
As the patient regains consciousness, he will spit out the airway

He should remain in the unconscious position under constant observation until he is *fully* conscious If he relapses into unconsciousness it may be necessary to reinsert the airway if breathing is still difficult.

5 5 THE HIGH SITTING POSITION

The following position should be used for the casualty who is conscious, but having difficulty in breathing, whatever the cause. It is very important that a casualty who shows signs of pulmonary oedema should be placed in this position.





5.6 MORPHINE ADMINISTRATION

Morphine is a very strong pain relieving drug which should be used with care It should be given only where specifically advised in this Guide or on the instruction of a doctor giving advice by radio.

- Give 7.5 mg (half an ampoule) intramuscularly as the first dose
- If there is no pain relief within 30 minutes, give a further 7 5 mg (half an ampoule) intramuscularly.
- A dose of 7 5 mg (half an ampoule) may be repeated every four hours if there is persistent pain

This drug should be given with caution if there is shortness of breath. It depresses breathing activity if too much is given, or the casualty is sensitive to it. The following signs indicate overtreatment with morphine·

- Shallow and slow breathing.
- Irregular breathing pattern
- Development of unconsciousness if the casualty was conscious at first.
- Small pin-point pupils of the eyes.

If these signs are present **RADIO FOR MEDICAL ADVICE.**

You may be advised by the doctor to give Naloxone which counteracts these side effects of morphine. The usual procedure is.

- Give 0.8 mg Naloxone intramuscularly
- There should be an improvement within 15 minutes if the patient's condition is due to morphine.
- If there is a response, give 0.8 mg Naloxone intramuscularly every hour until the casualty recovers from the above signs.

6 THE COMPLICATIONS OF POISONING

6.1 THE RESPIRATORY SYSTEM

Warning: Morphine must *NOT* be given to any patient who has been gassed, especially by an irritant gas.

6.1.1 ASPHYXIA

Asphyxia (suffocation) causes a lack of oxygen in the blood. It has many causes other than those arising from chemical poisoning. The latter are principally:

- The air passage may be blocked by vomit, blood or secretions.
- Obstruction to breathing in the throat or the air passage through spasm of the air tubes or by swelling of the linings of the voice box due to irritant fumes.
- Fluid in the lung air spaces (pulmonary oedema – see 6.1.2) caused by irritant fumes, e.g. ammonia or chlorine.
- Poisoning of the blood which prevents the carriage or use of oxygen in the body caused by e.g. carbon monoxide, cyanides, or aniline.
- Poisoning of the mechanisms of breathing in the chest (e.g. by organophosphate pesticides), or the brain (e.g. by chlorinated hydrocarbons).
- Gases which do not support life because they replace oxygen in the atmosphere, e.g. carbon dioxide, nitrogen, hydrogen.

Diagnosis

- There is difficulty in breathing with an increased rate at first (over 30 per minute). Later it may become slow and stop.
- The pulse is rapid, usually over 100 per minute.
- There is blueness of the skin with purple lips and tongue.
- The patient may be agitated at first but later become apathetic, with muscular weakness. Unconsciousness may follow this.
- The pupils of the eyes will react to light at first. If they become large and do not react to light, life is in danger.

Treatment

- The emergency treatment as described in 8.3 should be given.

- Continue to give oxygen (see 8.3.1) until the patient is breathing without difficulty and has a healthy pink colour.
- Give any special treatment if recommended for that particular chemical in the appropriate table of section 9.

If the patient becomes increasingly breathless, finds difficulty in lying flat, and coughs up a lot of frothy sputum, he may be beginning to suffer from pulmonary oedema (6.1.2).

6.1.2 PULMONARY OEDEMA

Pulmonary oedema is the term used when the lung air spaces become filled with tissue fluid, so that the patient is drowning in his own secretions.

Apart from immediate asphyxia, this is the most serious and dangerous complication of many types of poisoning. It is particularly common after:

- Inhalation of irritant gases or fumes.
- Inhalation of stomach contents whilst the patient is vomiting.

The patient may develop pulmonary oedema at any time up to 48 hours after the initial poisoning.

Diagnosis

The onset may be immediate after exposure to a chemical. However the patient may recover but then begins to feel unwell again.

The symptoms and signs are likely to be:

- Difficulty in breathing.
- Increase in breathing rate to 30–40 per minute.
- Cough with the production of frothy sputum, which is sometimes pink in colour with flecks of blood.
- Difficulty in lying flat.
- Gurgling noise in the throat when the patient is breathing.
- Blue discolouration of the skin.
- Mental agitation and fright.
- Severe sweating.

If the pulmonary oedema is severe, the patient may show signs of circulatory collapse (see 6.2.1):

- Convulsions may occur (see 6.3.2).

- Unconsciousness may follow the onset of pulmonary oedema within a few minutes.
- Breathing and the heart may both stop suddenly

Treatment

If unconscious

- Place the patient in the unconscious position (see 5 3)
- Insert a Guedel airway (see 5 4)
- Give oxygen continuously until the patient recovers (see 8.3.1).
- Give furosemide (frusemide) 40 mg intramuscularly at once to increase the amount of urine passed
- If there is no improvement after 30 minutes, give a further 40 mg furosemide (frusemide) intramuscularly

  Use a sucker, if available, to help get rid of the frothy secretions
- If breathing and the heart both stop, give artificial respiration and heart compression (see 5 3)

If conscious:

- Place the patient in the high sitting up position (see 5 5)
- Give oxygen continuously (see 8 3.1) until he recovers
- Give furosemide (frusemide) 80 mg by mouth at once.
- If there is no improvement after 30 minutes, give a further 40 mg by mouth.

  Give 40 mg by mouth twelve hours later
- A sucker, if available, may help to get rid of the frothy secretions if the patient cannot cough or spit it out.

RADIO FOR MEDICAL ADVICE IN ALL CASES OF PULMONARY OEDEMA.

