GENERAL STANDARD

FOR

FIRST AIDS AND SANITATION

CONTENTS :

PAGE No.

PART ONE: SANITATION

PART TWO: FIRST AIDS AND REHABILITATION

0. INTRODUCTION

Vast complexes and varieties in nature and locations of operations within Oil, Gas and Petrochemical Industries necessitates specific requirements related to sanitary and first aid measures. This Standard Specification outlines the mentioned specific requirements.

1. SCOPE

Sanitation and first aid are two essential factors and the minimum requirements for keeping plants/machinery, working places and personnel in healthy conditions are given.

The deleterious consequences of undesirable sanitary conditions and poor first aid procedures in the Oil, Gas and Petrochemical Industries are briefly categorized as follows:

a) Unsafe working conditions.
b) Malfunctioningmachineries.
c) Poor health of personnel.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor/Consultant/Contractor.

First Aids in Industries by Dr. J. Aryanpour

3. DEFINITIONS AND TERMINOLOGY

3.1 Sanitation

Use of scientific knowledge in providing means to preserve health; use of things that contribute to hygiene and health cleanliness of working places and living quarters.

3.2 First Aid

Immediate treatment by a first aider of an ill or injured person in an emergency before arrival of a physician/surgeon, such as artificial respiration, bandaging, massaging, and use of slings, splints, tourniquets, stretchers, antiseptics, emetics etc.

Abbreviations:

dB	Decibel.
AC	Alternative Current.
DC	Direct Current.
mg	milligram.
Lit	Liter.
kg	kilogram.
I.O.G.P.	Iranian Oil, Gas and Petrochemical.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

PART ONE
SANITATION

5. SANITATION AND HYGIENE OF THE PLANTS AND WORKSHOPS

5.1 Cleanliness

5.1.1 Not less than eight hours a day are spent at work; if the working surrounding are dirty and depressing the worker tends to become dirty and depressed. The standard of behavior, especially in the young worker, is set by standard of cleanliness and hygiene of working places.

5.1.2 Lavatories

Filthy lavatories invite disgusting habits. The general appearance of the factory, benches, tools, floors and walls must be spotless, the provision of proper cloakrooms and the adequacy washing and lavatory accommodation, make a special impression.

Lavatories should be of the water carriage type and separate lavatories for each sex provided at the rate of one for every twenty-five women and twenty-five men up to the first 100 men and then at the rate of one for every forty men in privacy and ventilated. In women's lavatories, sanitary towels should be available from automatic machines, and bins provided to receive soiled towels. The bins must be emptied and the soiled towels burnt daily. Wash basins with taps and wash plugs are unsatisfactory as they are seldom kept clean; the fountain type with a spray of water controlled by a foot pedal is most satisfactory. Soap should be dispensed from containers either in the form of liquid or powder. Hot air dryers are more satisfactory than towels, and though it seems to take much longer to dry the hands on a hot air drier than with a towel, the extra time taken is only a few seconds if the drier is in frequent use so that hot air is delivered immediately.

Note:

From medical point of view, employees who are disabled or unfit should use standard urinals or European lavatories. The rate of these lavatories depends on the number of men in a factory or local requirements.

5.1.3 Colors

Colors used to paint walls and machineries should be cheerful and pleasing; in cloakrooms and lavatories the walls should be covered with tiles and the floors with tiles or terrazzo that are easily washed.

5.1.4 Gulley

A gulley running the whole length of one side of the room with the floor sloping slightly towards its washing facilities should be provided.

5.1.5 Lockers

Separate lockers should be provided for each worker. Means of drying wet clothes and shoes should be provided; hot pipes under the lockers are satisfactory but if the clothes are crowded together in the lockers, drying may be delayed. The best locker is that in which the clothes are hung on coat hungers. A separate shelf should be provided for hats handbags. Mirrors should be fixed away from washing fountain or basin and in women's cloakrooms a wide shelf for handbags should be provided beneath the mirrors. Adequate space is essential in all cloakrooms and lavatories if a high standard of behavior is to be achieved.

5.1.6 Lighting

The intensity of lighting in lavatory should be greater than in the factories so that on entering a lavatory a sense of cleanliness is engendered. As a rule, the intensity of lighting should not be less than 26.9 Lux (25 foot-candles).

5.1.7 Living quarters

The most important sanitary factors which should be observed are:

a) daily cleaning of rooms, bathrooms, lavatories;
b) weekly change of bed lining;
c) bed linings should be changed before the shift change.

6. MECHANICAL AND ELECTRONIC EQUIPMENT AND RADIATION

6.1 Machinery and Plant

6.1.1 Machines should be so designed to facilitate the movement of employees and not only to design the space required for the size of machines.

Seating is a problem in the prevention of fatigue. Foot pedals are often inconveniently situated, both in height and distance from the center of gravity to the site of operation, thus causing an undue strain on the muscles of the back, pelvis and opposite leg. Shock absorbers should be fitted on all pedals whether foot or hand operated. The convenience and conversely fatigue of the employees should always be considered in the design of a machine. The layout of control and recording instruments should be studied so that the "pattern" of the operation is quickly observed. If control movements are required these movements should be geared to secure an optimum relation between speed of control and precision of operation.

6.2 Electronic Equipment

6.2.1 Electronic equipment which are utilized in the control rooms, key boards and computer rooms, etc. should be regularly checked for any malfunctions and kept sanitized. Monitors should be equipped with special filters for prevention against radiation.

6.3 Radiation

6.3.1 Biological effect

6.3.1.1 Radioactivity causes ionization of proteins. This effect is best shown by disintegration of chromosomes at the point of passage of rays and particles. Tissues undergoing mitosis are selectively sensitive to ionizing radiation.

The most important effects of radioactivity are as follows:

a) germinal epithelium is damaged;
b) haemopoietic system;
c) Gastro-intestinal membranes;
d) a rarefying osteitis and bone neoplasms;
e) tumor formation;
f) post cortical cataract;
g) skin disorders.

6.3.2 Special regulation

See IPS-G-SF-110.

6.4 Chemical Substances

6.4.1 Chemical substances may be absorbed into the body in three ways:

a) by ingestion and absorption from the alimentary tract;
b) by absorption through the skin;
c) by inhalation and absorption through the lungs.

The first way is rare and often semi-accidental cause of industrial poisoning, but the last is the most common way in which industrial poisons are absorbed. The lungs are the great mode of entry for most industrial toxic substances, first because of the nature of industrial processes, and second because substances absorbed through the lungs enter the systemic blood stream. Substances absorbed through the intestines pass through the portal system and elimination or detoxification by the liver may occur and a toxic quantity can reach the systemic blood.

6.4.2 Prevention

Prevention and avoiding of contamination of the skin consists as follows:

a) chemical substances should not be handled more than is essential;
b) adequate ventilation of workshops;
c) good nutrition;
d) periodic medical examination;
e) selection of workers for employment;
f) adequate washing facilities;
g) barrier substances may be applied in the form of powder, cream or varnish.

7. PERSONAL SANITATION

7.1 Personal Hygiene

7.1.1 In addition to cleanliness in the work places, personal cleanliness is of the first importance. Cloak-rooms, washing rooms, mess rooms, bath, nailbrushes, towels and soap must be provided. The hands should always be washed before eating, and the work-people urged to take a warm bath. Food and drink shall not be brought into the workrooms and smoking at work must not be allowed.

7.1.2 Skin

Facilities for washing and taking showers after work should be available and facilities for complete change of clothing before work should be provided.

Dirty clothing should be washed daily and a good neutral soap should be in hand.

Barrier creams should be available wherever recommended by the medical authorities. It should be applied to the skin to prevent irritating of substances from coming in contact with the skin.

7.1.3 Hairs

Long hairs should be kept covered by some hygienic protective cloth when working at workshops.

7.1.4 Dental examination

Regular dental examination can achieve the hygiene of the mouth.

7.2 Protection Against Infection

It needs the following precautions:

a) provision of wholesome water and food;
b) sanitary and washing accommodation;
c) maintenance of individual cleanliness and cleanliness of surrounding;
d) the detection and treatment of carriers of vermin and diseases.

7.3 Prevention Against Accident and Fire

a) adequate floor space and cubic space for each worker 11/327 cubic meter (400 cubic feet per person as the minimum permissible space);

b) control of toxic hazards;

c) elimination of electric shock and burn;

d) control of fire.

e) precautions against hazards of traffic movement.

7.4 Medical Examinations

7.4.1 In I.O.G.P Industries medical examinations are of two main types:

a) Examination prior to placement.
b) Periodical examination when the employee is exposed to special risk.

The details and techniques of medical examination will vary according to the industrial hazards.

7.4.1.1 Pre-placement medical examination

A properly conducted pre-placement examination protects employer and employee. Industrial Medical Officer must have full knowledge of two factors:

First, the work to be undertaken, including any special risks. Second, an exact knowledge of patient's physical and mental state acquired by a full investigation of family and personal history.

7.4.1.2 Periodic medical examination

Periodic examination is meant a medical inspection of an employee at specified intervals to prevent risk either to the employee or to the fellow employees, or detect hazards before any permanent harm has resulted.

8. GENERAL ENVIRONMENTS

8.1 Site Conditions

An environment at work should provide for:

8.1.1 Physiological requirements:

- Maintenance of thermal environment (including appropriate humidity) sufficiently warm to prevent excessive heat loss and not too hot to prevent adequate heat loss from the body.

- Atmosphere of reasonable purity.

- Admission of adequate daylight, the provision of sufficient artificial light and the avoidance of glare.

- Protection against excessive noise.

- Adequate space for work and movement.

- Nutritional needs.

8.1.2 Psychological requirements:

- work within (but near to) limit of mental capabilities;
- work without undue time stress and with reasonable hours of employment;
- hygienes and social standards not less than those prevailing in the community;
- opportunities to find out satisfaction in work and in membership of a group;
- recreational facilities.

8.2 General Conditions

The general environmental conditions in which work is performed, though frequently overlooked, are the most important of all factors affecting well-being at work. Another important factor is the relationship between the employee and the management. Unsatisfactory environmental conditions give rise to a fall in output, a lowering of health, an increase in accidents, and a host of real or imaginary grievances.

8.3 Heating

The temperature of work places after the first hour of work should not be less than 15.50°C (60°F), though even this is chilly for light work. For light work most people are comfortable at approx. 19°C (67°F) with an air velocity of 33 m (100 feet) per minute, though the range of comfortable temperature may extent from 12 to 24°C (54 to 76°F).

The output of an employee decreases as the temperature rises above comfortable level.

At least one thermometer should be provided in each workroom. The thermometer should be about 1.65 m (five feet) above the floor with the bulb freely exposed and so situated as to record fairly the conditions to which employees are exposed.

8.4 Ventilation

Ventilation is related to heating, for it is common knowledge that in the absence of proper heating, ventilation of a room is cut down by the occupants.

The object of good ventilation is to avoid these conditions, to create an adequate change of air and to supply clean air, so that the air is kept comfortable and body odors are removed.

8.5 Humidity

The amount of sweat evaporated from the skin, and loss of heat by this means, is influenced by the humidity of the air. High atmospheric temperatures prevent loss of heat by radiation, and if combined with a high humidity, the other main means of losing heat will upset.

Dry air is unpleasant over long period, dryness and soreness of the nose and pharynx are produced together with cracking of the lips.

However the humidity should be between 60-70 percent.

8.6 Lighting

8.6.1 The best light is daylight and the proper arrangement of adequate window space or roof lights directed towards the north will always provide better illumination than artificial light. The characteristics of daylight are its great intensity (on a dull day equivalent to 200 or more foot candles and on a bright sunny day 1000 or more foot candles) and the diffuseness of the light.

Recommended values for illumination:

- fine assembly work -107.60 Lux (100 foot candles);
- drawing office-32.28 Lux (30 foot candles);
- ordinary bench and machine work-10.75 Lux (10 foot candles);
- corridors-5.38 Lux (5 foot candles).

Others:

- work of simple character not involving close attention to detail, 4.30-6.45 Lux (4-6 foot candles);
- casual observation where no specific work is performed, 2.15-4.30 Lux (2-4 foot candles).

8.7 Noise Control

Full information is covered in IPS-G-SF-900.

8.8 Dust, Spray, Gases and Vapors

8.8.1 Dust, spray, gases and vapors may all find access to the body through the respiratory tract. Chlorine has an immediate action on the respiratory tract; phosgene has delayed action; lead, hydrogen sulphide act when absorbed into the blood stream, and others may show their effect many years later by their action on the lung such as silica, or on the body like manganese.

8.8.2 Dust

Dust hazard is the most difficult substance to control. Construction of dust-proof apparatus or the reduction of dust by ventilation is often a matter of extreme difficulty. Liquids and gases are easily confined.

Pneumoconiosis is defined as all forms of pulmonary reaction to inhaled dust. Legally, "pneumoconiosis" is associated with fibrosis of the lungs consequent on the inhalation of dust.

8.8.3 Silicosis

Silicosis is defined as a pathological condition of the lungs due to inhalation of silicon dioxide.

Silica occurs in various states of purity in earths, ores and stones. Quartz, granite, schist and sandstone consist of pure or nearly pure silica. The classical lesion produced by silica is nodular fibrosis.

8.8.4 Asbestoses

Asbestos is varying composition and consists of silicates, several base metals, principally magnesium and iron and to a less extent, calcium, sodium and aluminum combined in a fibrous form. Long fibers are used for weaving into cloth, belts, safety-curtains and brake linings, but asbestos board, paper and insulating materials are prepared from short fibered material.

Asbestos penetrates into the alvedi, whereas asbestos fibers tend to remain in the fine brochioles. After months or years of increasing shortness of breath the patient usually dies. Asbestos is one of the exogenous causes of lung cancer and mesothelioma of the pleura and peritoneum.

