

# UNIT 13

## FIRST AID IN A LABORATORY |

### Structure

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13.1	Introduction	13.6	First Aid Procedure for Unconscious Casualties
	Expected Learning Outcomes		
13.2	Accident Reporting	13.7	First Aid Procedures for Chemical Accidents
	The Need for Reporting Accidents	13.8	Controlling Bleeding
	Accident Reporting Procedure	13.9	First Aid Treatment for Shock
13.3	First Aid	13.10	First Aid Treatment of Localised Injuries
	Placement of First Aid Box		Burns
	Contents of First Aid Box		Fractures
13.4	General Features of First Aid		Eye Injuries
	Scope of First Aid	13.11	Summary
	Sequence of Actions	13.12	Terminal Questions
13.5	First Aid Procedure for Electric Shock	13.13	Answers

### 13.1 INTRODUCTION

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In the previous unit of this block you have studied the personal safety measures to be followed while working in the laboratory. Despite being aware about the hazards and taking necessary precautions while working in the laboratory the accidents can still happen. In this unit we will discuss about what to do in case an accident occurs in the laboratory.

We will start by discussing the need and the method for reporting a laboratory accident. We shall then introduce you to the first aid – the immediate and temporary care given to the victim of an accident or sudden illness, the first aid box, its contents and suitable location in the laboratory. We shall then describe the general features of first aid procedure in terms of its scope and sequence of events. This would be followed by a detailed discussion on the methods of administering first aid for specific situations like electric shock, unconsciousness, chemical accidents, bleeding, burns, fractures and eye

injuries etc. The contents of this unit could serve as a guide for offering first aid to those involved in laboratory accidents.

Our objective is to make you aware and also provide the necessary information that would be useful in dealing with laboratory accidents. We don't intend to make you a professional in the field we expect you to act in a responsible manner to provide precious support to the victim. **It is emphasized that for any serious injury, proper medical assistance should be sought at the earliest.** In the last unit of this course you will learn about the laws and regulations which are applied to a laboratory.

## Expected Learning Outcomes

After studying this unit, you should be able to:

- ❖ explain the need for reporting lab accidents,
- ❖ differentiate between an accident and an incident,
- ❖ state the procedure for reporting a laboratory accident,
- ❖ list the contents of a first aid box and suggest a suitable location for the first aid box in the laboratory,
- ❖ describe the general features of first aid procedure, and
- ❖ explain the first aid procedure for specific situations like electric shock, unconsciousness, chemical accidents, bleeding, shock, burns, fractures and eye injuries.

## 13.2 ACCIDENT REPORTING

Heinrich in 1930 defined an accident as an unplanned and uncontrolled event in which the action or reaction of an object, substance, person or radiation results in personal injury or the probability thereof. The definition has changed over time and one of the modern definitions given by Occupational Health & Safety Advisory Services defines a broader term called **incident**. According to them *an incident is referred to as a work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.* An **accident** is regarded as a particular type of incident in which an injury or illness actually occurs. A related term is called **near miss**. It is an incident in which no injury or illness occurs. Therefore, an incident can be either an accident or a near miss. Let us understand the need for reporting laboratory accidents.

**Near miss:** an incident in which no injury or illness occurs

### 13.2.1 The Need for Reporting Accidents

All accidents (no matter how small) and, dangerous near misses should be recorded and reported. The recording of accidents ensures that all injuries are treated. The record keeping of accidents also helps in knowing about unsafe working practices and long-term trends in accidents. This can be used to take suitable measures to improve the safety in the laboratory. Further, if there is an enquiry later, great problems may arise for those involved unless the

accident was recorded or reported. Hence, it is advisable to treat both minor and major accidents as serious and record all of them systematically.

It is equally important to record and report near misses, that is, the incidents where no one was injured, but could have been if circumstances were different. We analyse the reasons for the incident and possible risks. This helps us in taking suitable steps to prevent such near misses which next time may happen to be an accident. **We need not wait for an accident to occur to take preventive steps.**

### **13.2.2 Accident Reporting Procedure**

It is advised to use incident book and accident report forms for the purposes of keeping records of accidents. The incident book is to be maintained by the lab Incharge. It should contain the details, as listed below, of all accidents and near misses:

- (1) Date, time and location of incident
- (2) Name of victim
- (3) Nature of injuries sustained or suspected
- (4) Description of first aid treatment given
- (5) Name of person who administered first aid treatment
- (6) Names of witnesses (if any)

There is no need to record any other information in this book and details are to be provided by the person attending on the accident victim or by any of the lab staff. The book is a valuable source of information to the alert lab Incharge.

#### **Accident Report Forms**

Accident report forms are to be used in case of serious accidents. A properly completed accident report form should contain the following information:

- (1) The date, time and location of the accident
- (2) The name, address, gender and age of the victim
- (3) A brief description of the accident
- (4) The names of witnesses (if any)
- (5) Details of any injuries suffered or suspected
- (6) A description of the first aid treatment given
- (7) The name of the person who gave the first aid treatment
- (8) A description of any further action taken, e.g. removal to hospital

This form is also acts a useful record of the details of the accident, which might be hard to recall at a later date. These forms are to be completed and maintained by the lab Incharge. A copy of this report has to be sent to the Head of the institution for information, so that suitable measures are initiated to improve working conditions in the lab.

## SAQ 1

What is meant by an incident and how is it related to an accident?

### 13.3 FIRST AID

The originator of first aid was Esmarch (1823-1908) of Germany. He was an expert in hospital management and military surgery. The term 'first aid' was used officially in England for the first time in 1879 by the St. John Ambulance Association.

First aid is the immediate and temporary care given to the victim of an accident or sudden illness prior to the availability of suitable medical aid. Remember that it is a temporary treatment and its purpose is to

- (1) help preserve life
- (2) prevent the victim's condition from becoming worse, and
- (3) promote the victim's recovery.