This is a serious condition, and every effort should be made to get medical help on board, or transfer the patient to hospital if there is no rapid improvement in the symptoms and signs after treatment or if unconsciousness persists for more than a few minutes

Patients who have had pulmonary oedema should be kept in bed at rest for a minimum of 48 hours *after* they appear to be completely recovered, even if the illness has been slight.

If the sputum becomes green or yellow following an attack of pulmonary oedema, the patient may be developing bronchitis or pneumonia. This should be treated as described (see 6.1 3 and 6 1 4)

6.1.3 **BRONCHITIS**

Bronchitis is an inflammation of the bronchi, which are the branches of the windpipe inside the lungs. There are two forms, acute (i.e. of recent origin) and chronic (i.e. of long standing).

Acute Bronchitis

This may be a complication of poisoning occurring:

- Shortly after exposure, particularly following inhalation of fumes, smoke or gases.
- Following an attack of pulmonary oedema (see 6.1.2).
- Some hours or even days after exposure.

Diagnosis

The symptoms are:

- Gradual onset of feeling unwell with general aches and pains.
- Slight fever.
- A harsh, dry cough.
- A feeling of rawness in the windpipe in the neck and under the breastbone which is made worse by coughing.

In mild cases there is little fever, but in severe cases the temperature is raised to about 37.8°C–38.9°C (100°–102°F), the pulse rate to about 100, and the respiration rate is usually not more than 24 per minute.

In a day or two the cough becomes looser, phlegm (sputum) is coughed up, at first sticky, white and difficult to bring up, later greenish yellow, thicker and more copious, and the temperature falls to normal. The patient is usually well in about a week to ten days, but this period may often be shortened if antibiotic treatment is given.

Note:

- The rise in temperature is only moderate.
- The increase in the pulse and respiration rates is not very large.
- There is no sharp pain in the chest.

These symptoms distinguish bronchitis from pneumonia (see 6.1.4) which gives rise to much greater increases in temperature and pulse with obvious rapid breathing and blue tinge to the lips and sometimes the face. The absence of pain distinguishes bronchitis from pleurisy (see 6.1.6) for in pleurisy there is severe sharp pain in the chest, which is increased on breathing deeply or on coughing.

General treatment

The patient should be put to bed and placed in the high sitting up position (see 5.5) because the cough will be frequent and painful during the first few days. A container should be provided for the sputum which should be inspected. Smoking should be discouraged.

Specific treatment

Give soluble aspirin 600 mg every four hours by mouth. That is sufficient treatment for milder cases with a temperature of up to 37.8°C (100°F) which can be expected to return to normal within two/three days. If the temperature is higher than 37.8°C (100°F) give ampicillin 500 mg by mouth at once followed by ampicillin 500 mg every six hours by mouth for the next five days.

Note: If the patient has a known allergy to any of the penicillin group of drugs of which ampicillin is one, give 2 co-trimoxazole tablets by mouth every 12 hours for 5 days.

Co-trimoxazole must not be given to a woman who is pregnant or might be pregnant. If pregnancy is suspected **RADIO FOR MEDICAL ADVICE.**

Should there be no satisfactory response to treatment after three days seek **RADIO MEDICAL ADVICE.**

Subsequent management

The patient should remain in bed until the temperature has been normal for 48 hours.

Examination by a doctor should be arranged at the next port.

Chronic Bronchitis

This is usually found in men past middle age who are aware of the diagnosis. Exposure to dust, fumes and tobacco smoking predisposes to the development of chronic bronchitis. Sufferers usually have a cough of long standing.

Superimposed on his chronic condition, a patient may also have an attack of acute bronchitis, for which treatment (see 6.1.3) should be given. If this occurs the temperature is usually raised and there is a sudden change from a clear, sticky or watery sputum, to a thick yellow sputum. Every man with chronic bronchitis should seek medical advice on reaching his home port.

6.1.4 **PNEUMONIA**

Pneumonia is an inflammation of one or more lobes of a lung. The onset may be rapid over a period of a few hours after inhalation or ingestion of a chemical. The onset may be delayed however for 2 or 3 days, or it may occur as a complication of bronchitis (see 6.1.3) or pulmonary oedema (see 6.1.2).

Diagnosis

The patient is seriously ill from the onset with:

- Fever and shivering attacks.
- A dry cough at first followed by production of thick sticky sputum which is usually yellow or green, and occasionally tinged with blood.
- Difficulty in breathing which is often rapid and shallow at a rate of 30 per minute.
- Blueness of the skin, ears and lips.
- A rapid pulse rate of over 110 per minute.
- Occasionally pain associated with breathing or coughing. This may be localized to one side of the chest.

The temperature is usually as high as 39.4°C-40.6°C (103°-105°F).

General treatment

The patient should be in bed in the high sitting up position (see 5.5). Provide a beaker for sputum in order to examine its appearance. Encourage the patient to drink because he will be losing a lot of fluid both from breathing quickly and from sweating.

Specific treatment

- Give oxygen as directed (see 8.3.1) if the patient is blue until his condition and colour improve.
- Give ampicillin 500 mg intramuscularly every six hours for two days, followed by 500 mg every six hours by mouth for 3 days, or for longer if advised to do so by **Radio Medical Advice.**

Note: If the patient has a known allergy to any of the penicillin group of drugs of which ampicillin is one, give 2 co-trimoxazole tablets by mouth every 12 hours for 5 days.

Co-trimoxazole must not be given to a woman who is pregnant or might be pregnant. If pregnancy is suspected **RADIO FOR MEDICAL ADVICE.**

- Give paracetamol 1000 mg every six hours by mouth if there is any pain on breathing. If this is not effective, give 1000 mg every four hours.

If the patient shows no signs of improvement after 2 days – **RADIO FOR MEDICAL ADVICE.**

DO NOT GIVE MORPHINE FOR PAIN UNLESS SPECIFICALLY ADVISED TO DO SO BY A DOCTOR.

Subsequent management

The patient should be encouraged to breathe deeply as soon as he is able to do so and be told not to smoke. Patients who have had pneumonia should be kept in bed until they are feeling better and their temperature, pulse and respiration are normal. Increasing activity and deep breathing exercises are helpful to get the lungs functioning normally after the illness. Patients who have had pneumonia should not be allowed back on duty until they have been to see a doctor.