8.8.5 Prevention of silicosis and asbestoses:

a) the substitution of less dangerous materials;
b) suppression of dust at the source;
c) segregation of dusty processes;
d) protection of workers;
e) medical examination.

8.9 Infectious Disease

8.9.1 Also known as contagious or communicable disease. Due to parasitic organisms capable of transmission from some reservoir of infection to susceptible human recipients. High infectivity disease, demonstrated by virus infections, attacks many persons in a short period of time; low infectivity disease, for example bacterial and fungal diseases, attacks few persons.

8.9.2 Control and prevention of infectious diseases:

a) detection of source of infection and elimination of such sources;
b) disinfection:

  i) concurrent disinfection;
  ii) terminal disinfection;

c) immunization of exposed persons;
d) education of community in risk of infection and methods of avoiding infection. Advice in general hygiene.

PART TWO
FIRST AIDS AND REHABILITATION

9 . FIRST AIDS AND REHABILITATION

9.1 General

Proper medical and surgical treatment from the moment of the accident to full recovery does much to lessen the consequence of an industrial accident.

Facilities needed for proper first aid vary with different localities.

Whatever is provided should be freely accessible to the workers. The importance of the early and proper attention on the most trivial injuries cannot be overstressed in the prevention of sepsis and other complications leading to lost time. The extent to which a first aid room is used depends on its siting.

9.2 First Aiders and Teaching

9.2.1 In every industry or work-place first aiders have a real part to play. But the emphasis of their work is different form. Conventional first aid course devote much space to the control of serious haemorrhage, fractures and other form of severe injury. When the serious accident occurs the first aider must know what to do and how far to go. But if expert help is quickly available then heroic first aid is seldom needed.

The day-to-day picture of first aid in the factory is rather a stream of minor injuries and minor ailments, small cuts and burns, cold and headaches. Many of first aiders will have to treat the workmen by themselves and they will never be seen by a trained nurse or a doctor.

In undertaking full treatment of minor injuries and ailments, the first aider is shouldering a serious responsibility. He must know his job and his limits, and when to call for help. Given his knowledge, given the tools he needs for the job, he is the real first line of defense in the health care of his workmates.

Training in first aid has been carried out by the scientific organizations. Certificates have been issued and competitions promoted, and the great network of enthusiastic voluntary workers have pursued their activities with an almost religious fervor. Though the scope of their teaching may change in certain respects, but those who have been basically trained by these organizations are good as industrial first aiders. However they have to acquire a rather different approach if they are to play a proper part in modern industrial medicine and must be full of enthusiasm and intense interest in accepting the responsibility.

There must be one first aider responsible for every first aid boxes in each shift, and at least one deputy ready to take over in case of absence or illness of first aider. The key first aiders should have some general training before they learn industrial first aid treatment.

9.3 First Aider's Tools

9.3.1 The first aider must be provided with tools for the job. Depending on the number of employees in the plant, the minimum contents of the first aid box should be specified.

9.3.2 First aid boxes

There are three box types A, B and C (not the official nomenclature).

Box A is for work place up to 10 workers.
Box B is for units with 11-50 workers.
Box C is for factories with more than 50 workers.

Boxes could be improved by certain additions and omissions, and official revision of first aid box contents has recently been completed. Nevertheless, most of the basic items are essential, in particular, the official sterilized individual dressing is still the best emergency dressing as a prelude to removal for treatment elsewhere.

The classification of box size on the bases of the number of the workers at risk is a guide to minimum needs only. Some work places sustain very few minor injuries. Other machine shops or the like have a heavy minor causality rate. In consequence, the latter will use up first aid supplies far quicker than the former.

Most boxes supplied commercially have fronts to provide a work space for the first aider. This is a good arrangement; but the supporting chains are usually far too flimsy. Wooden boxes are superior to those made of tin, as the metal is more inclined to warp.

Internally, every box should have a space in which bottles can be kept upright. This space must be at least 254 mm (10 inch) in height if it is to contain 567 gm (20 OZ) bottles. A minimum space of 254 mm (10 inch) by 152 mm (6 inch) by 102 mm (4 inch) for 567 gm (20 OZ) bottles, and 217 mm (8½ inch) by 127 mm (5 inch) by 102 mm (4 inch) for 57 gm (10 OZ) bottles should be considered. Boxes supplied commercially seldom have this space; consequently, in most small factories, dust-covered bottles decorate the top of the first aid box.

The box must be plainly marked "First Aid".

9.3.3 The sterilized individual dressing

9.3.3.1 The official sterilized dressing is made in three sizes:

a) Small: for injured fingers,
b) Medium: for injured hands or feet,
c) Large: for other injured parts.

The dressing consists of a thick absorbent pad, with a layer of lint, or preferably gauze, on the side to be applied to the wound, and a roller bandage stitched to the other side. The whole forms a small roll, which is wrapped in paper and enclosed in a cardboard box. The dressing itself, inside the paper, is sterilized. Sometimes the pad is medicated; this is unnecessary and undesirable. When the paper covering has been turnoff, the bandage will be found to be rolled in such a way that the pad can be applied to a wound without being touched by the hand, and so remains germ-free.

This is an excellent true first aid dressing for any wound which is extensive or bleeding much, and the treatment should be done by a trained nurse, doctor or at hospital. As a dressing for small injuries to keep on while at work it is much too bulky.

A special version of the sterilized individual dressing is the sterilized burn dressing; in this the pad is impregnated with picric acid. Knowledge of the proper treatment of burns is rapidly advancing, and it is now clear that the application of picric acid or any other antiseptic or crust-forming chemical as a first aid dressing does harm rather than cure. For burns, the use of the non-medicated simple sterilized individual dressing is more beneficial rather than the sterilized burn dressing.

The minimum supplies of sterilized individual dressing in first aid boxes are as follows:

	Box A	Box B	Box C
Small Individual Dressing	6	12	24
Medium Individual Dressing	3	6	12
Large Individual Dressing	3	6	12

9.3.4 Cotton wool

Boxes have to contain a "sufficient" supply of sterilized absorbent cotton wool in 14.17 gm (½ OZ) packets. Cotton wool in substantial quantity is occasionally needed by the first aider for padding a splint, or mopping up a lot of blood. For such purposes, the 14.17 gm (½ OZ) packets have the great merit of cleanliness and convenience.

Each type of first aid box should contain 6 of these packets. The disadvantage of the 14.17 gm packet is that this quantity is far too much for most single use such as cleaning a wound and the remainder of a package is left about opened; which is no longer sterile, and soon gets physically dirty.

Small pledgets or pieces of cotton wool are essential for wound cleansing. For this purpose a cotton wool strip dispenser, as used in barber's saloons, is very useful. A screw-top jam jar with 12.7 mm (½ inch) hole cut in the metal top. Clean cotton wool is cut into 19 mm (¾ inch) strip, and packed neatly into the jar, the end being threaded through the hole in the top, pledgets can then be pulled off as required. Every type of first-aid box should contain clean cotton wool in a strip dispenser. The regular stocking up of the dispenser should be done by the responsible authority on a clean table, in a clean room, with clean hands, preferably a trained nurse.

If a first aider is to attempt to remove foreign bodies from the eye, cotton wool is needed in one other form. The "individual applicator" consists of a wisp of clean cotton wool wound round an orange stick and stored in an envelope. This is a permissible alternative to the corner of the one-too-clean packet handkerchief, which is still in use in many workplaces. To discourage the use of handkerchief such disposable applicators are included in all types of first aid boxes.

9.3.5 Adhesive plaster

A sufficient supply of adhesive plaster should be put in all boxes. Adhesive plaster is used in two forms:

a) The individual small plaster, with a gauze dressing attached. Many excellent proprietary varieties are available, with the gauze plain or medicated. Plain non-medicated gauze is preferable.

b) Strips on the reel of plaster, are cut as required. These strips are not normally applied directly to wounds, but are used to hold other dressing in place.

Every type of first aid box must contain a large tin of individual adhesive plaster dressing, preferably in three sizes. These are useful in the treatment of small cuts.

The attached gauze dressing may extend from edge to edge of the plaster, or it can be centered only with a complete surrounding of adhesive. For most purposes, it is preferable that the dressing which stretches from edge to edge to be applied which permits the escape of skin moisture, and so prevents the development changing. Rather than do this, it may be better to cover the plaster with a short length of ordinary bandage, which can then be changed as often as necessary.

A reel of sticking plaster is worth its place in the first aid box, though it should never be applied directly to a wound without some kind of dressing between it and the injury. Its great value is in securing ordinary bandage ends in place.

9.3.6 Protection from oil

In many jobs, it is necessary to protect a wound from oil, particularly cutting oil. Oil is not necessarily germ-infected; indeed some cutting oils contain an added antiseptic. Nevertheless, oil must be kept away from wounds to prevent their affecting the raw tissues, for this may lead to the development of skin sensitivity later. Oil also delays healing.

The obvious step is to cover the wound or the dressing with some oil-and water-proof barrier. The barrier has to be water-proof, as many lubricating fluids have a watery basis. To achieve this, rubber finger-stalls and gloves, water-proof plasters, and self-sealing crepe-rubber dressing covers have been tried. With one or two possible exceptions, these all have the serious disadvantage that they retain perspiration, producing a soggy skin around the wound, and so delay healing. At present, all first-aid cabinets contain one 76 mm (3 inch) roll of self-sealing crepe rubber, which can be used to make an individual fitting finger-stall which is regarded as obsolescent. A water-tight occlusive should remain on only when the patient is actually at work. It should be removed on leaving work in the evening, and preferably also at the lunch break, and reapplied at the start of work in the morning or afternoon.

Provided it is properly applied and frequently changed, the best protection against oil is an ordinary roller bandage applied over some other dressing. It will need changing at least three times a day, at start of work and at the end of the morning and afternoon shifts. An oily bandage left in contact with damaged skin overnight predisposes to oil acne and dermatitis.

9.3.7 The roller bandage

The proper use of the roller bandage can be taught only by demonstration and practice.

The allocation of roller bandage in boxes should be as follows:

	Box A	Box B	Box C
Roller Bandage 25.40 mm (1 inch)	6	9	12
Roller Bandage 51 mm (2 inch)	6	9	12

The 25.40 mm bandage is suitable for fingers and hands and 51 mm for limbs. In using a roller bandage, the first aider should observe the following points:

a) Clean the hands before breaking the paper seal.

b) Break the paper by grasping in both hands and contra-rotating.

c) Always work with the bandage rolled. Attempts to apply an unrolled bandage soon results confusion.

d) Keep the coil of unused bandage close to the part being bandaged and pull firm after each turn. There is a difference between pulling firm, and pulling tight which can be taught only by demonstration and practice.

e) Do not apply too much bandage.

f) The correct way of tying a bandage must also be taught by demonstration. The bandage end should be nicked with scissors split for about 30 cm and knotted once to prevent further splitting. Bandages round the fingers, hand or forearm should be usually tied. Bandages round the arm or leg should be fixed with a safety pin.

g) The split bandage ends should be tied with a reef knot and the ends cut short to prevent their catching in machinery.

The knot and ends are then best covered with a piece of adhesive plaster. Some advocate fixing the bandage with strapping alone, without a knot which is not safe.

h) Used roller bandage should be fixed with a pin and carefully preserved for future use.

There are special methods of bandaging the knee, elbow, shoulder, ankle, scalp, ear and eye. The first aider should never have to undertake these complicated maneuvers. With these types of injury sterilized individual dressing should be used and then refer the injured for further treatment to a nurse or doctor. The idea that bandages must be applied from the extremities of the body working towards the heart is an outdated myth.

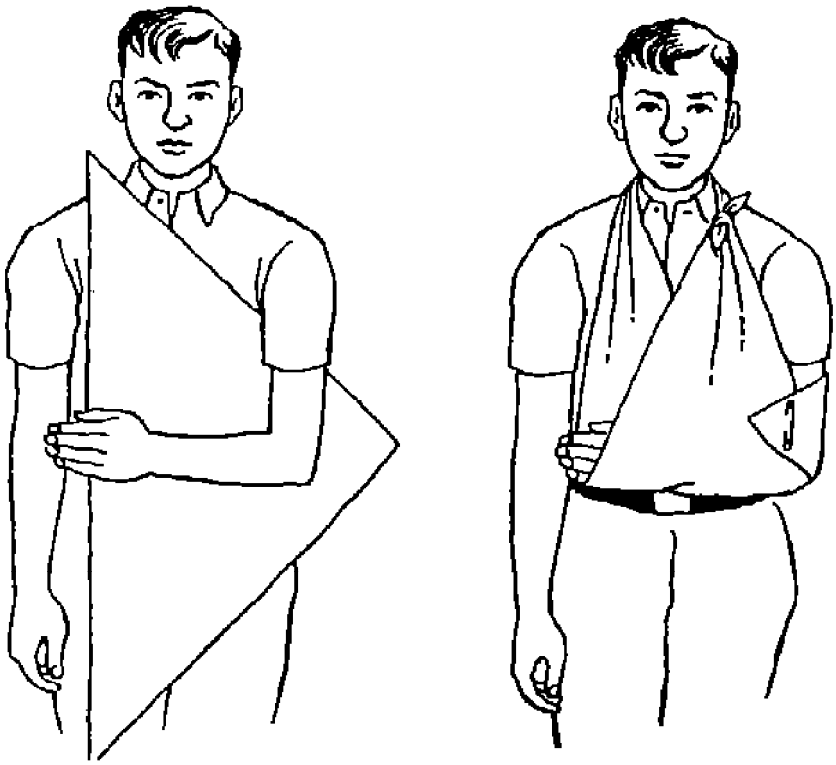
9.3.8 The triangular bandage

The 965 mm (38 inch) triangular is 965 mm (38 inch) along each of its two shorter sides. It is made by cutting diagonally a square piece of linen or calico. The present requirement is 6 triangular bandages in Box C only. The recent revision specifies 2 triangular bandage in Box A, 4 in Box B, and 8 in Box C.