Any lab is a potentially dangerous workplace, but serious injuries are rare. It is advisable to know how to provide first aid depending on the nature of the injury. Remember that first aid is a skill that can be learnt only by proper training and practice. St. John Ambulance Association, which has Headquarters in New Delhi and has over 670 branches all over the country, is offering first aid programmes at different levels and offers certificates to those who complete the particular programme successfully. It is advisable to remember that *first aid is limited to the assistance rendered at the time of emergency with such material as may be available*. The direct responsibility of the person giving first aid ends as soon as the victim is handed over to a doctor; but he / she should give a complete report to the doctor.

#### 13.3.1 Placement of First Aid Box

All first aid equipment should be placed close to the sites where accidents are likely to occur. The location of first aid boxes should be such that they can be easily identified and reached during times of need. An ideal first aid system in a laboratory would have two kinds of first aid boxes to meet two kinds of needs. The first type of first aid box would be to meet emergencies and would be placed in the lab. It would never be locked so that it is accessible at all times. Theft of some items may be a problem but this can be overcome by:

- (1) Educating users; and
- (2) Keeping stocks to the basic minimum requirements.

A more elaborate first aid box, as a second line facility, could have contents more than the minimum requirements and the box could be locked and a responsible person put in charge of it. This could be used in times of need as a secondary support.

#### 13.3.2 Contents of First Aid Box

The minimum contents of a first aid box are given in Table 13.1. In addition, the first aid box should carry on it the name of the person responsible for its contents, and be marked with a red cross on a green background. The phone numbers of the nearby doctors and hospitals, the replacement date of its contents *etc.* may also be typed and pasted on it.

**Table 13.1: Contents of the First Aid Box**

Item	Quantity
Individually wrapped sterile adhesive dressings (assorted)	5
Cotton roll	1
Half ounce packets of sterilised cotton roll	3
Sterile cotton pads in sealed packets	3
Half ounce packets of gauze, plain white	3
Swab sticks	6
Triangular bandages	2
Bandage rolls of 1", 2" and 2½" width	2 each
Individually wrapped sterile unmedicated wound dressings of sizes:	
Medium (10 cm x 8 cm)	2
Large (13 cm x 9 cm)	2
Extra large (28 cm x 17.5 cm)	2
Glucose	200 g
Burnol tube	1
Dettol / Savlon bottle	1
Spirit bottle (100 cm <sup>3</sup> )	1
Stainless steel spoon (padded) or Tongue depressor	1
Safety pins (assorted, rust proof)	6
Cardboard (8" to 12" length and 6" to 8" width)	1
Old news paper sheets (rolled using a rubber band)	6
Scissors (5 inch, blunt pointed)	1
Pen torch	1



## SAQ 2

Why is it necessary to have two types of first aid boxes in the laboratory, one unlocked and the other locked?

## 13.4 GENERAL FEATURES OF FIRST AID

The order of priorities in administering first aid is decided by the principal objective – to save life. Equally important is that you must not do anything that endangers the lives of others. It will not help the victim if someone is killed while attempting to rescue the person from an electrical fault or from a room filled with smoke or poisonous fumes. It is essential to keep calm and to assess the situation rapidly. Time is important and, in serious accidents, the first two or three minutes can make the difference between life and death.

### 13.4.1 Scope of First Aid

You must know that the scope of first aid actions spreads over the following three aspects:

In a victim, symptoms and signs are quite helpful in diagnosis.

- **Diagnosis:** Diagnosis of the victim involves considering the history, symptoms and signs.
  - **History** is the information as to how the accident or illness occurred. This may be obtained either from the victim (if conscious) or from witnesses.
  - **Symptoms** are the sensations of the victim such as shivering, feeling of cold, fainting, vomiting, thirst and pain.
  - **Signs** are any variations from normal condition of the body such as bleeding, swelling, deformity and congestion.
- **Treatment:** First aid treatment is a set of actions taken to preserve life of the victim, prevent the conditions from becoming worse and promote his / her recovery.
- **Disposal:** Disposal is the arrangement made for the removal of the victim to his / her home or suitable shelter or to a hospital. A tactful message should be sent to the victim's home or relatives indicating the main details of accident and the victim's destination.

### 13.4.2 Sequence of Actions

The precise sequence of actions in emergency situations is governed by the circumstances. The following is the general order to be followed:

- (1) Quickly separate the victim from the hazard (provided it is safe to do so).
- (2) Ensure that the patient's breathing is maintained. If the victim isn't breathing, begin artificial respiration immediately. If the heartbeat is found to be absent, begin resuscitation (Sec. 12.6). For both of these processes, the services of a trained person are quite helpful.
- (3) Control serious bleeding to prevent heavy blood loss.
- (4) Treat for shock.
- (5) Treat burns and deal with localized injuries (such as cuts or foreign bodies in the eye).
- (6) Reassure the victim and help decrease the anxiety.
- (7) Do not allow people to crowd around, as fresh air is essential for the victim. Ask them to telephone for an ambulance, fire brigade, or other services, which may be required. They can also help to take care of the victim until doctor arrives; or they can help to deal with the cause of the injury, i.e. with the spilled chemicals, broken glassware, etc. or minor fire.
- (8) Where necessary, your last action as a first aider with any victim is either to hand him / her over to a doctor or to transfer him / her to hospital.

Some of the terms used in this procedure are discussed in details later in this unit. In all serious accidents, witnesses should be obtained, if possible, before searching for personal belongings of the victim.

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### SAQ 3

Usually there is a crowding of on-lookers in a place of accident and, lab accident is no exception. How can the members of the crowd be used to deal with the after effects of the accident?