6.1.5 PLEURISY

Pleurisy is an inflammation affecting part of the membrane (the pleura) which covers the lungs and the inner surface of the chest wall. The condition is usually a complication of serious lung diseases such as pneumonia, but may follow inhalation of toxic gases or fumes. In a typical case arising during the course of pneumonia, the breathing movements rub the inflamed pleural surfaces together causing severe chest pain which is usually felt in the armpit or breast area. It is described as a stabbing or tearing pain which is made worse by breathing or coughing and relieved by preventing movement of the affected side. Occasionally the rubbing can be felt by the hand placed over the site of pain.

If pleurisy occurs without the other signs of pneumonia get **RADIO MEDICAL ADVICE.** All cases of pleurisy, even if recovered, should be seen by a doctor at the first opportunity.

Pleural effusion (Fluid round the lungs)

In a few cases of pleurisy the inflammation causes fluid to accumulate between the pleural membranes at the base of a lung. This complication should be suspected if the patient remains ill but the chest pain becomes less and chest movement on the affected side is diminished in comparison with the unaffected side.

General treatment

If pneumonia is present, treat as described in 6.1.4. Otherwise, confine the patient to bed. If there is difficulty in breathing, put the patient in the high sitting up position (see 5.5).

GET RADIO MEDICAL ADVICE.

6.2 THE HEART AND BLOOD SYSTEM

6.2.1 ACUTE CIRCULATORY COLLAPSE

Circulatory collapse is the name given to the condition where there is a gradual onset of unconsciousness due to a poor flow of blood to the brain. This may be caused by either failure of the heart (see 6.2.2) or by a direct effect of the chemical on the blood vessels in the rest of the body, preventing an adequate supply of blood reaching the heart and therefore the brain. The symptoms and signs of this condition are described below. If it is not treated adequately, this may

be a progressive and fatal condition. It is important to recognize this condition, since it may initially be confused with fainting attacks (syncope). Syncope is a temporary failure of the blood circulation due to fright, pain or a nervous shock and is seldom serious. The signs and symptoms are very similar to those of a circulatory collapse.

Note: Other causes of circulatory collapse, such as severe injuries and bleeding should be excluded before a diagnosis of poisoning is made.

Circulatory collapse can also be caused by:

- Severe traumatic injuries.
- Bleeding.
- Loss of body fluid owing to severe burns.

Diagnosis

Circulatory collapse

The patient will have the following signs:

- A pale, waxy colour.
- The skin is cold and clammy to the touch.
- A rapid, weak pulse with a low blood pressure.
- A reduction in the amount of urine passed if this condition persists for more than one or two hours.
- Gradual onset of unconsciousness may occur.
- The heart may stop (see 5.3).

Fainting attacks (syncope)

The patient will have similar signs to the above except that:

- The pulse is usually slow at first and then becomes rapid during recovery.
- The duration of unconsciousness is only a few minutes, and the patient recovers rapidly after treatment.

(There will not be any reduction in urine output since a fainting attack only lasts a short while).

Treatment

Circulatory collapse

- Place in the unconscious position (see 5.3), and insert a Guedel airway (see 5.4).
- Arrange two or three pillows under the patient's legs so that they are higher than the head.

- Keep the patient warm.
- Give oxygen (see 8.3.1).

RADIO FOR MEDICAL ADVICE.

Fainting attacks

- Place the patient in the unconscious position (see 5.3).
- Loosen the patient's clothing around the neck.
- Keep the patient warm.

With these measures, the patient will recover completely within a few minutes.

6.2.2 HEART FAILURE

Heart failure is the term used to describe the condition when the heart muscle is damaged either temporarily or permanently, and therefore does not pump blood around the body effectively. There are a number of chemicals which affect the heart directly, but some may cause a lack of oxygen in the body which results in the same effect. Heart failure may occur within a few hours of chemical poisoning, and may be relatively rapid in onset. However, it may also develop gradually over a period of 24 to 48 hours. The patient may recover with treatment, but occasionally the heart failure may be persistent.

It should be remembered that a patient in the older age group may have a poor heart and already be under treatment.

Diagnosis

Heart failure is characterized by:

- A feeling of weakness, apathy and occasionally headache.
- Difficulty in breathing, particularly after exertion. The breathing is usually rapid and shallow.
- Sweating and restlessness with a rapid pulse.
- Blueness of the lips, tongue and ears.
- The veins in the neck may be very prominent in severe cases.
- Oedema if heart failure has been present for several hours (see below).
- A reduction in the amount of urine passed (see kidney failure, 6.5.1).

If the heart failure is severe, or sudden in onset, pulmonary oedema may develop (see 6.1.2).

Treatment

- Place in the high sitting position (see 5.5).
- Give oxygen (see 8.3.1).
- Give furosemide (frusemide) 40 mg by mouth, followed by a further 40 mg by mouth twelve hours later if oedema is present.
- Give only small quantities of water to drink.

(See kidney failure diagnosis and treatment in 6.5.1).

Oedema is the name given to the presence of an abnormal collection of fluid in the tissue under the skin. Its presence can be confirmed by gently pressing the tip of one finger on to the affected part for ten seconds. When the finger is taken away a dent will be seen in the skin. In heart failure, the swelling first appears in the feet and ankles, and spreads up the legs. If the patient is in bed, the oedema will collect under the skin overlying the lower part of the spine. The swelling is worse in the evenings or after exertion.

RADIO FOR MEDICAL ADVICE.

6.3 THE NERVOUS SYSTEM

6.3.1 UNCONSCIOUSNESS

Unconsciousness may vary from a sleep-like state to a deep coma. If the coma is very deep and lasts for a long while, it indicates a severe degree of poisoning.

Remember that there are many other causes for unconsciousness apart from poisons. These include:

- Serious traumatic injury.
- Fits.
- Diabetes.
- A stroke.