The triangular bandage may be used either as a bandage for holding a dressing or a splint or for covering a large burn. The first aider with a supply of individual sterilized dressing will not need to use it for holding a dressing in a place.

To hold splints in place, it is folded on itself 3 times to produce a stout narrow binder. Further details is covered under fracture.

When used as a sling, the right angle of the triangle should point outwards behind and beyond the elbow, and the front layer of the sling should pass over the shoulder on the injured side (Fig. 1). To sling the arm at an angle of 45 degrees, the triangular bandage folded narrow may be used as a "collar-and-cuff" sling. This is essentially no more than a clove-hitch round the wrist. Slings can be improvised with safety-pins, a neck-tie, or simply by using the jacket.



THE TRIANGULAR BANDAGE
Fig. 1

9.3.9 Tulle gras dressing

First aiders often ask for a small soothing dressing, which can safely be applied to burns, and which will not stick, especially since the use of acriflavine emulsion has been discouraged. Individual sterilized tulle gras dressing, contained between two slips of transparent paper, stored in a small tin should be used. Tulle gras is curtain netting, impregnated with petroleum jelly. Twelve such dressing should be included in Boxes A, B and C.

9.3.10 Splints

"Suitable splints" with cotton wool or other padding used to be included in Box C is now obsoleted. Splints are easy to improvise, and often the best splint is the human body itself. Nevertheless, on occasion, a few pieces of wood will be useful. Further information is provided under clause of fracture.

9.3.11 Other statutory requirements

9.3.11.1 Every Box of A, B and C should contain a tin of safety pins of assorted sizes, as well as a copy of special form, a single-sheet to give the outline of first aids.

The following items, which still have to be stocked for statutory reasons, will soon lapse into harmless disuse:

In Boxes A and B:	Iodine (2 percent) in alcoholic solution.
In Boxes B and C:	Oily cocaine eye drop with camel hair brush in the cork.
In Box C:	Tourniquet.

To carry out the treatments as intended here certain other items are needed. In compiling this list, careful study has been made and experienced. First aiders are already aware and are expected to utilize them in their work places.

- Cetrimide (1 percent), either two 280 gm (10 OZ) bottles, these bottles should have plastic screw cap, not corks.

- Gallipot, 57 gm (2 OZ).

- Kidney dish, 152 mm (6 inch).

- Proprietary non-inflammable plaster remover, 28-113 gm (1-4 OZ) bottle. This is also useful for cleaning oil from the skin around wounds.

- Small unbreakable tumbler.

- Eye-bath unbreakable.

- Blunt-nosed surgical scissors with chain attached. The length of chain helps to prevent the scissors getting lost.

- Splinter forceps.

- Clinical thermometer.

- Magnesium trisilicate tablets, 50.

- Aspirin & phenacetin tablets, 50.

- Formalin throat tablets, 50.

The gallipot, kidney-dish, tumbler and eye bath should always be washed thoroughly with soap and hot water and dried on a clean towel after use. If this is not accomplished, infection will be spread from patient to patient.

9.4 Siting the First Aid Box

Ideally, the situation of the first aid box should be as follows:

9.4.1 The box should be fixed on the wall over a small enamel-topped table, which should be kept clear and clean.

9.4.2 There should be a strong chair close at hand, on which the patient can sit while being treated.

9.4.3 There should be sink, with running water, soap and towel close by, for the use of both the patient and first aider. A drinking fountain is an advantage; it has special value as it can be used for washing out the eye after chemical splashes.

9.4.4 Beneath the table, there should be a pedal controlled bucket for the disposal of used dressings. It is part of the first aider's job to see that this is emptied regularly and kept clean.

9.4.5 It is particularly important to try to preserve a small clear working-space to handle first aid treatments.

9.5 Replenishment

9.5.1 Regular inspection and replenishment of first aid boxes is part of duty of the trained nursing staff. The frequency with which this has to be done will depend on the number of causalities to be treated. In the industrial premises, plants are divided into the following categories for periodical inspections:

a) weekly;
b) monthly;
c) quarterly.

These visits for inspection and replenishing help to build a useful link between first aiders and the trained industrial nurses. If stocks run low between visit, first aiders are responsible for letting this be known.

First aid boxes should never be kept locked; first aid which is delayed while a key is searched for is a travesty. Normally, only a trained first aider must be responsible for the box and its stocks.

His name, and that of his deputy, should be on the outside of it. Where a first aid box is supplementary to a factory first aid room or medical department, it may be used only when the room or department is shut. In such a case, it is helpful if instructions to patients needing treatment are also displayed on the box.

10. PRINCIPLES OF WOUND TREATMENT

10.1 General

Wound is defined as any break in the skin with or without injury to the deeper tissues. Thus the term "wound" covers every type of skin break, from the trivial scratch to the severe crush injury.

The skin is the body tissue most liable to injury, and it is estimated that every day there are a million skin injuries of sufficient size to meet at least a first aid dressing. Of this one in every ten needs attention at a plant surgery of industrial health center.

It follows that wounds are by far the most common reason that needs first aid.

The following is some typical industrial wounds:

a) A straight cut from a chisel or sharp metal edge. This is an incised wound.

b) A treating wound with ragged edges where flesh is caught in a machine. This is a lacerated wound.

c) A crushing wound with the flesh around bruised and injured, from a hammer-blow, or injury from a spanner or rollers. This is a contused wound.

d) A deep stab, from stepping on a nail. This is a puncture wound. Incidentally, a severe puncture wound may bleed very little or even not at all.

e) A scraping wound or graze, where the skin surface is torn by a file or sand-paper, for example. This is an abrasion.

10.2 Major and Minor Wound

Wound is divided in two divisions as follows:

a) minor or simple wound;
b) major wound.

10.2.1 Minor or simple wound

The ordinary everyday small skin cut of work-places which can properly be treated by the first aider.

10.2.2 Major wounds

Everything more severe than the minor wound. In these the first aider gives true first aid treatment only, pending the arrival of, or referral to, a trained nurse or a doctor.

This division of wounds emphasizes the most important single decision which the first aider has to make.

He must never feel reluctant about passing on the patient to more skilled hands.

In the case of obviously severe wounds, there is no difficulty in making a decision; nor is there any with the 12.7 mm (half-inch) long shallow graze on the hand. Between these two there are many types of wound where the first aider will have to make a judgment.

There are three points to be considered:

1) The position of the wound

Any wound around the eye or involving the skin of the face is serious. Any wound, other than a small shallow cut, of the finger, hand or wrist is to be treated as serious; even a small scar on a finger may reduce the skill and affect the livelihood of a manual worker. Any wound of the abdomen is serious.

2) The type of wound

Any wound with ragged edges or with the flesh around it bruised is serious, because the damaged tissue is more liable to infection. Any deep wound or stab or puncture wound is serious, because infection carried in by the wounding object is more likely to gain a foothold, because there may be unseen damage to deeper tissues. Any gaping wound the edges of which do not easily come together, is serious, because the exposed raw area is more likely to get infected, and the scar will be wide and disabling.

3) Complications of wound

Any wound from which the blood pumps out in jerks is serious, because this means an artery has been cut. Any wound from which the blood gushes out in steady stream is serious because this means a vein has been cut. Any wound more than 3 mm (one eighth-of-an-inch) deep may involve damage to muscles, tendons, nerves or other structures. This risk is greatest in the wrist, hand and fingers. The first aider cannot tell if these structures have been injured. Therefore any cut more than 3 mm (one eight-of-an-inch) deep, especially in the wrist, hand or fingers, is serious

10.3 Infection

10.3.1 Infection means the entry of harmful germs into a wound so that they start to grow and multiply. Clearly, the prevention of infection in first aid is just as important as the control of bleeding.

10.4 Cleaning the Wound

10.4.1 A major wound needs thorough cleaning by a trained nurse or doctor. An extensive major wound may need opening and cleaning thoroughly by a surgeon, with the patient or at least the wounded part anesthetized. Delay in getting a major wound properly cleaned increases the likelihood of the germs gaining a foothold in the tissues. The first aider's job is to cover the major wound with a sterile pad as quickly as possible.

A minor wound is best cleaned by washing thoroughly with clean water under a running tap. If there is any visible dirt present around the minor wound, it may be washed away with soap and water. Better even than soap is the recognized detergent cetrimide (cetavlon); this has an antiseptic action as well, but does not injure the tissue.

When running water is not available at the first aid point; cleaning of the wound and surrounding skin should be done with cotton wood dipped in cetrimide. Finally, first the wound, then the surrounding skin, should be thoroughly dried with fresh dry pieces of cotton wool.

10.5 Closing and Covering the Wound

10.5.1 Any wound which is left gaping is more liable to become infected. Even if not infected, a gaping wound will heal much more slowly, and will leave behind a wide and perhaps disabling scar. The first aider must regard any gaping wound as a major wound, to be covered with a clean or sterile dressing and passed on at once to a trained nurse or doctor. Many gaping wounds will require stitching (suturing) to bring the edges together, for which most doctors use a local anesthetic.

In covering a major wound, the first aider must take all reasonable steps to keep germs away from the cleaned wound and the dressing.

The hands of first aider should be clean, and he must be careful not to cough, sneeze or talk over the wound. Even more important is to keep his own skin germs away from the wound or anything which is going to touch the wound surface. This means no touching of the wound with the fingers, and no touching of the surface of the dressing placed neat to the wound. Every first aider must practice this simplified "no-touch" method of dressing wounds until he does it quite automatically.

The wound which has been properly cleaned, closed and covered will heal in the shortest possible time, almost without pain, and with the smallest possible scar.

10.6 Re-Dressing Minor Wounds

10.6.1 A minor wound should be re-dressed as seldom as possible. If there is no pain, it is only necessary to change the outer dressing when it is soiled; the dressing immediately over the wound should be left in position, if possible for 48 hours. Exactly the same care must be used in changing a dressing as when the dressing is first applied.

If the patient complains of pain or discomfort in a minor wound on the day after injury or thereafter, the first aider must refer the patient at once to trained nurse or doctor, as infection is likely to have occurred.

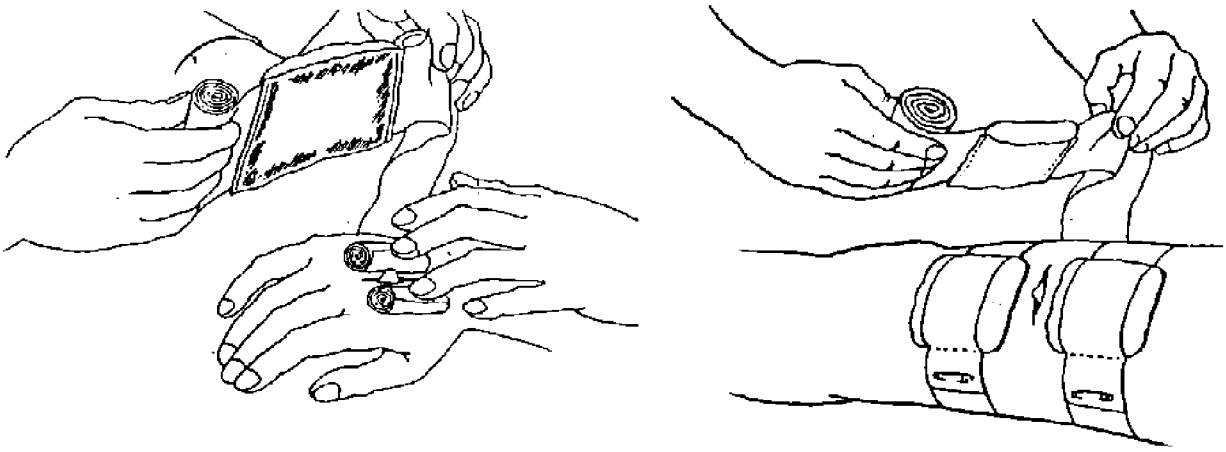
10.7 Foreign Bodies in Wound

10.7.1 A large foreign body, such as a piece of metal or glass, if sticking out of the wound, should be removed gently, provided this can be done without putting the fingers into the wound. If the foreign body does not come out easily, or if there is projecting bone, rolled bandages, with the paper removed, may be placed on each side of the projecting object; the wound, object and rolled bandages are then covered with a large individual first aid dressing; this should be bandaged in place firmly but not tightly. Any elaborate building up, while the wound is left uncovered, increases the chance of infection. An alternative method of bandaging over a foreign body without pressing on it is to use individual sterilized dressing on either side of the wound as shown in Fig. 2, this method is specially useful where the wound is large.

If there is sever bleeding from a wound in which there is a foreign body, control of the bleeding must take precedence over treatment of the foreign body.

Small foreign bodies should not be touched, but a note that they have been seen should be sent on with the patient.

In a severe injury, there may be a rare occasion that a piece of bone projecting through the wound or the skin; this should be left alone and not touched.



STERILIZED DRESSING ON EITHER SIDE OF THE WOUND
Fig. 2

10.8 Special Wounds

10.8.1 Small crush, graze or laceration

Any crush, grace and laceration, other than a very small one, is to be treated as a major wound and referred to trained nurse or doctor.

First aiders often ask to be allowed to use acriflavine or some other oily dressing for small crushes, grazes and lacerations, since it prevents sticking when the dressing is changed. But acriflavine has the disadvantages of iodine and other chemical antiseptics, and oily preparations delay healing. Frequent changing of the dressing should not be needed unless the injury has become infected.