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## 13.5 FIRST AID PROCEDURE FOR ELECTRIC SHOCK

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The sequence of actions for a first aid procedure as described in subsec.13.4.2 is followed generally but there are certain cases when this sequence is changed. Electric shock is one such case. You would have read in Unit 10 that the main injuries that may be expected in an electrical accident are burns, asphyxia and shock. Cuts, fractures or other injuries may result from falls due to electric shock. The sequence of actions in such a case would be:

- (1) Do not touch the victim until you are sure that the power has been turned off or that the victim is no longer in contact with the electric current or else you may be electrocuted as well. **No attempt at rescue must be made if the victim is in contact with a high voltage electric current such as that coming from overhead electric power cables.** In case of a mains supply voltage (220-240 V), the victim can be pulled or pushed away from the source by using for example, a wooden chair, thick dry cloth, rubber or other insulating material. For this, the person administering first aid should
  - stand on a dry insulating surface such as a wooden chair when attempting this, and
  - ensure that the hands are not wet.
- (2) If the victim is not breathing, the artificial respiration must be given immediately. For giving artificial respiration and heart massaging, the help of a properly trained person may be taken.
- (3) If the victim is unconscious but is breathing, place him / her in the recovery position (as described in Sec.13.6).
- (4) Treat burns and other injuries. Note that burns from electrical accidents may be much deeper and larger than their surface area indicates.
- (5) Treat for shock (as described in Sec.13.9).
- (6) In cases of serious injury, call for an ambulance or a doctor.
- (7) Don't move the victim, if you suspect any fracture.

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## SAQ 4

Before beginning to administer first aid to an electric shock victim, what is the first action to be performed?

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### 13.6 FIRST AID PROCEDURE FOR UNCONSCIOUS CASUALTIES

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Fainting: A condition of temporary loss of consciousness

Let us now discuss the first aid procedure for unconscious victims. The most common causes of unconsciousness in a laboratory accident are fainting, shock, asphyxia, poisoning and injuries to the head. Other causes include heart attack, epilepsy (fits) and diabetic coma. Unconsciousness or insensibility is due to interruption of the action of the brain through some interference with the functions of the nervous system.

The general procedure to be adopted for the first aid treatment of an unconscious victim is:

- (1) Remove the victim from any contaminated atmosphere. Open windows and doors. Provide enough fresh air by dispersing the crowd.
- (2) Turn head to one side
  - to let the secretions come out and,
  - to prevent tongue falling back and causing choking to the victim.
- (3) Loosen clothing about the neck, chest and waist.
- (4) Remove false teeth, if there, and, clear the mouth of blood, mucus *etc.* with a cloth to ensure that the airway is clear.
- (5) If breathing fails or stops, immediately give artificial respiration. If heart beat stops or pulse is not normal, apply heart massaging. For these the help of a properly trained person may be taken.
- (6) Control any severe bleeding.
- (7) Dress wounds and attend to fractures and other injuries.
- (8) Cover the victim with a blanket and arrange for transfer to hospital in the recovery position (discussed in Sec.13.6).
- (9) Keep a written record of the victim's responses and pulse rate at regular intervals.
- (10) Keep the victim still if s/he regains consciousness. Reassure her / him and moisten her / his lips with water but do not give any drink.
- (11) Do not leave an unconscious victim unattended.
- (12) Always ensure to inform the doctor about the unconscious state of the victim.



Let us now see how to administer first aid to those who become unconscious due to fits or diabetic coma.

### Fits

Fits of various kinds may be accompanied by unconsciousness, and are usually characterized by the victim being unaware of his / her reactions. You should remember the following points in relation to fits.

- (1) Clear movable objects away from the vicinity of the victim; e.g. stools, chairs, bottles, *etc.*
- (2) Pull the patient away only if s/he is in potential danger from stairs, cables, fires, etc.
- (3) Never try to open the victim's mouth.
- (4) After the fits, allow the victim to rest.
- (5) Never leave the victim unattended.
- (6) Take a padded spoon and put the handle in between teeth to prevent tongue biting during fits.
- (7) Transfer the victim to safe and shady place till the help is received.

### Diabetics

A diabetic patient may lapse into diabetic coma or unconsciousness, but usually the affected person is aware of the symptoms before this occurs. You can assist at any stage by giving the victim some sugar or sweets. Don't worry about creating an excess of sugar in the diabetic patient's bloodstream; **an excess of sugar is far less dangerous than lack of it.**

Sometimes it may be necessary to revive breathing and blood circulation to a person who has become unconscious due to a laboratory accident.

**Resuscitation** may be helpful in such situations. Let us learn about resuscitation.

### Resuscitation - An Explanation

A living person needs the support of "ABC" mentioned below:

- **Airway** - clear airway
- **Breathing** - normal breathing
- **Circulation** - proper blood circulation

A human being cannot live for more than 3 minutes without oxygen. In case, breathing is stopped, immediate remedial measures should be taken.

In case of persons becoming unconscious, "ABC" aspects are to be taken care of by a process known as resuscitation. It involves, the following steps

- I. Checking breathing and pulse
- II. Opening the airway to facilitate breathing
- III. Mouth-to-mouth artificial respiration for restoring breathing
- IV. Heart massage for restoring blood circulation

Let us discuss these steps in details

## I. Checking Breathing and Pulse

Before attempting to resuscitate a victim, it is essential that you check his / her breathing rate and pulse. You may cause problems if you attempt to resuscitate someone who is still breathing. Also, there is little point in spending a lot of time trying to restore a victim's breathing if you don't continually check that the victim's heart is beating.

(1) **Breathing:** Breathing, particularly for an unconscious person, can sometimes be very shallow. Hence, it is difficult to discover whether someone is breathing or not simply by observing the rise and fall of their chest. You can try either of the following methods:

- (a) Wet your lips and place them near to the victim's mouth or nose. When the victim breathes out, your lips will cool.
- (b) Hold a cold piece of glass mirror, or a highly polished surface close to the victim's mouth or nose. When the victim breathes out, a small amount of condensation should form on the polished surface. However, this method is not very satisfactory.

(2) **Pulse:** For an unskilled person, the wrist is not the best place to feel the pulse. A weak pulse is difficult to detect and in these cases, it is easy to detect your own pulse in your fingers, mistaking it for the victim's. A suitable method is to turn the victim's head and feel the victim's pulse below the corner of her / his jaw. Four separate checks lasting 15 seconds each will give you the best indication.

If the victim has stopped breathing, first of all we should clear the airway of the victim, so that he s/he could inhale fresh air.

The average rate of the pulse in a healthy adult is 72 beats per minute.