The most immediate danger to life is from failure of, or obstruction to breathing.

Diagnosis

- The patient looks as though he is asleep, but does not awaken when rousing stimuli are applied, e.g. rubbing the knuckles of the clenched fist firmly up and down the breast-bone. If the degree of consciousness is lighter he may however stir or groan.
- The muscles usually feel flabby, but are sometimes tense.

- The pulse may be either rapid or slow, but in serious cases will be weak or irregular.
- The breathing may be normal, but is often slow and shallow. Check for signs of asphyxia (see 6 1 1)
- The pupils are often small but if they are very large, and do not become smaller when a light is shone on them, this is a sign of deep coma
- The body temperature may become low (hypothermia) if the patient has been unconscious for some hours

Treatment

- Place in the unconscious position (see 5 3)
- Any blood, vomit or other secretions from the mouth must be mopped out, or removed by the use of a sucker if available
- Insert a Guedel airway (see 5 4)
- Watch for any signs of difficulty in breathing which may be due to:

  Asphyxia (see 6 1 1)

  Pulmonary oedema (see 6 1 2)

  Bronchitis and pneumonia (see 6 1 3 and 6 1 4)

  Heart failure (see 6 2 2)

  These should be treated in the appropriate way as described according to the diagnosis
- If the patient is unconscious for longer than a few hours further general measures may be necessary (see below)

DO NOT GIVE ALCOHOL OR INJECT MORPHINE OR ANY STIMULANT

General management

All unconscious patients

- Must have a clear air passage
- Must be kept in the unconscious position
- Must never be left alone.

Keeping the air passage clear is essential, and requires the patient to be kept in the unconscious position. Unconscious patients must *never* be left unwatched in case they move, vomit, have a fit or fall out of their bunk. They must be turned from one side to the other at least every three hours to prevent bedsores. Turn the patient gently and roll him smoothly from one side

to the other. **The head must always be kept back with a chin-up position when actually turning, and at no time must the head be allowed to bend forwards with the chin sagging** This is both to help to keep a clear air passage and to prevent neck injuries

Check the breathing and that the Guedel airway is securely in place as soon as you have turned the person.

Make sure that all limb joints are neither fully straight nor fully bent Ideally they should all be kept in mid-position Place pillows under and between the bent knees and between the feet and ankles Use a bed-cage (a large stiff cardboard box will make a good improvised cage) to keep the bedclothes from pressing on the feet and ankles. Check that elbows, wrists and fingers are in a relaxed mid-position after turning. Do not pull, strain or stretch any joint at any time Make quite sure that the eyelids are closed and that they remain closed at all times, otherwise preventable damage to the eyeball can easily occur. Irrigate the eyes every 2 hours by opening the lids slightly and pouring some saline solution gently into the corner of each eye in such a way that the saline will run across each eye and drain from the other corner. A saline solution can be made by dissolving one level teaspoonful of salt in $\frac{1}{2}$ litre (one pint) of boiled water which has been allowed to cool.

After 12 hours of unconsciousness further problems will arise Unconscious people must be given nothing by mouth in case it chokes them and they suffer from obstructed breathing However, after 12 hours of unconsciousness fluid will have to be given, particularly in hot climates and/or if the patient is obviously sweating. Because fluids cannot be given by mouth the fluid should be given *per rectum* (see 6 5 3). An input-output chart will be necessary and the instructions given under fluid balance in 6.5.3 should be followed. A container connected by tubing to a condom over the penis should be used to collect the urine The mouth, cheeks, tongue and teeth should be moistened every 3–4 hours, using a small swab moistened with water. Carry out mouth care every time the person is turned

After 48 hours of unconsciousness move the limb joints at least once a day. All the joints in all the limbs should be moved very gently in such a way as to put each joint through a *full range* of movement, providing other considerations such as fracture do not prevent this Watch that the exercise of the arms does not interfere unduly with the patient's breathing Do the job systematically Begin on the side of the patient which is most accessible. Start with the fingers and thumb then move the wrist the elbow and the shoulder Now move the toes the foot and the ankle Then bend the knee and move the hip round Next, turn the patient, if necessary with the help of another person, and move the joints on the other side.

Remember that unconscious patients may be very relaxed and floppy – so do not let go of their limbs until you have placed the limb safely back on the bed Hold the limbs firmly but not tightly and do everything slowly and with the utmost gentleness Take your time in moving each joint fully before going on to the next

6 3 2 CONVULSIONS

Convulsions are involuntary contractions of the muscles, which are usually accompanied by unconsciousness They usually occur when there is severe irritation of the brain. There is a variation in severity from twitching of the muscles to general heaving of the body or (most severe) a maintained general spasm of all muscles The latter condition endangers life by restricting the breathing. There are a number of causes, but the most important are

- The patient is an epileptic.
- Poisoning by chemicals or drugs.
- Lack of oxygen.

Convulsions may occur at any time after poisoning, and recur several times The more frequent and longer the attacks, the greater the danger to life

Treatment

- Place the patient in the unconscious position (see 5.3).
- Ensure that there are no hard or sharp objects in the vicinity so that the patient will not injure himself.
- Give diazepam 10 mg intramuscularly.
- If this does not control the fit within 10 to 15 minutes, give a further injection of diazepam 5 mg intramuscularly.
- **RADIO FOR MEDICAL ADVICE.**

For a few chemical poisons, there are specific treatments for the fits they cause These will be given in the appropriate tables of section 9

General management

Prevent the patient from hurting himself in the convulsive stage. Never restrain him forcibly, as this may cause injury, but remove hard objects and surround him with pillows, clothing or other soft material As opportunity arises, put the handle of a spoon, or other hard object, wrapped in a handkerchief or piece of cloth, between his teeth at the side of the mouth to prevent the tongue being bitten After the fit is over, let him sleep it off as he may be rather confused and dazed when he comes round. Reassure him, and do not leave him until you are sure he is aware of his surroundings, and knows what he is doing

6 3.3 MENTAL CONFUSION STATE

Mental Confusion State is the name given to the condition where a patient becomes confused and disoriented after being poisoned by a chemical This can occur either as a direct result of the chemical on the brain, e.g. chlorinated hydrocarbons, or because of asphyxia (see

6.1.1), circulatory collapse (see 6.2.1), heart failure (see 6.2.2), liver failure (see 6.4.5) or kidney failure (see 6.5.1).