The proper treatment for a really small crush, graze or laceration is thorough cleaning with cetrimide, followed by a dry dressing, protected by a bandage to keep it clean. Anything large should be covered with a sterilized first aid dressing and referred to a trained nurse or doctor.

10.8.2 Puncture wound

This may be caused by a nail through the boot, a drill which slips, a glass splinter, a wire brush, or any other thin pointed object. All such wounds should be treated as serious, because germs, particularly tetanus germs, may be carried deep into the tissues where they cannot be reached by ordinary cleaning. There is no point in cleaning the wound and the skin around unless the skin is dirty, by application of a small dressing; the patient should be referred as soon as possible to a trained nurse or doctor.

10.8.3 Animal or human bite

The mouth is full of germs, so bites are usually badly infected, because they are often lacerated or punctured wounds. Even small bite should be treated as a major wound.

10.8.4 A puncture wound of the chest cavity

Such a wound may damage the lungs. The patient may cough up blood and find it hard to breath. He may breath easier if proposed up in the semi-sitting position with greatest comfort for the patient. A puncture wound of the chest is rare occurrence.

Any patient with a chest wound should be moved to hospital as quickly as possible.

10.8.5 Wound of the abdomen

Because of the risk that an abdominal wound may have punctured the stomach or bowels, it is very important that the patient should be given nothing to eat or drink. He should be moved to hospital without delay.

11. BLEEDING

11.1 General

Bleeding (hemorrhage) is part of the natural response to injury. So it will not cause alarm in the first aider or the patient. Bleeding is nature's means of wound cleansing, because it washes dirt out from the bottom of the wound.

Too much bleeding is a danger, simply because, beyond a certain point, the body cannot swiftly make up for blood loss. But bleeding from most wound will stop spontaneously without any treatment at all.

The body has two very effective methods of stopping bleeding:

11.1.1 The clotting of blood, as a result of its coming in contact with cut and injured tissue.

11.1.2 The pulling back and shrinking of the cut end of blood-vessels, so that the holes from which the blood coming out get smaller and may close entirely.

11.2 Bleeding from Minor Wounds

This will occur during the cleansing of the wound; it helps to make the cleansing more thorough. As soon as the wound is covered and the edges drawn together by the dressing, clotting of the blood will take place and the bleeding will stop.

11.3 Bleeding from Major Wounds

This will also usually stop on its own when a dressing is applied. The first aider can apply three ways to help the body to stop such bleeding.

11.3.1 Rest

Make the patient lie down quietly, and keep the wounded part still. This lowers the blood-pressure and slows the pulse, so that the volume of the blood flowing through the injured part is lessened.

11.3.2 Raising the injured part

If the injured part is raised above the level of the rest of the body, the amount of blood reaching it will be less for simple hydraulic reasons. A wounded arm or leg may be raised and put on pillows, but the stomach or chest cannot be effectively raised.

11.3.3 Pressure on the place which is bleeding

This is the most important and most effective way of controlling bleeding. It can be stated that if enough pressure is applied, hemorrhage can always be controlled.

11.3.3.1 Applying pressure

- Place a clean pad over the wound and bandage it firmly in place. If blood quickly comes through the first pad, put another pad on top, and bandage this firmly in place. If blood comes through the second pad, apply a third pad. If blood still comes through, press firmly with the hands on the third pad, and hold in position until a doctor can take over.

- As already stressed, sterilized individual dressing is ideal for the control of bleeding, since it has a built-in pad attached to a bandage and the whole dressing is sterilized.

- If an appropriate first aid dressing is not available, a rolled-up bandage may be used as a pad, or a clean folded handkerchief. If necessary, a clean handkerchief may also be used as a bandage.

Every first aider, specially in I.O.G.P Industries should have been trained in the use of a pad and bandage to control bleeding, so that he can effectively handle when faced with his first major wound.

11.3.3.2 Pressure points

Certain points between the heart and the site of bleeding where, by pressing hard against an underlying bone, the arterial flow can be stopped is wrongly exercised and shall be abandoned. It is not expected the first aider to risk the patient's life by hunting for a pressure point, instead of applying direct pressure to the place which is actually bleeding.

11.3.3.3 The tourniquet

First aid boxes must contain a rubber or pressure bandage for use as a tourniquet. It should never be used, as it is not a first aid measure. It is often ineffective and frequently harmful. If improperly applied, it can cause death of a limb. If improperly applied, it can increase bleeding by obstructing the veins but not the arteries. Finally it is never necessary, as bleeding can always be stopped by the safe simple method of direct pressure.

11.3.3.4 Importance of blood loss

About one-eleventh of the weight of the body is blood. There are about 5.67 L of blood in the average adult. A normal adult can lose a 0.47 L of blood without ill effect; many people give this much blood twice a year to the blood transfusion service. Most bleeding is not serious, and the first aider need never be frightened by it.

The loss of a large amount of blood produces a very dangerous state. As the bleeding continue, it leads to pallor and weakness, then unconsciousness and finally death. If life to be saved, after the bleeding has been controlled by firm pressure, it is vital at the earliest possible moment to replace the blood which has been lost, by means of a blood transfusion.

A patient who is believed to have lost a large amount of blood must be moved as swiftly as possible to a hospital where a blood transfusion can be started at once.

If transfusion can be started within half-an-hour, life will probably be saved; delay of over an hour may prove fatal. By making arrangements quickly and calmly, the first aider is acting in a life-saving role.

It will help the doctor at the hospital to estimate the amount of blood which has been lost, and the amount of blood the patient needs, if the blood lost can be mopped or scooped up, and the blood and stained dressing, cotton wool and clothing put in an enamel basin and sent with the patient to hospital. But do not waste time on this if it means delay in taking the patient to hospital.

Cover the patient with two blankets or a coat. Apart from lifting out of danger or on to a stretcher, keep movement to a minimum.

11.3.3.5 Nose bleeding

Epistaxis or nose bleeding may follow on the nose, nose picking a bad cold; such nose bleeding will usually stop quickly. Or it may follow a severe head injury, which means usually that the skull is fractured. Often nose bleeding is spontaneous and has no obvious external cause; this type is more likely to last for some time and can be serious. It is not part of first aid to attempt to diagnose the cause of spontaneous nose bleeding.

First aid treatment in the absence of major injury is as follows:

a) Sit the patient up, with the head slightly forward, so that any blood which runs down the back of the nose can escape from the mouth instead of being swallowed.

b) Make him breath through his mouth, and pinch the nose firmly so that the nostrils are closed. Thereafter, he must be warned not to sniff.

c) Apply cold water to the bridge of the nose, by means of handkerchief or cotton wool soaked in it.

If the bleeding continues or recurs, the patient should be seen by a doctor. The first aider should never attempt to plug the nose.

12. STING, INSECT BITES AND BLISTERS

12.1 Bee and Wasp Stings

It will occur in the plant areas indoor and outdoor.

12.1.1 Bees

The bee leaves both its sting and poison-bag behind. If the sting is grasped with a pair of forceps, in order to pull it out, the contents of the poison-bag may be pumped into the patient. The sting is best lifted or scraped off the skin with one blade of a pair of forceps or with a pin. The patient should then suck the wound and spit out.

The only other local treatments of any value are: The application of a proprietary "antihistamine" ointment sold in a collapsible metal tube; failing this, a cold compress or an ice-pack may help. These are described in the next section. Bee’s venom is not acid and treatment with mild alkali is useless. If the sting is in the mouth, skilled nursing or medical help is required at once. While help is coming, the patient should be given a piece of ice to suck.

12.1.2 Wasp

The wasp leaves no sting behind, so the patient should suck the wound and spit out forthwith. Further local treatment is exactly the same as for a bee sting (antihistamine ointment, a cold compress or an ice-pack). Like bee venom, wasp venom is a complicated mixture of organic compounds and it is not alkaline so vinegar or lemon juice are valueless as methods of treatment. If the wasp sting is in the mouth, skilled help should be sought at once, and ice given to suck.

With any sting, the patient may start to swell up either around the injury or generally, show signs of shock. If this happens skilled nursing or medical help is needed immediately.

12.1.3 Spider and snake

Spider and snake bites can occur in the working areas. Those at risk are dockers and banana-ripening store operatives. The creatures are imported in the banana bunches.

The snake is most often seen in the different part of Iran.

12.1.3.1 Treatment of snake bites

Wash the bites thoroughly, to remove any venom which the snake may have spot out into the skin. Suck the wound hard and spit out. Tie a bandage tightly round the limb, between the bite and the body. This will not stop the blood flow, but will cut down the flow of lymph (body tissue fluid) back to the body; it is in the lymph that the venom mainly travels.

The bandage should be loosened for half a minute every quarter of an hour. Patient should be visited by skilled helper at once, or sent to hospital immediately. The snake should be killed and sent in a box with the patient for identification if possible.

12.1.4 Mosquito bites

Patients sometimes arrive at work with painful swelling due to mosquito or other bites. These are not first aid problems and need nursing or medical examination and care.

12.2 Treatment and Care in Hospital

12.2.1 Systemic

This is the same as for any potentially necrotic and infected wound; antibacterial agents in adequate dosage. Tetanus antitoxin also should be given, since the snake's mouth may have transmitted tetanus bacilli or spores.

12.2.2 Supportive

It is essential to prevent exertion, reassure the patient, prohibit alcoholic beverages, and order complete rest in bed. To relieve nervousness and pain, pentobarbital 100-200 mg orally, may be given and repeated, if necessary, every 4-6 hours. In respiratory depressants morphine must be avoided.

For treatment peripheral vascular failure, either strychnine 1-2 mg subcutaneous or by mouth. To combat collapse, normal saline with 10% dextrose, and either whole blood or human blood plasma should be given. The patient must be kept under observation at least for 24 hours.

12.2.3 Specific

Antivenin (antitoxin) and polyvalent antivein serum for all snake poisoning is commercially available. Systemic administration, an injection of 2-3 cc or more around the wound should be applied to minimize tissue necrosis, subsequently, similar injections proximal to the wound as the tourniquet is shifted.

After adequate doses of serum have been injected, the tourniquet can be removed. For systemic treatment, the dosage and route of administration will depend upon the age, size and clinical condition of the patient. If the patient is a child or in shock intravenous administration may be indicated, provided it has been demonstrated beyond doubt that he is not allergic to those serum.

Otherwise, intra-muscular injections are necessary. The injections should be repeated every 1-2 hours until symptoms are significantly diminished; they should be continued at the same rate as long as the swelling, paralysis, or other symptoms are progressing. It must be remembered that over-treatment is the lesser error in snake venenation; up to 100 cc (occasionally more) of antivenin may be required.

13. GENERAL EFFECTS OF SERIOUS INJURY

13.1 Shock General

13.1.1 Every severely injured patient soon becomes very ill. This illness is known as shock. Without proper treatment, shock is often fatal. With proper treatment applied quickly enough, the patient almost recovers. Proper treatment of shock can be summed up in the words "blood transfusion". Even half-hour that blood transfusion is delayed decreases the patient's chance of recovery.

The first aiders duty is plain. It is to speed the removal of the severely injured patient to a properly equipped hospital, doing only what is necessary meanwhile to prevent the shock getting worse. If the severely injured patient is in hospital within half-an-hour, the first aider will have played a major part in saving life.

There are six kinds of shock as follows:

1) primary;
2) secondary;
3) hemorrhagic;
4) traumatic;
5) toxic;
6) nervous.

The word "shock" is used only for true wound shock which is for items 2-3 and 4 above.

The muddle over the shock is matched by the confusion and controversy over treatment. The following points is based largely on the valuable researches carried out at hospital.

13.1.2 The shocked patient

13.1.2.1 The state and condition of the patient with shock is as given hereunder:

a) The facial expression is anxious and worried-looking, or staring in a vacant way.

b) The skin is pale-white, ashen-gray, or slightly blue.

c) The skin feels cold, yet in spite of this it may be soaked in sweat.

d) The patient is sometimes restless, fidgety, and even talkative, but may be dull, and sometimes even unconscious.

e) The breathing is rapid an shallow, sometimes sighing.

f) The pulse is usually rapid and feeble, though occasionally normal.

g) The patient usually complains little of pain, but may complain greatly of thirst.

h) There may be external signs of the cause of shock, such as injury or bloody vomit.

The first aider cannot measure the blood-pressure. If he could, he would usually find it low or even very low. Similarly, he would find the body temperature to be subnormal, though he must not waste time trying to take it.

A shocked patient does not always show all of the above conditions at the same time. In medicine, there are exceptions to even the best word pictures. Thus a patient with shock due to heart attack or a bad fracture may be in great pain.

13.2 Shock

13.2.1 General

Shock is due to loss of body fluid. This happens in four different ways:

1) Bleeding

This may be:

a) external, from the outer surface of the body;
b) internal, from the inner surfaces of the body into stomach or gut, for example stomach ulcer; or
c) into the soft tissues of the body, (around the broken ends of bone).

2) Seeping away of plasma from the capillaries

Plasma is the fluid part of the blood. The capillaries are the small tubes which join the arteries to the veins. They are the finest blood-vessels of all and they have the thinnest walls. Those which start to leak in shock are:

a) at the site of injury, especially if the injury is a crush or a barn; and
b) in the rest of the body, probably mainly in the muscles and the gut.

3) Vomiting

4) Sweating

Each of these ways of losing body fluid must be looked at in rather more detail. But the fluid in each case comes either directly or indirectly from the blood. Moreover, the more rapid the blood loss, the smaller is the amount needed to produce shock. By contrast, a much greater blood loss can be born without symptoms of shock provided it occurs sufficiently slowly.