## II. Opening the Airway

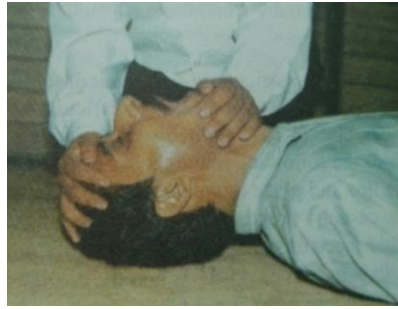
The procedure for opening the airway is as follows:

- (1) Remove obstructions covering the victim's head and face. Loosen the clothing at the neck and waist.
- (2) Clear the mouth of any blood, vomit and loose or false teeth. You may do so using your forefinger and the middle finger after wrapping a piece of cloth on these two fingers (Fig.13.1). You may also use the handle of a padded spoon.



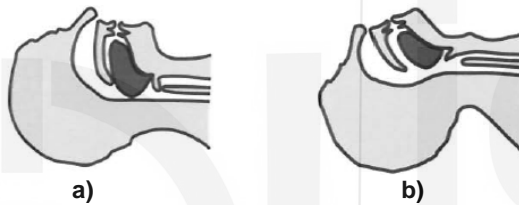
Fig.13.1: Cleaning the mouth of the victim.

- (3) Place one hand over the jaw and the other hand on the forehead. Lift the neck and push the forehead backwards so that the chin is up (Fig.13.2). The mouth should remain open.



**Fig.13.2: Adjustment of the chin and head.**

This extension of the head and neck lifts the tongue forward and clears the airway (Fig.13.3 (a) and (b)). If the tongue does not fall forward, pull it forward with finger. In some cases, this action is sufficient to restart the victim's breathing.



**Fig.13.3: (a) In the unconscious victim lying on his/her back, the tongue may fall backwards and block the air passage; (b) If the neck is lifted and forehead is pushed backwards so that the chin is up, the tongue moves forward thus opening the air passage.**

If breathing starts, place the victim in the recovery position (Fig.13.4).



**Fig.13.4: Recovery position.**

### III. Mouth-to-Mouth Artificial Respiration

If a victim does not start breathing by the above process, artificial respiration must be started immediately to provide a supply of air into the lungs. The most important single factor is the speed with which the inflations can be given. Delay can be deadly. The mouth-to-mouth respiration is the most effective and can be used almost in all circumstances, with a few exceptions such as cyanide poisoning. The procedure for mouth to mouth respiration is as follows:

- (1) Pinch and compress the nose to close it.
- (2) Take deep breath (Fig.13.5a).

- (3) Place your mouth around victim's mouth, make an airtight seal and quickly breathe into victim's mouth (Fig. 13.5b).
- (4) Watch the victim's chest movement for its rise and fall.
- (5) Repeat and continue at your natural breathing rate until normal breathing is restored.



**Fig. 13.5: Artificial respiration a) Taking a deep breath pinching the nose of the victim; b) breathing out into victim's mouth.**

The pupil of the eye in a living person has the shape of a black dot at the centre of the eye. When the person is dead, the pupils dilate i.e., grow larger in size.

Sternum is indicated in Fig. 13.6 a.

Closed fist: A hand with the fingers closed tightly into the palm.

### Heart Massage for Restoring Circulation

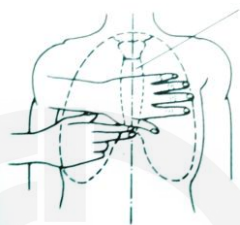
In cases of breathing failure, you should check that the victim's heart is still beating. This is especially important with victims of electric shock or poisoning where heart failure is a particular hazard. This check can be carried out by feeling the pulse at the wrist or neck or by applying an ear to the victim's chest. Other symptoms are widely dilated pupils and a grey colour of the skin.

The heart massage is done as follows:

- (1) If a heartbeat cannot be detected, place the victim on his / her back on the floor (hard surface).
- (2) Strike the upper left chest forcibly in the middle of the sternum or breast bone region with a closed fist. This may result in resumption of normal heartbeat, for instance, in electric shock cases.
- (3) If the heart still does not beat, cardiac massage is to be given by using the procedure given below.
  - a) The position for massaging is 1"-2" (or two fingers width) above the bottom end of sternum (Fig. 13.6 a).
  - b) Place the heel of one hand on this point and the other hand on the top of it. Interlock the fingers to keep away from the victim's rib. Only the heel of your hand should make contact with the chest so that excess pressure may not be applied.
  - c) Keep your elbows straight and lean forward.
  - d) Then start pushing with the force of both your hands one above the other (Fig. 13.6 b). Apply steady smooth pressure to depress victim's sternum 1½" to 2".
  - e) Then relax pressure maintaining the position of the hands.

- f) Give 15 such chest compressions and then two quick lung inflations by mouth-to-mouth breathing.
- g) Continue this process four times in a minute - namely -
- 60 chest compressions (15 at a time for four times)
  - 8 lung inflations (2 at a time for four times)

The steps (f) and (g) are valid if there is a single person doing resuscitation. If there are two persons doing resuscitation, one may give chest massage and the other may give mouth-to-mouth breathing such that for five compressions there is one mouth-to-mouth breathing. The process of resuscitation in both the above cases, has to be continued till the heartbeat resumes or until medical help arrives or the victim reaches hospital.



**Fig. 13.6: Heart Massaging: a) Finding the position for massage - placing a hand at a distance of about two fingers (1"-2") above the bottom end of sternum; b) Applying the pressure on the chest - note the leaning position of the person providing first-aid and his straight elbow on the victim's chest. His fingers are interlocked and pressure is applied through the heels of the hands.**

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### SAQ 5

What are the purposes of resuscitation?

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## 13.7 FIRST AID PROCEDURES FOR CHEMICAL ACCIDENTS

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There are three general procedures to be followed for chemical accidents and all are based on the principle of diluting the hazardous chemicals as quickly as possible. The procedures relate to the three routes of entry of the chemical into the body as mentioned in Unit 12.

These are:

- Ingestion: i.e. the oral route
- Inhalation: of the vapours, fumes or dust
- Dermal exposure: direct skin contact by spills or by improper handling

Let us deal with each one of these separately.