Diagnosis

If the Mental Confusion State is due to a direct action of the chemical on the brain, the patient will develop the signs and symptoms within 15–30 minutes after exposure. The patient may be disoriented as to the date, time and place, and be unable to speak coherently. He may be unable to recognize friends, or perform simple tasks which he does in everyday life. On occasions, the patient may appear drowsy and can only be roused with difficulty. In severe cases, he may become unconscious (see 6.3.1). Some chemicals may cause confusion with mental agitation and aggressive violent behaviour.

Treatment

- All patients should be placed in the ship's hospital or in a quiet cabin in order to rest quietly.
- The patient should be kept under observation and at rest for at least 24 hours after apparent recovery.
- Look for signs of asphyxia (see 6.1.1), circulatory collapse (see 6.2.1), heart failure (see 6.2.2), liver failure (see 6.4.5), kidney failure (see 6.5.1) and treat for these if appropriate.
- If severe mental agitation with aggressive behaviour occurs, give chlorpromazine 25 mg intramuscularly. If there has been no improvement after 30 minutes, give a further 50 mg intramuscularly.

RADIO FOR MEDICAL ADVICE.

6.4 THE DIGESTIVE SYSTEM

6.4.1 STOMACH AND INTESTINES

Chemicals may act as local irritants on the stomach and intestines. They may also be absorbed, and cause general poisoning symptoms (see 4.1.2). The more severe corrosive chemicals, e.g. acids and alkalis, may cause bleeding or perforation of the gut. Remember that other illnesses, e.g. food poisoning, peptic ulcer, alcohol excess, may cause similar symptoms.

Diagnosis

- There may be chemical burns around the lips and in the mouth and throat.
- Nausea and vomiting usually occur, but there may be symptoms of more general poisoning.
- Diarrhoea may occur; it is important to note whether the faeces become black after poisoning since this is likely to be caused by bleeding from the gut.
- Thirst may become intense after severe diarrhoea and vomiting.

Treatment

Emergency first aid as described in section 8 should be given first.

Pain

There may be pain in the mouth, throat or abdomen, particularly with corrosive chemicals.

Treatment of pain

- Give two magnesium trisilicate tablets. Repeat every two hours until relief is obtained.
- For very severe pain give morphine sulphate 7.5 mg intramuscularly as directed in 5.6.

6.4.2 VOMITING

- This may relieve the patient if the irritant has thereby been cleared.
- However, frequent and prolonged vomiting is a bad sign.

If the vomited material is green with bile, this may suggest a paralysis of the gut.

RADIO FOR MEDICAL ADVICE.

The patient should be transferred to a hospital as soon as possible.

Treatment of persistent vomiting

- Give frequent glasses of water only – at least one every hour – for 36 hours or until the patient has recovered.
- **DO NOT GIVE SOLID FOOD.**
- Give an injection of metoclopramide hydrochloride 10 mg intramuscularly every six hours until vomiting has stopped.
- The maximum amount to be given over a 24 hour period should not be more than 30 mg.

6.4.3 BLEEDING

- The patient may vomit up bright red blood, or dark brown "coffee grounds" which is blood that has been altered in the stomach.
- He may also pass black, tarry, foul smelling faeces which may be solid or fluid.
- If severe bleeding occurs, there will be signs of circulatory collapse (see 6.2.1).

Treatment of bleeding

- Patients who have internal bleeding may need a blood transfusion.
- **RADIO FOR MEDICAL ADVICE.**

6.4.4 PERFORATION OF THE GUT

If an intense pain develops in the stomach accompanied by a rigid abdomen when touched, then a perforation of the gut may have occurred. This causes peritonitis which is an inflammation of the thin layer of tissue (the peritoneum) which covers the intestines and lines the inside of the abdomen. The onset of peritonitis may be assumed when there is a general worsening of the condition of a patient already seriously ill following ingestion of corrosive chemicals. It commences with severe pain all over the abdomen – pain which is made worse by the slightest movement. The abdomen becomes hard and extremely tender, and the patient draws up his knees to relax the abdominal muscles. Vomiting occurs and becomes progressively more frequent, large quantities of brown fluid being brought up without any effort. The temperature is raised (up to 39.4°C (103°F)) and the pulse is feeble and rapid (110–120), gradually increasing in rate. The pallid anxious face, the sunken eyes and extreme general weakness all confirm the gravely ill state of the patient. If hiccoughs begin, this must be regarded as a very serious sign.

Treatment of perforation of the gut

- Give nothing by mouth.
- Give only one dose of morphine as directed in 5.6.
- **RADIO FOR MEDICAL ADVICE AND TRANSFER THE PATIENT TO A HOSPITAL AS SOON AS POSSIBLE.**

6.4.5 THE LIVER

The liver is the chemical factory where the body attempts to destroy all poisons. It is almost always affected in poisoning, but may also be severely damaged by certain chemicals, e.g. chlorinated hydrocarbons, metal salts and phosphorus. Injury to the liver does not show itself until two to three days after poisoning.

Diagnosis

- There is often nausea with vomiting with a fever.
- The whites of the eyes may become yellow, followed by the skin generally (jaundice); this is often the first sign of liver damage.
- There may be pain and tenderness in the right upper abdomen.
- The urine often becomes dark brown.
- The tongue is dirty, and the faeces may become copious, foul and pale like putty.

Rapid and progressive failure of the liver causes increasing drowsiness followed by loss of consciousness and death after some days.