13.2.2 Bleeding as a cause of shock

Actual blood loss is now regarded as by far the most important factor in producing shock after severe injury.

External blood loss can be seen, and the blood should be mopped up and collected and sent with the patient to hospital, to help the surgeon to judge how much has been lost.

Internal blood loss into the tissues themselves can be equally important as a cause of shock. If a large bone is broken, there will usually be a great deal of bleeding into the tissues around the broken ends, even though nothing shows from outside. A broken shin-bon (or tibia) will cause an internal bleeding or about a pint of blood, not really enough on its own to produce shock. But a broken thigh bone (or femur) will cause two-and-a-half to three pints of hidden internal bleeding, with quite considerable shock as a result.

13.2.3 Capillary leakage and results of fluid loss

13.2.3.1 When tissues are injured, they produce certain chemical substances which pass into the blood. These substances affect the capillaries in the immediate vicinity of the injury and also generally throughout the body. Their distant effect can be shown in the following ways:

If the veins from the injured part are temporarily blocked, the degree of shock is reduced; and when the block is released, the shock gets worse.

The capillaries in the burnt area itself become very leaky, and considerable quantities of fluid can be lost from the burnt surface.

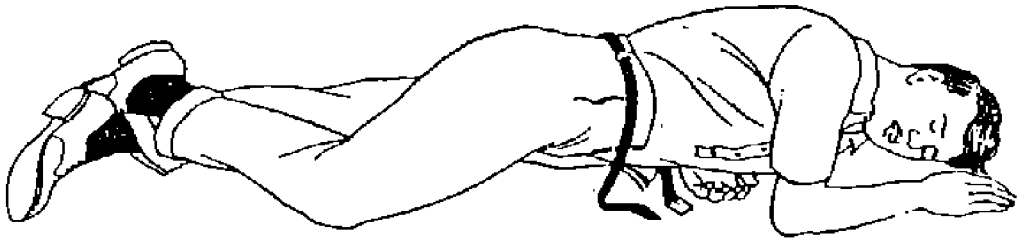
Apart from severe burns, capillary leakage is a major factor in producing shock whenever there is substantial damage or destruction of living tissue. Such injury is usually due to crushing, from falls, collapsing building, pinning under vehicles, also limbs crushed in rollers or torn off by machinery.

13.2.3.2 Results of fluid loss

Too little blood is reaching the brain.

13.2.4 Positioning of shocked patient

If the patient is vomiting or is semi-conscious or unconscious, and the injuries permit, he should be gently rolled into the semi-prone position (Fig. 3); once again, there should be nothing placed under the head to raise it.



POSITIONING OF SHOCKED PATIENT
Fig. 3

13.2.5 Heat

Patient feels cold when the blood-vessels in the skin have all closed down as part of a deliberate move to force what little blood is available to the brain and other vital organs.

If external heat is applied the skin is made to glow, blood will be drawn away from the vital places.

The shocked patients who were not warmed did as well as or even better than those who were warmed.

Therefore the right first aid is to dispense entirely with artificial sources of heat.

13.2.6 Fluids

The shocked patient is often intensely thirsty because of blood and fluid loss.

It follows that the only safe way is: "no fluids or sweets of any kind" to be given by mouth to the shocked patient.

13.2.7 Morphia

Morphia is not a treatment for shock but a means of relieving pain. It is needed only if pain is continuous and severe-as, for example, when a limb is trapped in machinery. Obviously it will not be necessary if the patient is unconscious.

Crush injuries-severe crushes, with much destruction of muscle tissue, involve an added risk besides shock. Debris and poisons from the crushed muscle released into the blood damage or even destroy the kidneys. The resulting condition is called the "Crush Syndrome". The same kind of kidney damage may follow severe burns.

The general care of crush injury follows precisely the same lines as for shock.

13.2.8 Fainting

A person who has fainted looks "shocked". There is extreme pallor, with beads of cold sweat on the forehead. It may be impossible to feel the pulse. Breathing may be shallow an sighing. But in a few moments recovery starts and consciousness begins to return.

The person who faints is usually young and healthy. The cause may be mental, such as the sight of blood, fear of an injection, or sudden bad news or physical such as extreme pain or standing for a long time to attention.

The only treatment needed is to loosen any tight clothing around the neck; if consciousness does not return within two minutes, the patient should be rolled into the semi-prone position (Fig. 3) and expert help should be gained.

The patient who feels he is about to faint can usually prevent this by pulling his stomach, buttock and leg muscles tight, and holding them tight a minute or so.

13.2.9 Electric shock

13.2.9.1 Electric shock is the general bodily reaction to the passage of an electric current. It may vary from slight tingling to sudden unconsciousness looking just like death. But the first aider must never presume death in electric shock, for the breathing may stop and the pulse vanish, yet life can still be restored.

Direct current is less dangerous than alternating current, for the following reasons:

Direct current produces a single violent muscular contraction, which tends to throw the patient away from the source of the shock. The resulting fall is as likely to cause injury as the shock itself. By contrast, alternating current produces continuous muscle spasm, which may cause the affected muscles of the arm and hand to grip involuntarily the source of electric supply. So a continuous prolonged shock is more likely.

The lowest fatal voltage ever recorded was 38. A great deal depends on the contact between the source of electricity and the skin, and between the skin and the ground. A metal floor will also increase conductivity. A person who is fatigued stands shock worse than one who is fresh.

With very high voltage, the current usually does not penetrate the body deeply, because the electrical pressure is so great that the tissues and conductors are destroyed.

Ordinary domestic AC current alternates at 50 cycles per second. Such a current can just be felt if it is of one miliamps. By contrast a DC current should reach 5 milliamps before it is perceptible. One hundred milliamps AC is the usual minimum fatal current, but as low a figure as 20 milliamps. AC has caused death. The length of duration of exposure to a current is very important; with exposures of over 5 seconds, the danger of serious injury is great.

The skin has a very high electrical resistance about 3000 ohms if dry and healthy. Once this resistance is overcome, the current follows the internal water courses of the body. A current passing from head to leg, as in judicial execution, will travel via the fluid around the brain and spinal cord, damaging vital nerve system on its way. A current passing from leg to leg does less harm than one passing from arm to leg, since the latter will pass over and often damage the electrical mechanism of the heart.

Most electric shocks occur among electricians and one third of all fatal electrical accidents are due to portable electrical apparatus and hand-tools.

A sever electric shock may occur during electric welding, where a sweaty welder may come in contact with a metal sheet which could be live. A fatal shock may be caused by a jib-crane fouling an overhead cable; or a metal strip may touch the "live" overhead wires feeding an electric gantry.

13.2.9.2 Symptoms

These may vary from muscle spasm and pain to unconsciousness and even deep coma. The muscle spasm may be momentary with a single direct-current shock, or continuous from alternative current. Pain in the affected muscles may be intense. In as much as the patient cannot overcome the spasm of the muscles by an effort of will, the muscles are effectively paralyzed, as long as the shock continues.

If the spasm is strong enough, the electric current may paralyze the breathing muscles, or put the breathing control center in the brain out of action and such a paralysis is usually transistory. At the same time, the electric current may partially paralyze the heart muscle. As a result the heart beats rapidly but feebly, in a state of "flutter"; in this state, although the blood is still circulating, the pulse cannot be detected. It follows that the absence of both pulse and respiration in a patient unconscious from electric shock are not signs of death. Prolonged artificial respiration may yet save life.

13.2.9.3 First aid and treatment

Speed and coolness are essential, and may be life-saving. The first move is to disconnect the patient from the source of the electricity:

a) Switch off the current.

b) If this is impossible, pull or push the patient away from the source of the electricity, while taking great care not to make electrical contact with either the ground or the patient.

c) Stand or kneel on a dry non-conductor, such as a dry rug, mackintosh or rubber mat.

d) Pull or push the patient away from the source of the electricity, again using a dry non-conductor. Considerable force may be needed to get the patient free. If the patient has to be grasped, use special electrician rubber gloves, or dry sacking, a dry coat or several thicknesses of dry paper. If a crooked stick is available, this should be used.

e) Avoid contact with any part of the patient which may be moist, for example the arm-pits or crutch, or the face, which may be wet with spittle.

f) With very high voltages at electricity stations or overhead wires, the patient will be thrown clear. If not, the danger to a rescuer while the current is still on is very great, and all possible precautions shall be taken. Effort should be made to get the electricians to switch off the current before rescue is attempted.

Once the patient has been rescued from contact with the electric source, if breathing has ceased or is very feeble, artificial respiration should be started at once, using the methods described in Clause 23. At the same time, the standard treatment for shock in an unconscious patient should be applied, but this definitely takes second place to artificial respiration. Since artificial respiration may have to continue for half an hour or more, a resuscitator or a rocking stretcher is of the greatest value.

In about half of all electrocution cases with cessation of breathing, there is recovery with artificial respiration; nine out of ten patients who start breathing again do so within half-an-hour of artificial respiration being started.

Delay in starting artificial respiration can prove disastrous. If it is started at once, 70 percent of the patients recover. If there is more than three minutes' delay only 20 percent recover.

First aiders should get to know the position of the electrical switches in the part of the factory for which they are responsible.

14. FRACTURES

14.1 General

A fracture is a broken or cracked bone. Broken bones in industries are the small bones of hands and feet, usually happen as a result of object falling. Safety protective boots are means of preventing fractures.

14.2 Role of First Aider

In I.O.G.P. Industries because skilled help can almost always be quickly obtained, the first aider's role in fracture treatment is to look after a patient with fracture of thigh until expert helpers arrive. But with a suspected fracture of the arm, hand or foot, the first aider may well have to get the patient ready for transport as a sitting case to the hospital or industrial health center. Fracture of thigh is a task of experienced ambulance service men to transport the patient.

The serious injured patient will often have one or more fractures. The treatment of the patient's general condition must have priority; care of the fracture will be limited to making the patient as comfortable as possible.

With the patient who has sustained a moderate and local injury, the first aider must always foresee the possibility of a fracture. In such cases, he should call for help or refer the patient to the industrial medical department or hospital.

Transport of severe fractures is thoroughly explained in the first aid manuals. The ambulance attendant must know all these situations and first aid basic principles. The industrial first aider needs to know only certain basic principles and how to apply them if the need arise.

14.3 Types and Signs of Fracture

Many varieties of fracture are described. For the industrial first aider only two are important:

1) closed or simple; and
2) open or compound.

Most fractures are closed. Open fracture is so rare that many first aiders will never see one.

An open or compound fracture is one where there is an outside wound as well as a fracture, and a communication between the skin, air and the broken bone-ends. This greatly increases the risk of germs getting into bones. The first aider can observe a compound fracture if there is a broken bone-end sticking out from a wound or through the skin, or if broken bone is visibly in a wound. But in most compound fractures, the bone cannot be seen in the wound. The first aider can explain there is a wound outside and a broken bone inside; whether they communicate is a matter for the surgeon to investigate.

The safe way to treat the wound is cover it as quickly as possible with a large individual dressing in order to keep out any infection. Once this is done, the patient's general condition and the fracture itself can be attended to. It is particularly important to handle any such injury extremely gently. One rough movement may link together an outside wound and an inside fracture and so convert a closed into an open fracture.

For the first aider there are only two certain signs of a fracture:

1) If the patient is conscious, he claims that he heard or felt a bone snap.

2) The limb or injured part is often bent in a way which could happen only if the bone was broken. This is called the "deformity"; it can usually be detected without removing the clothes. Deformity is best appreciated by comparing the injured and uninjured limbs.

14.4 Fracture of Individual Bones

14.4.1 General

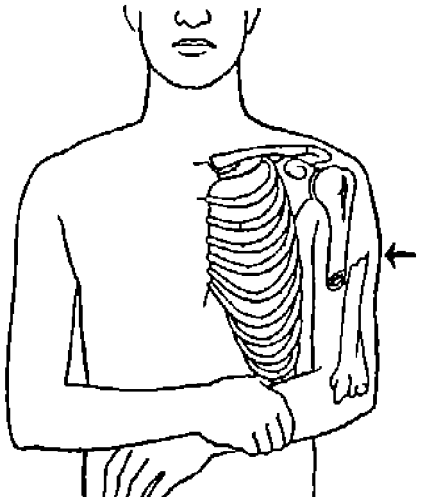
Certain bones are particularly liable to get broken. Often the deformity or change in shape produced is so characteristic that by simply looking at the injured part to feel that there is a fracture.

14.4.2 Collar bone or clavicle

The cause is usually a fall on the outstretched hand. The arm is held tight against the side of the chest, and any movement gives pain over the collar bone.

14.4.3 Upper-arm bone or humerus (Fig. 4)

Again the arm is held tight against the side of the chest, but this time pain on movement is over the broken humerus.



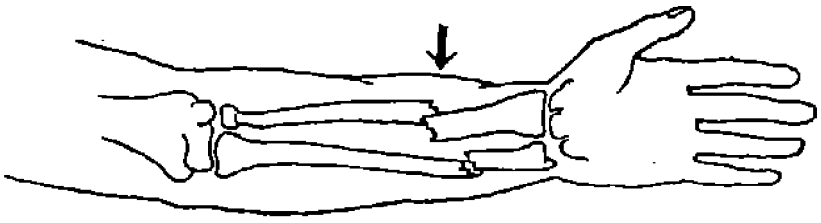
UPPER-ARM BONE OR HUMERUS
Fig. 4

14.4.4 Forearm bones

The radius and ulna (Fig. 5).

The injured forearm is supported with the other hand. There will be pain at the site of break. The amount of deformity depends on the extend of the breaking.

A young person may crack one of the forearm bones only part of the way through; this is called a green-stick fracture. If one bone alone is broken, the other will act as a splint.