### Ingestion

The standard treatment for this type of exposure is as follows:

- (1) Make the victim to spit out as much of the ingested material as possible and then wash the mouth thoroughly a number of times with water. Do not let the victim swallow the chemical.
- (2) If the chemical has been swallowed, give large drinks of water or milk to dilute the chemical in the stomach.
- (3) Do not induce vomiting as this may result in further damage to the delicate tissues of the upper food passages, if the substance is corrosive.
- (4) Transport the victim to hospital. Wherever possible, the following information should accompany the victim:
  - (a) the identity of the ingested chemical,
  - (b) the approximate amount and concentration of the chemical consumed,
  - (c) brief details of the treatment already given.

Amyl nitrite capsules have a shelf –life of two years and can explode if not kept cool. Cyanide salts are usually forbidden in schools.

Experiments with cyanides and other highly toxic substances should never be carried out without having sufficient amounts of the specific antidote immediately available (amyl nitrite), and a specially trained first aid provider.

Safe laboratory practice, *e.g.* never pipetting by mouth, never eating in the lab, always washing hands after working with chemicals, *etc.* should minimise ingestion accidents.

### Inhalation

This route of toxic substances into the body is the most dangerous and requires the most immediate response. Most poisonous gases, such as chlorine, hydrogen sulphide, ammonia and hydrogen cyanide, are detectable by their odour or by their irritating effect on the nose, throat, *etc.* Do not ignore these initial warning signs as the nose quickly becomes insensitive to smell. For example, hydrogen sulphide has strong smell of rotten eggs but because of the paralysing effect of the gas, it seems to be odorless when highly concentrated. Therefore, one may inhale a large amount of the gas without realising it.

Remember also that poisoning by inhalation does not just happen with gases – it can happen with vapours also, *e.g.* phosphorus pentachloride. Other substances, like dust and spores, *e.g.* some of those encountered in the biology lab, may produce severe allergic reactions, which require the same treatment as gas hazards.

The standard procedure in gas based accidents is as follows:

- (1) Remove the victim from the danger area, provided this can be done without putting yourself in danger,
- (2) Loosen the victim's clothing and administer oxygen if it is available.

- (3) If breathing is stopped, apply artificial respiration through a properly trained person.
- (4) Transport the victim to hospital if the situation needs it. Give details of the gas inhaled and of the treatment given.

### Procedures for Treatment of Chemical Burns

Accidental splashing of chemicals onto the skin can produce burns as a result of the corrosive nature of the substance involved. It can also cause skin disorders such as dermatitis. Examples of chemicals that could cause burns are as follows: phenol, bromine, strong acids especially concentrated sulphuric acid, nitric acid, strong bases, (sodium hydroxide and potassium hydroxide) *etc.* The standard first aid treatment for chemical burns is the same as that for dealing with splashes of poisons or other potentially hazardous chemicals on the skin.

The procedure is as follows;

- (1) The first step in such a situation is to remove the chemical at the earliest.
- (2) Remove contaminated clothes, longer they stay on the skin, greater the damage.
- (3) Remove rings, watches and other ornaments in the affected area as these may trap the chemicals and increase the damage.
- (4) Drench the affected area with large amounts of running water. Continue for at least five minutes or until you are satisfied that the chemical is no more in contact with the skin.
- (5) Chemicals known to be insoluble in water can be removed with soap under a running tap. In cases where the water supply is limited, it is best to wipe as much of the acid or other corrosive liquid from the skin quickly as possible with clean cloth before using the little water which is available to wash the affected area.
- (6) Take care that the washings do not go onto the unaffected portion of the skin. Save yourself also.
- (7) Avoid using neutralising solutions. These generate heat, which increases damage.**
- (8) If the victim is seriously injured or if the burn was caused by splashes of hydrogen fluoride or other extremely dangerous substances, arrange immediate transportation to the nearest doctor.

Immediate and plentiful dilution is the most desirable action for many “skin contact” accidents with chemicals – particularly for concentrated sulphuric or nitric acids. In fact, water alone, is increasingly recommended for all types of burns.

Antidote: Any substance that gives relief from the effect of a harmful material

Don't underestimate the penetration effects of the chemicals for example phenol can kill through penetration. The effects of burns from bromine, phenol or sodium are considerably reduced and the accompanying pain of the injury is lessened by applying an antidote as given in Table 13.2.



Table 13.2: Antidotes for Some Chemical Reagents

Chemical	Antidote
Bromine	Wash with 2 M ammonia, keep the affected part dipped in sodium bisulphite solution.
Phenol	Apply ethanol or glycol on a cotton wool pad.
Sodium	Apply ethanol on a cotton wool pad.

"2 M" stands for 2 molar solution.



Eye wash station

Acute effect - Severe and immediate effect

Chronic effect - The effect due to prolonged exposure

### In case the corrosive chemical falls in the eye i.e. it is a case of an ocular burn

- Remove the contact lens, if it is there, as the chemical can get in between the lens and cornea and cause damage. Do not let the patient rub her / his eyes.
- Wash the eye with gently running water from the tap, an eyewash bottle or eye wash station for 10 to 15 minutes.
- Open the eyelids and ensure that water drenches the eyeball.
- **All eye injuries must be seen by a doctor preferably within an hour.**

### Acute and Chronic Effects of the chemicals

The effects of accidents due to chemicals are severe and immediate on the human body. These effects are called **acute effects** and can be noticed without difficulty. However, due to poor lab practice or an unsafe system of work there can be gradual poisoning by a chemical. This also has harmful effects. The harmful effects due to long term exposure to a chemical are called **chronic effects**. These effects generally go unnoticed or are attributed to the wrong cause. It may be hard to trace the real cause of these chronic or long term effects. In some cases, final results could be much worse than the immediate results. For instance, consider the effects of ingested alcohol:

- Acute effect – drunkenness and vomiting
- Chronic effect – addiction, liver damage, etc.

Safe lab practice will also minimize chronic effects. An example of good practice is ventilating the lab in the morning; this will minimize immediate poisoning or suffocation (acute effect) and longer term poisoning (chronic effect) due to inhalation hazards.