Treatment

- The patient should rest in bed and be kept warm.
- Although the patient may be feeling very sick he should be encouraged to take a high carbohydrate diet in the form of liquids and bread. Liquids should include at least two teaspoonfuls of glucose in a glass of water every two hours. In addition he may be given plenty of bread, soft drinks and sweet tea. Food with a high protein content (red meats, fish, chicken, eggs, milk) should be avoided.
- No drugs should be given unless there is severe vomiting, in which case give metoclopramide, hydrochloride 10 mg intramuscularly every 6 hours; continue until vomiting has stopped, the maximum amount to be given over a 24 hour period should not be more than 30 mg.
- **RADIO FOR MEDICAL ADVICE.**

  The illness is likely to take some days to resolve and normally a long period of convalescence is advised during which no alcohol should be taken. If there is a rapid onset of the symptoms and signs, associated with drowsiness or coma, then the damage is likely to be severe.

  THE PATIENT SHOULD BE TRANSFERRED TO HOSPITAL AS SOON AS POSSIBLE.

6.5 THE URINARY SYSTEM

6.5.1 THE KIDNEYS

Most chemicals are excreted by the kidneys which may be damaged in the process. In severe poisoning, kidney failure may develop after 24 hours, and if it does not improve, the patient may die after seven to fourteen days. Important points to be aware of are the following.

- A steady reduction of urine production may be a warning of the onset of kidney damage.
- Kidney failure must not be confused with retention of urine in the bladder.
- Kidney failure may arise for reasons other than chemical poisoning.

Diagnosis

The volume of urine passed, if any, should be measured and recorded every two hours. There will be only a small amount of urine passed in a period of 24 hours, usually less than 500 ml. If no urine is passed at all, or less than 180 ml is passed in six hours, check whether the bladder is overfull (retention) (see 6.5.2). If it is not full then kidney failure is present.

Symptoms which may be associated with kidney failure are:

- Vomiting and diarrhoea.
- Persistent hiccoughing.
- A distended abdomen.

The bladder may be irritated by the chemical causing a persistent desire to pass urine. It may be painful to pass urine, and there may be staining with blood.

If kidney failure has been diagnosed:

- **RADIO FOR MEDICAL ADVICE.**

Treatment

It is important in all types of chemical poisoning, where kidney failure may occur, to promote a good urine output, preferably more than 2 *litres* in 24 hours. The patient should therefore be given at least **2½ litres** of non-alcoholic drinks or water within every 24 hours, unless there is a reduction in the amount of urine produced. The following indicates the amount of fluid to be given for the appropriate amount of urine produced:

- Less than 180 ml of urine produced over a 6 hour period – apply fluid restrictions as set out below. This indicates true kidney failure.
- Between 180 and 500 ml of urine produced over a 6 hour period – give the patient a quantity of sweet drinks or water equal to the amount of urine passed plus 200 ml of water during the following 6 hours. This should be continued until the urine output increases to over 500 ml in 6 hours, or medical advice has been obtained to the contrary.
- More than 500 ml of urine produced over a 6 hour period; give at least 650 ml of non-alcoholic sweet drinks or water within every 6 hours.

Note: Any substantial increase in the fluids taken by mouth which does not result in the production of a similar volume of urine in the following 6 to 12 hours is dangerous and the above criteria must be applied.

Fluid restriction

Allow the patient to drink a quantity of water equal to the total urine passed the previous day, *plus* 750 ml over the next 24 hours. If the cabin temperature is greater than 25°C, give an additional 250 ml of water. It is important to look for any signs of waterlogging (oedema) in the body, which may indicate heart failure (see 6.2.2).

6.5.2 THE BLADDER

It is common in cases of prolonged unconsciousness for the urinary bladder to become overfull (urinary retention). It is also possible for this to occur in a conscious patient. It is an important cause of not passing urine, and should be distinguished from kidney failure. If retention is present the bladder becomes increasingly distended with the patient complaining of pain if he is conscious. The bladder can be felt in the lower abdomen as a rounded, tender swelling above the pubic bone and, in severe cases, can extend upward as far as the navel.

6.5.3 FLUID BALANCE

The body has self-regulating mechanisms to maintain a normal balance between fluid in and fluid out.

Fluid in

An average daily intake of the fluids from food and drink is about 2.5 litres. In temperate climates it is possible to manage for a short time on as little as 1 litre (just under 2 pints). In hot climates where there is a large fluid loss through sweating an intake of 6 litres per day may be necessary.

Fluid out

Body fluid is lost through unseen perspiration, obvious sweating, the breath, the urine and the faeces. At least 2.5 litres of fluid will be lost in this way during the day, which may be increased in hot climates.

In any illness where fluid balance is likely to be a problem a fluid chart recording the amount of fluid in and fluid out should be started. During the first 12 hour period the fluids in should normally be 0.5 to 0.75 litres *more* than the fluids out. After the first 12 hour period the fluid in and out should balance over the day, taking into account loss due to sweating, etc. as mentioned above.

If the patient cannot take fluid by mouth for any reason, such as unconsciousness, persistent vomiting or burns to the mouth and throat, it may become necessary to give fluid by rectum to maintain fluid balance.

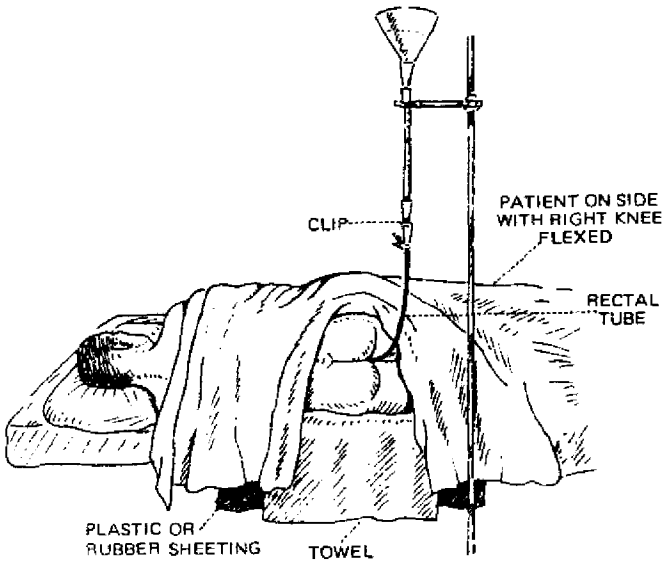
Giving fluid by rectum

To prepare the bed place two pillows, one on top of the other, across the middle of the undersheet. Protect the pillows with a width of rubber or plastic sheeting covered by a wide clean towel. Allow the ends of the sheeting and towel to hang over the side of the bed to drain any possible leakage. The patient should be placed lying on his left side with his buttocks raised on the pillows and with his right knee flexed. He should be made comfortable but only one pillow should be allowed to support his head so that the tilt can be maintained. He should then be covered by a sheet leaving only the buttocks exposed.