THE RADIUS AND ULNA BONES
Fig. 5

14.4.4.1 Forearm bones at the wrist

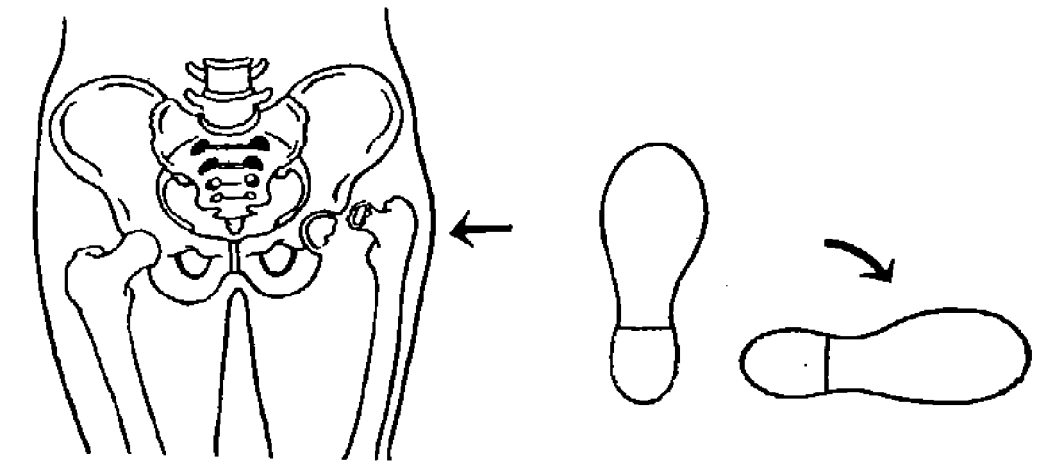
The common cause is a fall on the wrist, particularly in an elderly woman. The fracture is called colles's fracture and the deformity, seen from the side, is like a dinner fork.

14.4.4.2 Small bones of the wrist and hand

The usual causes are jerks, falls and blows. Like same fracture when cranking a diesel engine and "Kick's Back".

14.4.5 Thigh bone or femur at the hip (Fig. 6)

The femur is the largest bone in the body and when it breaks accompanies by shock. In old people, the femur is fragile and a simple fall will snap the "neck" of the femur close to the hip joint. The deformity is quite characteristic. The leg is held rolled outwards, so that the toes point away from the other foot. Sometimes it can be seen that the injured leg is shorter.



FRACTURE OF THIGH BONE
Fig. 6

14.4.6 Fracture of thigh bone

Because it is so strong, the femur will be broken only by great violence, such as a fall from a height or motor vehicle accidents. Pain and uneasiness will be extreme; the leg will be held quite still; there may be shortening.

14.4.7 Shin bones

The tibia and fibula-the large shin, the tibia, is just under the skin, so a break can be felt quite easily by running a finger along it. Generally, the thin little fibula is also broken. The common causes are road accident, falls and football injuries.

14.4.8 Shin bones at the ankle

It is usually impossible for the first aider to distinguish between a badly strained and broken ankle. The cause is usually a twist or a slight fall. Occasionally the whole foot is pushed backwards on the leg and in addition to fracture of bone the ankle is dislocated.

14.4.9 Ribs

Rib fractures are common. They may be caused by sudden compression of the chest, or by falls, for example, on the corner of a work-bench. There is usually no deformity, but sharp pain on breathing or coughing.

14.4.10 Skull

With head injury, the general condition of the patient matters much more than the local damage. Falls, blows and road accidents are the usual causes. Often the patient will be drowsy or unconscious. Blood from the nose or ear, following a blow on the head, suggest a broken skull.

A bad bruise on the scalp may feel like a fracture of the skull; there is a raised circular swelling with an apparent deep or hole in the center. Usually there is no break, but this is a matter for a trained nurse or a doctor to decide.

14.5 Care of Fractures, Strains and Sprains

14.5.1 Principle of first aid care

The principle of first aid care of any fracture is to steady the broken bone-ends so that the patient can move or be moved without added pain or further injury.

14.5.1.1 The injured part should be steadied and supported to prevent movement of the broken bone-ends. This means that the joints at each end of the broken bone must be held still.

14.5.1.2 If the limb is in a very unnatural position, it should be moved with great care and without force that patient can lay down as natural position as possible. If the position of limb has not much changed should not be moved.

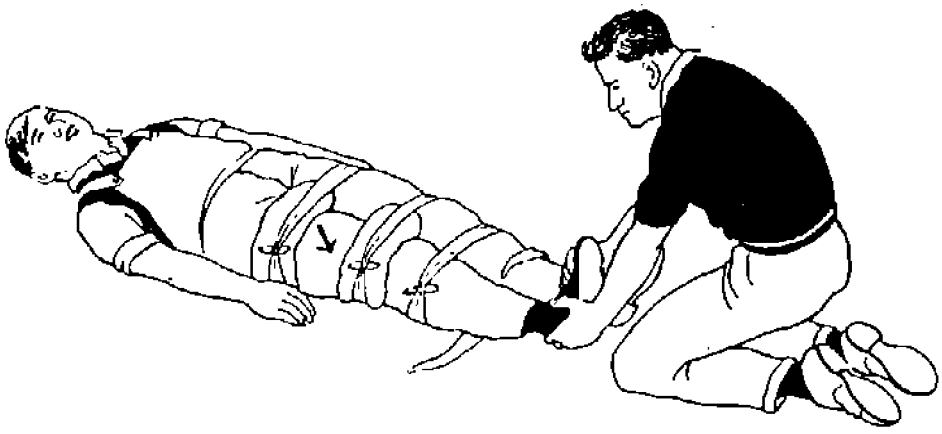
14.5.1.3 If the patient is to move, or to be moved without further expert help, the injured part should be fixed in a comfortable natural position.

14.5.1.4 Patient's clothes should not be taken off as this may harm the broken bone-ends.

14.5.2 Fractures of hip, thigh and shin

Patients with fractures of the hip, thigh and shin will normally be transported to hospital by ambulance as quickly as possible. Any splinting needed should be done by the expert ambulance men.

If, for any reason, the first aider have to splint a fracture of hip, thigh or shin, the safest way is to tie the two damaged and undamaged limbs together with four to six folded triangular bandages. Should an assistant be available, he may at the same time exert a steady pull on the injured foot, without bending or turning it in any way. This pull is to overcome, or at least reduce, the muscle spasm around the fracture which is the main cause of the pain (Fig. 7).



FRACTURE OF HIP, THIGH AND SHIN
Fig. 7

Plenty of cotton wool should be placed round the injured limb, before the two bandages are applied on either side of the fracture. Never tie bandage directly over a fracture.

On no account should any attempt be made to remove the clothes. It is reasonable, however, to roll up the trousers or pull down the stockings to see if a fractured shin bone has penetrated the skin.

Once the limb is properly immobilized, the patient may be lifted carefully on to a stretcher.

14.5.3 First aids of other fractures

14.5.3.1 Patients with severe head injuries will go straight to hospital under expert care; they will usually be unconscious and the fractured skull as such needs no first aids.

14.5.3.2 Patients without sustaining shock, but with fractures or suspected of the arm, forearm, wrist and ankle hand and foot, collar bone and ribs should be transported as a sitting case to the industrial medical department or hospital. For such patients, a firm bandaging should be done before being moved.

14.5.4 Procedure of firm bandaging of other individual fractures

With suspected fractures around the shoulder, in the arm or forearm, it is usually enough to apply carefully and gently an ordinary right-angle sling, without taking off the clothing. The conventional methods of splinting are as follows:

14.5.4.1 Collar bone

Cotton-wool pad should be applied in the arm-pit. The upper arm to the side of the chest should be bonded with two triangular bandages. The forearm to be supported in a sling at an angle of 45 degrees. A large cotton-wool pad should be placed under the sling end which passes over the injured collar bone.

14.5.4.2 Humerus

The side of the chest to be used as a splint. A large cotton-wool pad should be placed between the arm and the chest, and arm to the side of chest bonded with two triangular bandages. The forearm in a sling, at a right-angle should be supported.

14.5.4.3 Radius and ulna

Pad with cotton wool a splint long enough to extend from the elbow to the junction of the fingers and hand. Fix the splint to the forearm and hand along the palm surface, with a bandage at either end. Place cotton-wool pad on each side of the fracture and bandage over them.

This treatment also applies to fractures of radius and ulna at the wrist, or other doubtful wrist injuries.

14.5.4.4 Ankle

Pad all round with cotton-wool, and bandage firmly. No weight should be borne on the injured ankle.

14.5.4.5 Hands and feet

Fractures of the small bones of the hand and foot, fingers and toes require no first aid splinting. The injured hand should be rested in a sling. No weight should be borne on the injured foot.

14.5.4.6 Ribs

Fracture of the ribs require no first aid splinting. If pain is extreme, this may be eased by propping up with several pillows.

Whenever bandages or slings are used for fixing fractures, these shall be secured firmly enough but not too tight as the tight bandage will cause the part below it to start to swell.

14.5.5 Fractured spine

Fracture of the spine may happen in the neck or the back. A broken neck may follow when diving into a pond which is too shallow. Sudden stop of a car, motor-cycle, plain or train crushes are common injuries of the neck. The head jerks forward or backward and snaps the neck.

A broken back is due to a fall from a height, such as scaffolding; it may happen regardless of whether the head or feet, buttocks or back strikes the ground first. The back may also fracture by direct violence, for example, when a heavy weight material falls on the back.

The damage to the bone is comparatively unimportant but it matters to the spinal cord inside the bone. Any damage to the spinal cord is absolutely permanent. There can be no recovery from the paralysis (loss of movement of muscles) and loss of sensation below the level of the damage.

Because movement of broken spine may itself cause damage to the spinal cord, the first aider should take absolutely no measures unless he has to.

The first aider will suspect or recognize a broken spine by the following signs:

1) the story of accident;
2) pain at the place of injury;
3) the patient feels "afraid to move" and may be unable to move if he tries.

If it is absolutely necessary to move the patient or adjust his position, it shall be done very gently and slowly. The greatest care shall be taken not to bend the back or neck or twist the spine.

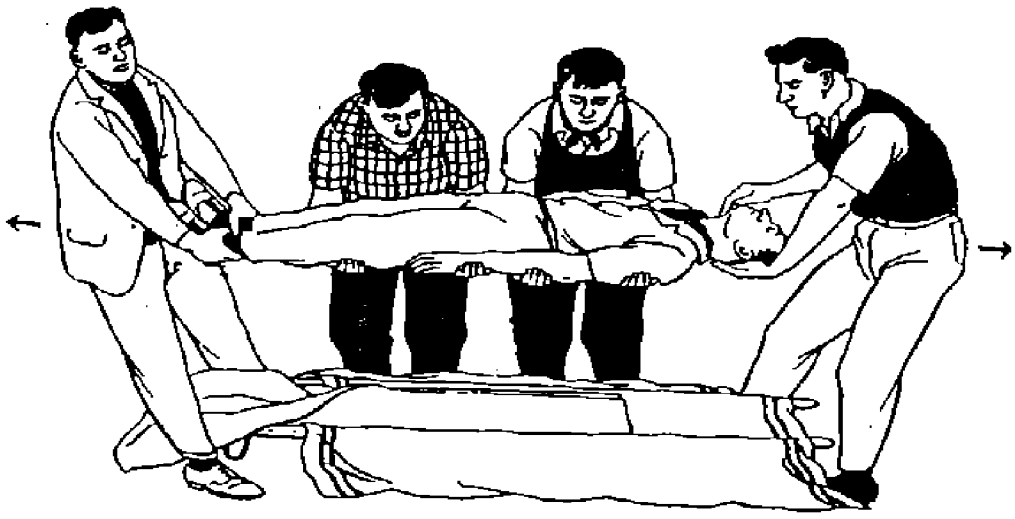
For anything more than the slightest movement, head and foot traction should be used, preferably with four people helping (Fig. 8). But it is emphasized that this is a job for expert first aider who have practiced the maneuver carefully.

If lifting is absolutely necessary, then the opportunity should be taken to put the patient on to a flat hard stretcher without pillows, or on to a door.

But the proper course is always to wait for the expert ambulance men to handle it unless there is an overwhelming reason for not doing so.

If patient with a broken back is found lying on his face, he may with advantage be transported on his face.

With a broken neck, the patient should be moved on his back, with his head supported between two rolled blankets, sand-bags, or bricks wrapped in cotton-wool.



FRACTURED SPINE
Fig. 8

14.5.6 The recovering fracture

Patients should be encouraged to go back to work, this is the way of keeping a patient generally fit. First aiders can play a valuable part and offer certain practical advice.

A plaster splint should not be covered with a rubber glove; the retained sweat softens the plaster. For similar reason, it is important not to rub a plaster or to get suds or water on it. The patient with crutches or in plaster should be encouraged to move around from time to time and not remain standstill. The rubbers on the ends of crutches should be in good repair.