## SAQ 6

Are these four steps for dealing with a gas-affected victim in the correct order? If not, put them in the correct order by indicating the respective numbers within brackets:

- (1) Apply artificial respiration if breathing has stopped.
- (2) Loosen the victim's clothing and give oxygen if available.
- (3) Remove the victim from the danger area if possible.
- (4) Transport the victim to hospital, if the situation so requires.



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## SAQ 7

What is the purpose of applying an antidote to a chemical burn?

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### 13.8 CONTROLLING BLEEDING

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The accidents involving cuts and sometimes falls are accompanied by bleeding. The nature of bleeding would depend on the severity of the accident. In this section, we will discuss methods of dealing with three types of bleeding:

- (1) Severe bleeding
- (2) Moderate and mild bleeding
- (3) Internal bleeding

The first of these, severe bleeding, must be attended to urgently. You would recall that controlling bleeding was the third step in the general procedure for first aid. You need to use your judgment here. If a large artery is cut, stopping bleeding would be the first life – saving measure that needs to be taken. The second type of bleeding would usually be dealt with in the later stages of the general procedure under localized injuries. The third type of bleeding cannot directly be dealt with by the first aid provider for this you would need medical help. While treating a patient, you should ask him or her when he / she last had an anti-tetanus injection. **All technicians especially those working with soil or animals should have anti-tetanus injections every five years.**

#### Severe Bleeding

In case of severe bleeding, follow the steps given below:

- (1) The bleeding can be controlled by the following means:
  - (a) Apply direct pressure on the wound for 5-15 minutes with a clean pad of cloth. If a clean cloth is not available, use fingers or bare hands. Press the sides of large wounds gently but firmly together. If it is not possible to apply pressure directly on the wound, apply indirect pressure at an appropriate point on any artery between the heart and the wound. This treatment prevents blood reaching the wound and is the method, which must be applied immediately in any accident in which an artery has been cut. Indirect pressure may also be applied around the wound using a ring bandage. The technique may be used if pieces of glass or metal are in the flesh.
  - (b) Wherever possible, lay the victim down with the head lower than the rest of the body and – provided an underlying fracture is not suspected - raise the injured part and support it. This has the effect of increasing the blood supply to the brain. If the injured part is raised above the heart, the pressure effect of having to flow uphill will also reduce blood loss from the wound.
- (2) Carefully remove any foreign bodies that can easily be picked out of the wound.

Wounds are cuts in the skin which cause bleeding and can be either external or internal. Both categories are potentially dangerous as, in addition to the loss of blood, they may allow germs to enter that could cause infection.

Dressing is a covering applied to wound or an injured part.

**Sling:** A sling is used to afford support and rest to an upper limb such as arm, wrist, chest *etc.* Arm sling (Fig.13.7), for example, is a wide piece of cloth looped from the neck under an injured arm for support.



**Fig.13.7: Victim with an arm sling**

- (3) Apply a dressing directly over the wound and press it down firmly. Cover it with a pad of soft material and bind it with a firm bandage to keep the dressing and pad in position.
- (4) Immobilize the injured part using a sling or, in the case of a lower limb, by padding and tying it to the other leg.
- (5) Call an ambulance and carefully transport the victim to the hospital.

### Dressing a wound

A wound should be cleaned first and covered with a protective dressing. The main purpose of the dressing is to:

- (1) prevent infection,
- (2) control bleeding,
- (3) absorb any discharge from the wound, and
- (4) reduce further injury.

The main types of first aid dressing for surface wounds are sterile adhesive pads such as 'Band-Aid', and the prepared standard gauze dressings covered with a pad of cotton wool which are supplied sealed in paper or plastic covers to keep them sterile. 'Bandaging' is a skill, which is obtained only by practice, and it is outside the scope of this course to turn you into a bandaging expert. However, it is necessary for you to know the essentials about the use of first aid dressings.

### Slight Bleeding

Many a times, the bleeding stops on its own or is easily controlled by applying local pressure. The procedure for first aid treatment for wounds having slight bleeding is as follows:

- (1) Reassure the victim and keep him / her still.
- (2) Wash the wound in running water. Dry the skin with swabs of cotton wool, using each swab only once and wiping away from the wound.
- (3) Apply a dressing with a pad if required and bandage firmly. It is convenient to use an adhesive dressing.
- (4) If you don't suspect that a bone is broken you may raise the injured part and support it in this position with a sling or by resting it on something of a convenient height such as a table or laboratory stool. You can support the area with a pad of old newspaper or plain wood or cardboard.

### Internal Bleeding

If the patient's condition becomes worse without any external injury, one possible cause is internal bleeding. You cannot do much in such a case; you can try to reassure the victim and call for a doctor immediately. Internal bleeding should always be suspected after a violent blow has been sustained and the person is in a state of shock.

However, one common type of internal bleeding that you can treat is a nosebleed. In case of a nosebleed,

- (1) the victim must be made to sit upright with his / her head slightly forward,
- (2) pinch his / her nose just below the hard part for about 10 minutes,
- (3) tell the victim to breathe through mouth,
- (4) do not attempt to plug the nose, and
- (5) seek the medical help immediately.

This procedure should be followed in all cases, though persistent bleeding from the nose should receive professional medical attention.

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### *SAQ 8*

List four steps you would take to give first aid treatment for a severe bleeding.

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## **13.9 FIRST AID TREATMENT FOR SHOCK**

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All accidents are accompanied by a certain amount of shock that can be seen in terms of shivering, giddiness or excessive sweating etc. It is due to the changes in the system of blood circulation. Shock may arise due to

- loss of blood caused by injury or
- fall in blood pressure without loss of blood.

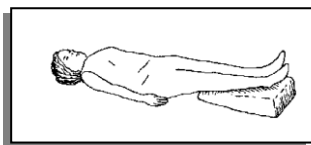
Shock may also be present even in cases where one suffers from severe and sudden fear, without any physical injury. In some laboratory accidents, such as explosions or burns from splashes of concentrated sulphuric acid, the effects of shock may be more serious than the injuries themselves. Shock varies a lot in its severity and can be fatal. Sometimes the effects are delayed and shock may not be observed until some time after the accident.