The importance of the treatment should have been explained to the patient and he should be encouraged to relax and not to resist. The buttocks should be separated gently then a catheter (26 French gauge) well lubricated with petroleum jelly (vaseline) should be passed, slowly and gently, through the anus into the rectum for a distance of about 23 cm (9 inches). After the catheter has been inserted its external end should be taped to the skin in a convenient position to attach to a tube and drip set. Give 180 ml (6 fl oz) of water slowly through the tube taking about

10 to 15 minutes to drip the water in. This amount will usually be retained. Leave the catheter in position and block its end with a spigot, or small cork, or compression clip.

Give the patient a further 180 ml of water every 4 hours. This should give a fluid intake of about 1000 ml (1 litre) per day. It is worth trying to increase the amount given on each occasion to 200 ml and to give this every 3 to 3½ hours, particularly if the weather is warm and the patient is sweating. However, if any overflow occurs the amount given must be reduced. The rectum will not retain large amounts of fluid and fluid must be retained in order to be absorbed. Occasionally the rectum will not accept fluid readily, especially if it is loaded with faeces. Smaller quantities at more frequent intervals should be tried in these cases. Careful observation will show whether the fluid is being retained. Aim to give at least 1 litre of fluid per day if possible. Giving fluid by rectum should be continued until the patient can safely take fluid by mouth, or medical assistance becomes available.



6.6 HIGH TEMPERATURE

A temperature of over 40°C (104°F) can be dangerous to the survival of the individual and require careful management and nursing.

Treatment

- Give soluble aspirin 600 mg every four hours by mouth
- Place a sponge wrung out in tepid or cold water in each armpit and another on the forehead. With the patient naked sponge him all over, using long strokes, with tepid or cold water
- In addition ice packs or cold wet compresses may be applied to the forehead, armpits and groin, and iced drinks given
- The air conditioning controls should be altered and a fan should be used to increase air movement and evaporation from the skin
- Check the patient's temperature frequently as you cool him Because this treatment causes rapid cooling of only parts of the body, it is important that the thermometer remains in position underneath the tongue for four minutes so that the temperature recorded is that of the body as a whole There should not be any ice in the mouth while the temperature is being recorded
- After tepid sponging, when the person's temperature is down to at least 39°C (102°F) the skin may be dried and powdered with talc
- If the patient complains of cold and starts to shiver and his temperature has fallen sufficiently, cover him with a thin sheet
- As the temperature may well rise again, check the temperature every 30 minutes until it has been below 39°C for at least an hour: thereafter check the temperature hourly until ~~the fever has disappeared~~. it has returned to normal (37.8°C) (98.6°F)

If the brain centre which controls body temperature is damaged, heat regulation may be upset for many days Patients thus affected sometimes need to be surrounded by ice packs or to have frequently changed cold water bottles placed around them Read the section on fluid balance (see 6 5 3).

6 7 CHEMICAL BURNS

Many chemicals, particularly corrosives, may produce chemical burns when in contact with the skin or eyes or mucous membranes. These are very similar to burns from fire or electricity, except that the chemical may be absorbed through the skin causing general symptoms of poisoning. Some chemicals may be absorbed even if the skin surface is intact (see 4 1 2)

Diagnosis

- There is often a burning pain with redness at the site of contact.
- There may only be an irritating rash.

- In severe cases there may be blistering or a loss of skin and/or underlying tissue.
- Nausea, vomiting, headache, breathing difficulties and an abnormal mental state or the development of unconsciousness, all suggest absorption of the chemical.
- **RADIO FOR MEDICAL ADVICE.**

Treatment

- Emergency treatment should be given as directed for skin (see 8.1) and eyes (see 8.2).
- Further treatment of less severe burns should be undertaken as follows.

  Wash your hands and forearms thoroughly and then remove the first-aid dressing to expose either a single burned area (in multiple burns) or a portion of a large single burn. The aim is to limit the areas of burned skin exposed at one time both to lessen the risk of infection and the seepage of fluid. Clean the skin around the edges of the burn with soap, water and swabs. Clean away from the burn in every direction. DO NOT use cotton wool or other linty material for cleaning as it is likely to leave bits in the burn.

  Leave blisters intact but clip off the dead skin by using a sterilized pair of scissors if blisters have burst. Flood the area with clean warm boiled water from a clean receptacle to remove debris. Soak a swab in boiled warm water to dab gently at any remaining dirt or foreign matter in the burned area. ***Be gentle*** as this will inevitably cause pain.

  Next cover the burn with the vaseline gauze dressing, overlapping the burn or scald by 50–100 mm (2–4 inches) according to its size. Now apply a covering of absorbent material to absorb any fluid leaking from the burn, e.g. a layer of sterile gauze, covered with a layer of sterile cotton wool. This is held in place by a suitable bandage – tubular dressings or crepe bandage are useful for limbs and elastic net dressings for other areas.

  Thoroughly wash hands and arms before proceeding to deal as above with remainder of a large burn or another burn in the case of multiple burns.

  Dressings should be left undisturbed for a week unless the dressing becomes smelly or very dirty, or the temperature is raised. Re-dress such areas as above.

  If there is persistent pain, give paracetamol 1000 mg by mouth every four hours until the pain has been relieved. If there is severe pain, not relieved by paracetamol, give morphine sulphate 7.5 mg (half an ampoule) intramuscularly and obtain medical advice by radio on further amount and frequency of morphine sulphate injections.