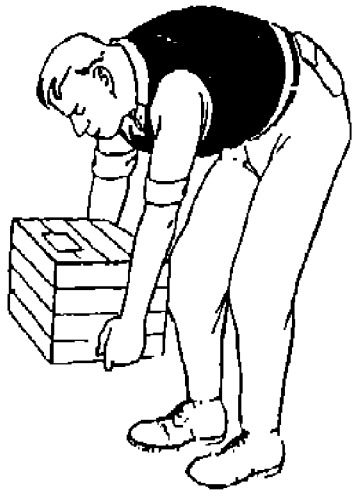
14.5.7 Strains and sprains

14.5.7.1 Strain

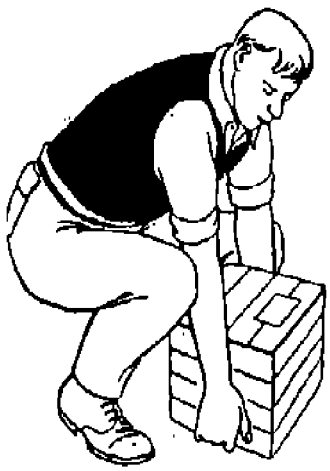
A strain is an injury to a muscle or tendon. A sprain is an injury to a joint. With both strains and sprains, the first aider's prime duty is to make sure that other serious injury is not undetected. The decision is beyond his responsibility, therefore, if there is the least doubt, the patient should be referred to a trained nurse or doctor.

Signs of strain are sharp pain in a muscle or tendon, the affected part is held stiff. The muscles most commonly strained are those of the back.

A severe strain may involve the complete rupture of a muscle or tendon. The pain is more severe, there may be great swelling, and the affected part cannot be moved. Such cases will probably need surgical treatment. No rest is required for simple strain, active movement from the start hastens recovery. To relieve pain, a cold compress can be applied. Many industrial strains particularly those of the back, can and should be prevented. Modern mechanical handling methods can get rid of much "back breaking" incidents. When manual labor cannot be avoided, its proper technique should be learnt; the motive power should come from the hip and thigh muscles with bending at the hip and knees, rather than from the back muscles with bending at the spine (Fig. 9). There are two figures showing a right and a wrong way to carry heavy objects.



Wrong



Right

STRAINS AND SPRAINS
Fig. 9

14.5.7.2 Sprain

Sprains will happen by the same kinds of injury which cause fractures. Taking x-ray pictures will show if bones have been fractured.

In a sprain, the ligaments and other soft parts around the joint are either stretched or actually torn. It is usually either a twist or a wrench. There is pain at the point of injury and the joint is held stiff. Swelling may be considerable.

14.5.7.3 Dislocations

A dislocation is the displacement of one or more bones at a joint. Dislocations are much less common than either fractures or sprains.

There is loss of movement in the dislocated joint and the joint looks peculiar. The pain is often described as "sickening". Often the patient can tell what has happened. Dislocation of a joint may be repeated again.

Shoulder is most commonly dislocated owing to a fall on the outstretched hand. Jaw, usually dislocates because of a big yawn. Dislocation of other parts of body are ankle, thumb and finger joints. It needs great violence to dislocate either the elbow or the knee.

The first aid treatment is to support the part beyond the dislocation in the position of greatest comfort and to get expert help. The first aider shall never himself try to put back a dislocation, as by doing so he may cause a fracture.

Quite often, a dislocation and fracture occur together. Diagnosis of these double injuries is beyond the first aider control.

15. BURNS AND SCALDS, ELECTRICAL AND HEAT INJURIES

15.1 General

A burn is tissue damage caused by dry heat; and scald is damage by wet heat. Tissue damage in direct contact with strong chemical is referred to as a chemical burn.

The seriousness of any burn depends on four factors:

a) area;
b) depth;
c) part of body affected; and,
d) the age of the patient.

15.1.1 Area of burn

The skin area involved in a burn is more important than the depth. Even a superficial burn involving more than 5 percent of the body surface is serious; if more than 15 percent of the surface is involved, the condition is extremely dangerous, and the patient may die of shock, unless blood transfusion is started within an hour or so.

In all large burns, there is severe shock, due to great quantities of body fluid lost from the raw surface of the damaged tissues, or by the swelling of the burnt part. Naturally, the larger the burnt area, the greater the shock.

Burning sterilizes the tissues, but the damage and the exposure of a large raw area greatly increase the chances of subsequent infection. The greater the area, the greater the infection risk. First aider should help to keep the burn clean and infection-free; but wrong action will introduce infection.

15.1.2 Depth of burn

For practical purposes two "depths" of burn have to be recognized:

a) Superficial burn

Only the outer layers of the skin are affected. The burnt area goes red, and blisters may or may not form. Pains is considerable, but the burn usually heals rapidly and there is little scarring. Large superficial burns produce considerable shock.

b) Deep burns

All the layers of the skin are damaged, and the fat and muscle beneath the skin, and even the bone, may be involved. The burnt area is yellowish-white or completely charred. If the skin is completely destroyed, there will be less pain than in superficial burns, because the surface skin nerves have also been destroyed. Deep burns often become infected. They heal very slowly and scarring is often serious.

15.1.3 Part of body

Burns of the face and hands are more serious than burns of corresponding size elsewhere because quite small scarring may disable affected part of body and cause ugliness.

15.1.4 Age of patient

Children and old people react severely to burns, and are exposed to extensive burns.

15.2 Varieties of Burns

15.2.1 Dry hot burn may be caused by contact with hot metal such as soldering filler rod or an unprotected hot bag. The burn is localized and may be superficial or deep.

15.2.2 Dry cold burns may be caused by contact with liquid gases such as liquid oxygen or carbon dioxide. The burned area is marked, localized and paled.

15.2.3 Fire burn may be caused by furnace back-fire, flammable oil products, solvents or a burning building. The clothes usually catch fire and the burn often covers a large area; parts of it may be superficial and other parts deep. Charred clothing may stick to the burn. The patient is usually very shocked.

15.2.4 Sunburn will be caused by exposure to sunbeams or artificial lights. It is very superficial but there is often considerable reddening and blistering.

15.2.5 Friction burn is a rare type of burn. It is caused friction of a fast moving rope.

15.2.6 Electrical and chemical burns are covered in Clauses 15.3.5 and 15.5.2.

15.2.7 Wet burns or scalds may be caused by steam, hot water, hot oils, cooking fat, hot solvents or tar. They are usually superficial but are often extensive and therefore serious.

15.3 First Aid Treatment of Burns

15.3.1 General

In treating a burn or scald the objectives are:

a) to prevent shock;
b) avoid infection; and,
c) relieve pain.

The first aider must not allow anything bactriologically "dirty" to be put on the burn, for example, grease or ointment from some dirty old pot. He must not touch the burn with his hands, and should speak as little as possible until the burn has been covered with a clean or sterile dressing.

For treatment purposes, burn is divided into trivial, medium and serious. The first aider can safely treat the trivial burn himself, but any medium burn, larger than a coin or an average cigarette burn, should receive expert treatment from a trained nurse or a doctor, so that the chances of infection may be kept to a minimum. The serious burn involving more than a few square cm of skin will be sent direct to hospital.

15.3.2 Trivial burns

Trivial burns are often very painful. The pain is quickly relieved by holding the burn part under running cold water. If after this, there is any sign of injury to the skin, the burn should be carefully cleaned with cetrimide or soap and water, and cotton wool, in the same way that minor wounds are dealt with. After cleaning, the burn and surrounding skin should be dried with clean cotton wool, and covered with an individual sterilized tulle gras dressing. The dressing is contained between two slips of transparent paper. One slip is pulled off, and the dressing, still attached to the other slip, the second slip is then quite easily removed, leaving the sterilized tulle gras in place. In applying the tulle gras first aider must take care not to touch the dressing, except at the corners of edges separating it from the slip of paper, forceps will be helpful if the tulle gras is too large and it should be cut to the right size before the slips of paper are removed. The tulle gras is covered with a small individual sterilized dressing, an individual plaster or clean cotton wool and a roller bandage.

If there is a blister, it should not be pricked, and the first aider should not try to remove dead skin.

15.3.3 Medium burns

Since thorough cleansing of the burnt area will be undertaken by the doctor or nurse, the first aider’s duty is simply to cover the burn with one or more individual sterilized dressing, and to get the patient to the expert as quickly as possible. There is no point in putting tulle gras on any burn which is efficiently cleaned.

15.3.4 Serious burns

No attempt shall be made to clean the burn or to take off the clothes, or to pull away any charred clothing which has stuck to the burn; the burning will itself have sterilized the whole area. The burn area shall be quickly covered with one or more large sterilized individual dressing. If the burn area is extensive, a clean towel or sheet should be used as a covering. At hospital, cleaning will be undertaken with full surgical precautions in an operating theatre.

Rapid replacement of body fluid lost is the life-saving treatment, in such cases, quick transport of patient to hospital is literally vital. Attempts to carry out blood transfusion or even intravenous saline infusion outside hospital cause more harm by delaying full-scale controlled fluid replacement. They are now resorted to only when the patient is trapped and cannot be quickly released, or where the distance to hospital will take a long time.

The general treatment of shock, should be followed. If the patient is thirsty, he may wash out his mouth and spit out. Only if there is considerable delay in getting the patient to hospital small sips of water, can be given. Larger quantities of fluid taken suddenly may cause vomiting. With small burns, hot sweet tea is harmless.

15.3.5 Electric burns

15.3.5.1 General

Electricity can cause burns, "electric shock", or both. Burns occur at the points of entry of an electric current, that is, the points of contact with a live conductor. A common cause is electric short circuit of a portable hand tools, especially if there is inadequate earthing. Severe burn with extensive charring of the tissues will occur when body comes in contact with high-tension lines. The heat and destruction from a high-tension contact are so great that the part of conduction is broken and the injured man runs away with his clothes on fire.

A mild electric current can produce a pattern on the skin like the branches of a tree or the meshes of wire netting. This is probably because the electricity flows along the trickles of sweat on the skin. A moderate current will produce a dry, shriveled burn, with little pain, less than from a heat burn of the same size. There is little or no reddening around the burn, and the burnt tissue takes the form of cone with the point inwards, extending down from the skin into the deeper structures. Quite a small burn may involve tendons and other important structures, and this may not be apparent for three or four days.

Sometimes the point of entry of an electric current may be similar burn at the point of exit. Where the entry burn is on the hand, there may be an exit burn on the foot.

15.3.5.2 Treatment

Even the smallest electric burn should be covered with a clean dry dressing and referred to a nurse or doctor. The "devitalization" of the tissue around the burn will delay healing and increase the risk of infection. The best treatment is a small skin-graft, usually applied in the out-patient department.

15.3.6 Chemical and tar burns

For chemical and tar burns see Clauses 15.5.2 and 15.6.

15.4 Heat Stroke

15.4.1 The heat stroke is a rare and somewhat dangerous condition which occurs when the overheated patient has neglected treatment and continued for some time in a very hot environment. The first, and much more common, effect of too much heat is heat exhaustion. This is also known as miners 'or stokers' cramp.

15.4.2 Cause

The essential cause is loss of too much body water and body salt as a result of too little replacement of what has been lost by sweating. Sweating is part of the natural mechanism of cooling the body. It is not the production of sweat, but its evaporation from the body surface lowers the body temperature. If the body is getting too little water and salt to replace what is lost as sweat, or if the surrounding air is so full of water-vapor that the sweat cannot evaporate, the body cuts down on further sweating and the internal temperature starts to rise. If this is allowed to continue, true heat stroke develops.

15.4.3 Symptoms

Heat exhaustion, the skin is clammy, and the patient irritable; he complains of severe cramps in the limbs.

Early heat stroke, the skin is hot and dry, and the irritability and cramps are much more severe.

Second stage of heat stroke, the patient may be found unconscious, breathing hard and sometimes twitching a little. The skin is dry, red and burning hot.

15.4.4 Prevention

Among those specially liable to heat exhaustion and heat stroke are especially marine strokers in the tropics. Workers at furnaces and in foundries, and other very hot places should be provided with special salt drinks which may be flavored with orange or lemon and glucose. The workers concerned soon learn for themselves how much salt drink they require to meet their differing individual needs.

Working in air, tight rubber protective clothing may produce heat exhaustion and heat stroke, especially if the weather is warm. The layer of air between the skin and the protective clothing soon becomes saturated with sweat, and an artificial humid atmosphere is produced. If such clothing is essential for heavy work, its outside should be soaked in cold water. The evaporation of this water will cool down the worker inside.

In very hot condition 0.24 to 0.48 L of sweat may be lost per hour, and this should recompense by fluid intake.

15.4.5 Treatment

The patient should be removed from the heat, stripped to the waist and bathed or sprinkled with cold water. He should then be fanned with towels to encourage the evaporation of the water, which will cool the patient further. This cooling process must be stopped when the patient's temperature has fallen to 37.8°C.

If the patient is conscious, or as soon as he becomes conscious, he should be given copious droughts of cold water, with a salt spoonful of common salt per tumbler and orange or lemon to improve the taste.

On recovery, the patient should rest (the length of rest depends on severity of the attack). All cases of heat exhaustion or heat stroke should be seen by a doctor or a nurse before returning to work.

15.4.6 Sunstroke

This is usually a combination of heat exhaustion and ordinary fainting. It is particularly liable to occur in those who are suddenly exposed to the heat in unsuitable clothing. Its treatment is the same as for heat exhaustion.

15.5 Chemical Burns, Injuries and Poisons

15.5.1 General

Chemical substances may harm the human body in three ways:

a) by direct burning the skin or eyes;
b) by irritation of the skin, so that dermatitis is produced; and,
c) by entering the body and causing rapid or slow poisoning.

Almost all chemical substances can cause trouble if misused. If used with proper care, they can be handled with complete safety. In this type of work, prevention is the target.

15.5.2 Chemical burns

Chemical burns may be caused by acids or alkalis. In either case, speedy treatment is vital. The acid or alkali shall be washed off at once, or at least greatly diluted by flooding the affected part with large volumes of water. Thus if no special antidotes are available, a chemical splash in the eye should be treated by holding the eye open under a running cold tap, or by plunging the upper part of the face into a bucket of cold water and blinking hard. Similarly, an acid or alkali splash on the skin should immediately be held under a running tap.