The chief symptoms of shock are as follows:

- Extensive sweating
- Paleness, cold skin and rapid breathing
- An increased pulse rate or a weak pulse
- Trembling, faintness, blurred vision, giddiness
- A feeling of sickness and vomiting
- Anxiety

If the victim is seriously injured, it is advisable to get him / her immediately to the hospital. Do not waste time as sometimes immediate blood transfusion may be required to save the life.

In other cases, the following treatment should be given:



- (1) Make the victim lie or sit down, if necessary, and deal with the injury or cause of shock. If the person is feeling cold wrap her / him in a blanket, but do not use hot water bottles or electric fires as this draws blood from the vital organs to the skin.



- (2) Loosen ties, belts or other tight clothing at the neck, chest and waist.
- (3) Raise the victim's legs, if possible, to bring more blood back into the brain. If the person is sitting down, e.g., after fainting, it may be more convenient to get her / him to lower his / her head between the knees.
- (4) Keep the person still and reassure her / him.
- (5) Do not move the person unnecessarily.
- (6) If the injured person complains of thirst, moisten her / his lips with water. Remember, a seriously injured person may require an anesthetic immediately on arrival at hospital; so, do not give her / him anything to drink until you are satisfied that any injury is only trivial, e.g. faintness or dizziness.
- (7) Do not allow the victim to drink alcohol and never give tea, coffee or any other liquid to a person who is unconscious or is suspected of having internal injuries. If the patient has anything in her / him digestive system such as tea, either the anesthetic, if administered later at the hospital, may be refused or it could cause vomiting. In either case, it makes the surgery, if required, quite difficult.

### SAQ 9

"The best thing for shock is a warm cup of sweet tea" is a common advice generally offered by the onlookers. If you had time to give a reply, what points would you raise?

## 13.10 FIRST AID TREATMENT OF LOCALISED INJURIES

So far, we have seen main life-saving functions of first aid. Let us discuss the task of controlling some other injuries so that they do not pose a major threat to the victim while professional medical aid is sought.

### 13.10.1 Burns

There are two types of burns, which we need to discuss. These are the chemical burns and thermal burns. Of these the chemical burns have already been discussed in Sec. 13.7; so we shall discuss thermal burns, i.e. burns due to high temperature. Two common injuries due to thermal burns are:

- i) Dry burns from flames or from picking up hot glassware or metals
- ii) Blisters from steam, boiling water or other hot liquids.

Direct contact with the source of heat causes tissue damage. In addition there is a considerable danger from shock that is directly related to the extent of the injury.

The aims of the first aid treatment of thermal burns are to reduce the local effects of heat,

- to relieve pain,
- to prevent infection of the affected area,
- to replace fluid loss and thereby reduce shock, and
- to remove a severely injured victim to hospital as quickly as possible.

The procedure to be followed is as follows:

- (1) Cool the injury as rapidly as possible and reduce pain by immersing the affected part in cold water or holding it under a running tap.
- (2) Remove rings, bracelets, boots or anything else of a pressing nature before swelling occurs. Don't pull away clothing that has been burnt and is sticking to the skin.
- (3) Cover the wound with a dry, sterile dressing.
- (4) Give small volumes of cold drinks at frequent intervals to a badly burnt conscious victim to counteract the effect of fluid loss. However, before giving liquids it must be made sure that a surgery is not necessary.
- (5) Reassure the victim.
- (6) Badly burnt or blistered victims must be taken to hospital as quickly as possible. Any burn injury in which more than 10% of the body surface is burnt is considered as very severe and immediate hospital treatment is vital. For example, the surface area of your head or back represents about 11% of the total surface area of your body.

Do not prick any blisters that form, and do not touch the affected area as this can increase the risk of infection. For very minor burns, apply 'Burnol'. If severe burns are there, do not apply lotions or ointment.

### **13.10.2 Fractures**

Any broken or cracked bone is referred to as a fracture. The general symptoms of a fracture are as follows:

- Sensitivity when gentle pressure is applied to the affected area and localized pain, which increases if the, injured part is moved. Some fractures such as those of the wrist or fingers produce little pain and the victim may feel that s/he has only bruised or strained the affected area.
- Swelling occurs as a result of blood loss into the surrounding tissues and may mask other symptoms.
- If a deformity or unnatural movement is observed, wherever possible the injured and uninjured limbs should be compared.
- Shock.

**Bruise:** Bleeding beneath the surface of the unbroken skin.

It is not our intention to introduce you to many types of fracture that can occur or all the ways a first aid provider might deal with them. The essential thing we wish to bring to your notice is that if a victim with a fracture is moved without first taking steps to immobilize the fractured limb there may be serious complications.

**Splint:** A thin, rigid strip of wood, metal etc. used to keep a broken bone in place. It can be improvised by flat wood or news papers.

The recommended action in any accident in which a fracture is suspected is to keep the victim still and not to move her / him unless it is necessary to separate her / him from some other hazard which could endanger her / his life. Remember that any movement can cause further injury and the part should be immobilized by means of a body bandage or by the use of splint and bandages.

The best general treatment for a fracture is to:

- 1) cover the victim with a blanket
- 2) keep the victim warm
- 3) send for an ambulance
- 4) treat for shock and do not give any drinks.

### **13.10.3 Eye Injuries**

The eyes are a particularly vulnerable part of the body. Safety glasses, goggles or a face shield are a 'must' for any experiment where there is any danger of splashes of chemicals, broken glass or particles of metal entering the eye. Eye injuries are common occurrences, particularly where power tools are used. However, the use of safety goggles will prevent nearly all accidents of this kind. Injuries are usually caused by

- 1) entry of a foreign body in the eye, or
- 2) chemical splashes into the eye.

In either case, initial first aid treatment is through the use of tap water.

Splashes of chemicals or of corrosive liquids in the eye must be treated immediately as any delay may result in permanent damage to the sight. Strong alkalis are particularly dangerous. The aim of first aid treatment is to dilute and eliminate the chemical as quickly as possible and then to get the victim to hospital for urgent treatment.