  Treat any complications of absorbed poison as appropriate:

  - Asphyxia (see 6.1.1).

    Pulmonary oedema (see 6.1.2).

- Heart failure (see 6.2.2).
- Unconsciousness (see 6.3.1).
- Liver failure (see 6.4.5).
- Kidney failure (see 6.5.1).

Fluorescein staining

Staining the eye with fluorescein will highlight any area of corneal or conjunctival damage. Pull the lower eyelid downwards and draw the fluorescein paper strip, which contains the dye, gently across the inner moist surface of the lower lid with the patient looking upwards. This wipes the dye off the strip onto the lid and when the patient blinks a couple of times the dye spreads over the eye. Wipe any excess dye off the eyelids. Any area of corneal or conjunctival damage will attract the dye and be stained green. For further treatment see 8.2.

6.8 FROST-BITE

If the skin is exposed to severe cold, particularly the fingers and toes, the tissue becomes frozen. The symptoms and signs are:

- The skin initially becomes red, but then turns white.
- The affected area is usually painless.
- It is hard to the touch.

If the affected area is left untreated, death of the tissue (gangrene) may well occur.

Treatment

- Warm the affected area quickly by placing it in water at a temperature of 42°C (107.5°F) until it has thawed.
- Keep the patient in a warm cabin.
- DO NOT massage the affected area.
- Severe pain may occur during the thawing. Give paracetamol 1000 mg by mouth. If this is not effective give morphine as directed (see 5.6).
- Dress the area with sterile dry gauze.
- If the area does not recover its normal colour and sensation after this treatment **RADIO FOR MEDICAL ADVICE.**

7 GENERAL TOXIC HAZARDS

7.1 THE CHEMICAL HAZARDS FROM FIRE

Combustion of many chemicals may produce a wide range of substances which are toxic.

These may be present at a distance from the main site of the fire, and may have no odour. Self-contained breathing apparatus should be used in approaching chemical fires.

The symptoms may include:

- Dizziness.
- Headache.
- Nausea and vomiting.
- A persistent cough and difficulty in breathing.
- Unconsciousness.

Inhalation of fumes may result in rapid collapse and unconsciousness, which should be treated as in 6.3.1. Pulmonary oedema (see 6.1.2) may develop after a few hours.

The main toxic chemicals which may be produced are listed below:

- Carbon dioxide (Table 615).
- Carbon monoxide (Table 616).
- Hydrochloric acid fumes (Table 700).
- Hydrogen cyanide (Table 645).
- Nitrogen oxides (Table 610).
  (Particularly produced in smouldering fires.)

Treatment

The main danger from fume exposure is asphyxia (see 6.1.1). The patient should be:

- Removed rapidly to a fresh atmosphere.
- Given oxygen (see 8.3.1).
- Treated appropriately for asphyxia (see 6.1.1).

If burns are present as a result of the fire, they should be treated as for chemical burns (see 6.7).

7.2 HAZARDS FROM WELDING

Symptoms of poisoning may arise during welding in confined spaces, if adequate precautions are not taken. The main danger is from nitrogen oxides (Table 610). Certain metal alloys, in particular those containing zinc or cadmium, give off fumes causing characteristic symptoms known as "metal fume fever". These usually do not develop for a period of 6 to 12 hours after exposure, and comprise:

- Shivering.
- Fever, headache and muscle pains.
- Nausea.
- A dry cough.

These symptoms usually resolve spontaneously without any treatment over the following 12 hours. Pulmonary oedema, however, may occur as a very rare complication (see 6.1.2).

If the patient is removed from any further exposure there are no lasting effects, or recurrence.

7.3 HAZARDS FROM EXPLOSIVE CHEMICALS

The main hazard is injury from explosion. Contact with explosives does not normally cause a medical problem from the chemicals themselves, unless they are in a decomposed state, when they may produce fumes, particularly of nitrogen oxides (Table 610), which may be inhaled.

- If the chemicals are in contact with the skin, they should be washed off with water as directed in 8.1.
- If fumes are inhaled, the patient should be treated as directed in 8.3.

If signs and symptoms occur following exposure to explosive chemicals, **RADIO FOR MEDICAL ADVICE.**

7.4 HAZARDS FROM RADIOACTIVE MATERIALS

Radioactive materials have two possible hazardous properties:

- The radioactivity.
- The chemical effects.

Either or both of these may be important. The chemical effect, as opposed to the radioactive effect, would occur more or less immediately.

The effects of chemicals could be either poisoning or burns. They should be treated as appropriate to the chemical as described in section 9.

Ingestion of, or contamination by, radioactive materials should be dealt with in the following manner:

- Anyone assisting a person who may have been contaminated, should wear gloves, covering for the hair and other protecting clothing if available.
- Remove all clothing, coins, metal objects, keys, etc., and any movable material in contact with the body.
- Remove any visible radioactive material with absorbent paper, towels or cloth.
- Place all these articles including towels, etc. in a plastics bag, which is then labelled, and placed in a box to be kept inaccessible to personnel until the articles have been decontaminated.
- Take the patient to the nearest shower, taking all reasonable precautions to prevent spread of contamination and wash the body, hair and eyes carefully with water.
- Allow any wounds or cuts to bleed and then treat according to first aid principles.
- Rinse the mouth thoroughly and encourage the patient to blow his nose in order to eliminate possible contamination.
- **RADIO FOR MEDICAL ADVICE.**
- It may be necessary to evacuate the patient to a special centre on shore.

A hazard due to external radiation may exist if a radioactive material is separated from its shielding. If it is suspected that a person has been exposed to external radiation, medical advice should be sought as soon as possible.

Further information concerning accidents involving radioactive materials is to be found in section 10 of the Introduction to Class 7 of the International Maritime Dangerous Goods Code, and Emergency Schedules (EmS) 7-01 to 7-09*, to which reference should also be made.

* Refer to IMO Publication "Emergency Procedures for Ships Carrying Dangerous Goods".