The standard first aid procedure is as follows:

- 1) Hold the eye open or get the victim to blink repeatedly while washing the eye with clear, fresh tap water for several minutes.
- 2) Place a clean dressing over the eye.
- 3) Arrange immediate transport to the hospital. All eye injuries caused by the action of chemicals require urgent medical treatment. In some cases, the effects of the injury may not develop for some time.

**Grit:** Hard particles of sand or stone.

Foreign bodies, such as a piece of sand or an eyelash, may be removed from the eye using the corner of a clean handkerchief. All eye injuries resulting from solid objects should receive urgent skilled medical attention.

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## SAQ 10

Can you write down the four steps you would take on discovering a suspected fracture?

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### 13.11 SUMMARY

Accidents in laboratories, by and large, occur due to unsafe work practice. The accidents may result in harm to someone and / or damage to equipment and premises. In this unit, we have listed a series of guidelines for offering first aid treatment for specific situations like electric shock, unconsciousness, chemical accidents, bleeding, burns, fractures and eye injuries. Due care must be shown while using these procedures. Wherever necessary, the victim should be provided with skilled medical attention at the earliest.

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### 13.12 TERMINAL QUESTIONS

- (1) Differentiate between incident book and accident report form.
- (2) If an electric shock victim is in contact with high voltage electric current such as that coming from overhead electric power cable, what is the method to be used in separating the victim from the hazard?
- (3) Assume that you have given the required first aid to an unconscious victim. You are waiting for proper medical assistance. In this situation, what would you record in writing?
- (4) State the first aid procedure to be followed in dealing with a victim who has swallowed some poisonous chemical while pipetting.
- (5) Name any five sources of vapour, gas or dust that could cause poisoning by inhalation.
- (6) Suggest three methods of checking whether the victim's heart beats.
- (7) What are the main purposes of first aid dressing?
- (8) What is the first step in the first aid treatment of shock?
- (9) The five aims of first aid treatment for thermal burns are
  - (i) to reduce the local effect of heat
  - (ii) to relieve pain
  - (iii) to prevent infection of the burn
  - (iv) to replace lost fluid
  - (v) to reduce shock

What are the five steps to be taken to achieve these aims?

## 13.13 ANSWERS

### Self Assessment Questions

- (1) According to Occupational Health & Safety Advisory Services *an incident is referred to as a work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred. An **accident** is regarded as a particular type of incident in which an injury or illness actually occurs.*
- (2) One of the first aid boxes containing minimum content is to be kept in unlocked condition in order to cater for emergency usage. It must be within easy reach. The other first aid box with contents above the minimum requirements should be kept locked and, a responsible person put in charge of it. The second box serves as a support in times of need.
- (3) The members of the crowd can be used to contact ambulance, fire service, doctor etc. A person can be asked to take care of the accident victim until doctor arrives. They can also be used to clear up the spilled chemicals, or broken glassware or extinguish the fire (if it is only a small one) *etc.*
- (4) The power supply has to be turned off or it should be made certain that the victim is no longer in contact with the power supply.
- (5) Resuscitation helps to clear the airway, restore respiration and restart circulation.
- (6) (3) (2) (1) (4).
- (7) The antidote helps in lessening the pain of the injury by removing or neutralising the substance. Also, it helps in reducing the effects of burns.
- (8) (a) Control bleeding.  
(b) Remove foreign bodies, unless they are deeply embedded  
(c) Apply a dressing directly over the wound.  
(d) Immobilize the injured part of the body.
- (9) If the victim has to undergo an operation using an anesthetic, tea or any fluid in the digestive system would result in the refusal of the anesthetic or vomiting. In either case, the chances of the patient undergoing a smooth operation are considerably diminished by fluids. If a victim is thirsty, only her / his lips need to be moistened with water.
- (10) (a) Do not move the victim unless absolutely necessary.  
(b) Immobilize the fractured part by use of a body bandage or splint.  
(c) Treat for shock.  
(d) Call for professional medical aid, and remember – don't give any drinks.



## **Terminal Questions**

- (1) Incident book contains details of all accidents and 'near misses'. The book is a valuable source of information to the alert lab Incharge who also maintains it. The entries in the incident book are to be made by the person attending on the accident victim or by any of the lab staff. Accident report forms are to be used in case of serious accidents. These forms are to be prepared and maintained by the lab Incharge and a copy of each filled-in form may have to be sent to the Head of the institution who could initiate measures to improve safe working conditions in the lab.
- (2) The victim can be pulled or pushed, using a wooden chair, thick dry cloth, rubber or other insulating material. The person administering first aid should stand on a dry insulating surface such as a wooden chair.
- (3) The victim's responses and pulse rate are to be recorded at regular intervals.
- (4)
  - a) Tell the victim to spit out as much as of the chemical as possible and to wash the mouth repeatedly with water.
  - b) Give large drinks of water or milk to dilute the poison.
  - c) Don't induce vomiting as this may cause further damage.
- (5) Chlorine, hydrogen sulphide, ammonia, hydrogen cyanide and phosphorus pentachloride could cause poisoning by inhalation.
- (6) The heartbeat can be checked by feeling the pulse at the wrist or neck or by applying an ear to the victim's chest.
- (7)

(i) Prevention of infection	(ii) controlling bleeding
(iii) absorbing any discharge	(iv) reducing further injury.
- (8) Where ever possible, ensure that the victim is lying down (with the legs raised) or sitting down (with the head lowered between the knees), and protected from the cold by using a blanket wrapped underneath; but do not use hot water bottles or electric fires as this draws blood from the vital organs to the skin.
- (9)
  - (i) Reduce the local effects of heat by immersing the affected part in water. Use gently running water or a full bucket or bowl. Speed is essential.
  - (ii) Relieve pain by removing anything that might cause swelling by pressing, but do not pull away clothing that has been burnt and is sticking on to the skin.
  - (iii) Cover the injury with a dry, sterile dressing.
  - (iv) Counteract the effect of fluid loss by giving small volume of cold drinks if the victim is conscious, and if operation is not necessary.
  - (v) Reassure the victim.