Antidote has an almost great significance, but there is always the danger that with chemical burns precious minutes may be lost hunting for an antidote when speedy treatment with water will fulfill the same result. Only after this has been done should time be given to finding and applying the correct chemical antidote unless, of course, a large volume of antidote is immediately at hand.

15.5.3 Acids treatment and prevention

Acid may be quick-acting or slow-acting. The chief risk come from filling, transporting and emptying carboys, and from accidental spilling and splashing. Those without technical training for example, cleaners in laboratories, run special risk, and should be carefully instructed in the necessary precautions.

15.5.3.1 Quick-acting acids

With quick-acting acids the patient feels irritation and burning almost at once. These kind of acids are: hydrochloric acid which is used in pickling-vats, metal wire drawing and miscellaneous usage. It produces a dark brown blister which later turns black.

The other quick-acting acids are: Nitric acid, Nitro-hydrochloric acid, and sulphuric acid, etc.

15.5.3.2 Slow-acting acids

With slow-acting acids there is no immediate pain, so that the patient may not know that he has been in contact with the acid for a period of half-an-hour to four hours. By then, the acid has penetrated deep into the tissues.

Hydrofluoric acid, Hydrobromic acid, carbolic acid and oxalic acid are in this group.

15.5.4 Treatment of acid splashes

Quick action is required with either type of acids as given below:

a) Wash off the acid immediately with a large volume of water from a tap, shower or bath. Continue washing until the neutralizing antidote is available.

b) If water is not available, the acid should be dabbed off the skin with cotton wool, a clean rag or a handkerchief. Any wiping movement must be avoided for this tends to spread the acid.

c) If an antidote is immediately available in large quantity, it should be used instead of water, but it must be used freely and copiously. If there is only a small supply, it should be applied as soon as the affected part has been completely flooded and douched with water. The antidote here recommended is "buffered phosphate solution" which has the valuable property of neutralizing both acids and alkalis. If this is not available, a solution of bicarbonate of soda (2 tablets spoonfuls to 0.48 L (one pint) of water) may be used.

d) If the clothes are contaminated with acid, they should be removed at once if possible. If not immediately possible, the affected area of clothing should be flooded with water or antidote. If in doubt swill everywhere.

e) Slow-acting acids should be dealt with as above, but special treatment by a trained nurse or doctor will be needed to neutralize any acid which has penetrated into the tissues. For example, calcium gluconate may have to be injected under a hydrofluoric-acid burn.

f) Every suspected cause of a slow-acting acid burn should be seen by a trained nurse or doctor as soon as possible after initial first aid treatment. With quick-acting acids, the same applies if, after initial treatment, the skin shows any change or the patient feels any adverse effects, or if the quantity of acid involved was considerable.

15.5.5 Prevention

The prevention of chemical burns should be considered by the management and in consultation with the plant/complex medical officer. This will include the provision of first aid facilities at all danger points. The industrial medical officer should make sure that the first aiders and those concerned know how to use these facilities.

15.5.6 Alkalis and treatment

Alkali burns are more serious than acid burns, because the alkalis tend to penetrate quickly into the tissues, and to go on acting even after thorough washing and neutralization. Thus alkalis closely resemble the more dangerous slow-acting acids. An alkali burn is therefore usually worse than it appears at first. Once the alkali has penetrated, the skin appears pallid and sodden, and later a deep slow-healing ulcer may develop.

The main alkalis used in industry are caustic soda, caustic potash, ammonia, bleaching powder, lime and cement.

15.5.7 Treatment of alkali splash

First aid treatment is exactly the same as for acids, with the first emphasis on speedy complete washing with a large volume of water; this may be followed by buffered phosphate solution. If the solution is available in a large quantity, it may be used instead of water from the start.

If buffered phosphate is not available, dilute vinegar (two table-spoonfuls to 0.48 L (a pint) of water) or citric acid tablets dissolved in water may be used, but these are unlikely to be available in industry, they add little to the benefit of the water douche.

With lime, bleaching powder or cement, solid particles should be removed from the skin before the part is flooded with water, as water makes them stick. Removal is best done with a piece of cotton wool or a soft brush.

All alkali injuries should be seen by a trained nurse or doctor at the earliest possible moment. The provision of first aid facilities at danger point is even more important with alkalis than with acids.

15.6 Tar Burns

Burns caused by tar should be covered with a dry dressing and the patient referred to a trained nurse or doctor. Solidified tar is itself a good dressing, so no attempt should be made to remove it.

16. CHEMICAL INJURIES TO THE EYE

See details in Clause 25.

17. CHEMICAL SKIN IRRITATION

Dermatitis or inflammation of the skin is of great importance in industry. Almost any chemical substance can produce dermatitis in a person whose skin is sensitive, yet others can handle the same substances with complete immunity. Clear example is dermatitis produced by water in some washerwomen. Strong alkaline soap may also produce dermatitis. Some substances are particularly liable to cause trouble, for example: acids and alkalis, solvents and degreasers, detergents, oils and tars, glues, synthetic resins, plastics, accelerators and metallic irritants, such as mercury and arsenic, nickel and cyanide, and sugar, flour and certain woods.

The first aider should never attempt to deal with a case of industrial dermatitis, or any other skin condition. The treatment should be carried out by an expert at the earliest possible stage. Delay makes treatment far more difficult, and exposes others to the same risk.

Here again, prevention consist of management and the doctor to make proper planning to include personal cleanliness of employees, the use of a carefully selected barrier cream or other physical protection, proper hygiene of wash-places and lavatories, changing and cleaning of protective clothing and special duties for first aiders.

18. CHEMICAL POISONS

18.1 General

Chemical substances may enter the body through the skin, the lungs or through the stomach and digestive system. The subject of industrial poisoning is of great extent, most of it being outside the range of the first aider. He should however, know how to deal with such emergencies as may arise and he should be aware of the existence of certain possibilities.

The direct action of chemicals on the skin has been dealt with in Clause 17, but certain chemicals, for example chrome and nickel, may produce ulcers in the skin or in the membrane lining the nose. Such ulcers are known as "trade holes". Fortunately these are now extremely rare. Certain other chemicals can penetrate the skin without damaging it. In consequence, they have to be handled with great care and circumspection.

18.2 Gases, Fumes and Dusts

Gases, fumes and dusts are important hazards in certain industries. Many dusts, though unpleasant, are not poisonous. But dust containing particles of silica of certain size are liable, over the years, to produce severe lung damage. These risks are now well appreciated and general preventive measures should be taken.

Chemicals entering via the mouth, stomach and digestive system are comparatively low in industry. Poisoning may happen accidentally or by attempted suicide. Pollution of hands will contaminate food stuff. This emphasizes the importance of washing the hands before food is eaten, and no food or drink should be served in places where poisonous chemical processes are involved.

18.3 Notifiable Industrial Diseases

The well-known industrial poisons have been very largely brought under control. These poisons mainly cause symtoms of very slow onset, and are therefore seldom seen by the industrial first aider.

Fourteen different industrial diseases and conditions are notifiable by doctors, these are:

Lead-Phosphorus-Manganese-Arsenic-Mercury-Carbonbisulphide-Aniline-Benzen-Anthrax-Compressed-airillness-Toxic jaundice-Toxic anemia-Chemical skin cancer-Ulceration due to chromium.

Note:

Industrial dermatitis is not a "notifiable industrial disease".

19. UNCONSCIOUSNESS, GASSING AND ASPHYXIA

19.1 General

19.1.1 When a patient has become unconscious the first aider shall make an immediate assessment of what has happened and check to see if the patient is or is not breathing. Most unconscious patients will breath, but if breathing has ceased, the patient is in immediate danger of asphyxia and urgently needs artificial respiration. The unconsciousness and asphyxia are different medical cases, even though they may both be present at the same time. With unconsciousness, there may or may not be asphyxia. But with asphyxia, there is always unconsciousness.

19.2 Ascertaining the Cause

There are three kinds of situation:

a) where the cause is obvious;
b) where it is probable; and
c) where the first aider can see no obvious cause.

It is vitally important to make this assessment, since the first step in first-aid is to remove the unconscious person from danger area, and this can be done only after a broad decision about the probable cause has been made.

- Where the cause is obvious

Some circumstances in which the patient is found, show fairly clearly what has happened, for example, where unconsciousness is due to partial drowning, electric shock, head injuries or attempted suicide.

The patient who has attempted suicide may be found hanging, or with his head in a gas-oven and pillow under the head, or in bed with an open bottle of tablets beside him. In these circumstances the first aider should waste no time to save life if he can.

- Where the cause is probable

In situation where the cause of unconsciousness is probable by accidental gassing, (domestic or industrial). Gassing in industry may have many different causes. The first aider should know of the existence of risks in any particular processes in the plant area.

Some common industrial processes always have certain risk. When stacks and boilers develop defects, it will cause gas or vapor to blow back and result in asphyxia or unconsciousness of men working nearby. Similarly, men working in deep holes, wells, closed tank are subject to special risks.

- No obvious outside cause

The first aider will not be able to make an accurate diagnosis in cases where there is no obvious external cause, though he may have his suspicions. It will help him to remember that there are six common causes as follows:

- fainting;
- fits;
- strokes;
- diabetes;
- alcohol;
- hysteria.

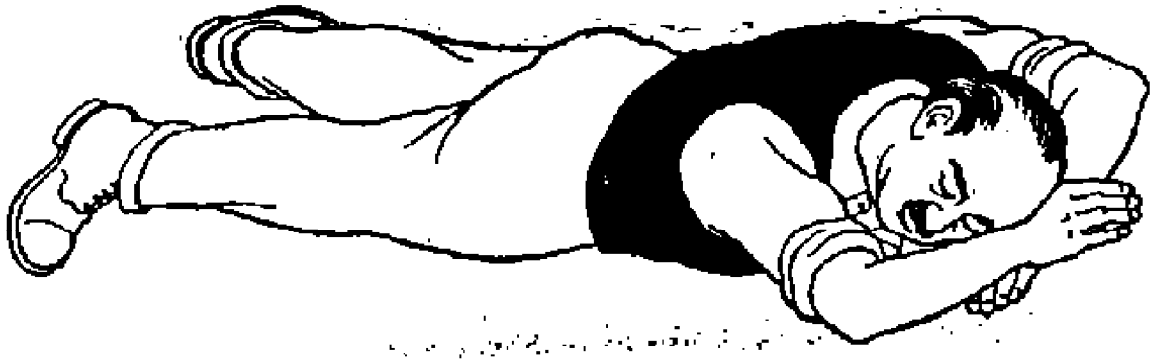
19.3 Care of Unconscious Patient

When the patient has been moved off the danger zone there are certain general lines of care, whatever the cause of unconsciousness, which shall always be followed as indicated.

19.3.1 The unconscious person should be moved out from danger area. If he is not in danger, no attempt should be made to move him.

19.3.2 The patient should be rolled over into the prone or semi-prone position. An unconscious patient may suffocate, if left lying on his back. The tongue falls back into the throat and may block the entry of the wind pipe. Suffocation will happen if the patient has a false teeth. In addition, saliva or vomited material may enter breathing passage and cause serious results. Often the unconscious patient will be in shocking state, struggling for breath, and the color of his skin will turn blue. This is due to the patient lying on his back with obstruction of the air passage.

Many lives have been lost because patients have not been turned over into the prone or semi-prone position. Prone means face downwards and the elbows bent, so that the forearms and hands are under the forehead (Fig. 10). Semi-prone means that the patient's body is on its side, his face turned towards the ground. To stop the body rolling rightover, both arms should be bent naturally at the elbows, and the upper leg bent slightly at the hip and knee, so that it falls forward over the lower leg and acts as a supporting strut (Fig. 3). If there is retching or vomiting, the semi-prone position is to be preferred as the mouth and nose are more easily kept clear.



PATIENT IN PRONE POSITION
Fig. 10

Before rolling the patient over, no obvious fractures should be present. If there is a fracture roll the patient over but support the fractured part. Rolling should be done firmly but gently, moving the whole body into what looks like a natural and easy position.

19.3.3 Take any false teeth out of the mouth gently. If the jaw is tightly closed, do not try to force it open.

19.3.4 Raise the point of the chin with the hand, so that the neck is bent slightly back. This helps to open up the air passage at the back of the mouth.

19.3.5 Loosen any tight clothing, especially round the neck or waist.

19.3.6 If the patient has to be moved, he should be lifted carefully on to a stretcher, still in the prone or semi-prone position, and carried in this way.

19.4 Eliminate the Following Actions

19.4.1 Do not force fluid into an unconscious patient's mouth. He cannot swallow and will probably inhale it and may get pneumonia.

19.4.2 Don't slap or throw water over him.

19.4.3 Don't try to transport him sitting up. He must be moved lying down in the prone or semi-prone position. Attempts to sit up an unconscious person, for example in the back of a car, have proved fatal.

19.5 Internal Causes of Unconsciousness

19.5.1 Reference should be made to the following causes as discussed in:

a) Care of unconscious patient Clause 19.3.
b) Fainting Clause 13.2.8.

19.5.2 Fits

19.5.2.1 Fits are alarming but are usually quickly over. They are almost always due to the condition of epilepsy, and the patient will often have and had previous attacks. As a result of the new drug used to control them, epileptic fits are much rarer than they used to be; but they may occur if the patient forgets to take his tablets, or to bring them with him to work.

19.5.2.2 At the start of the fit, the person utters a cry and then falls over. The limbs stiffen and then start to jerk. The patient may froth at the mouth, bite the tongue, pass urine or pass a motion. All the time he is quite unconscious, and when the violent phase is over he falls into what appears to be a deep sleep. This usually lasts only a short time. He may hurt himself in falling. Pillows, coats and other soft objects placed around him are safer and more effective than human strength. Never force the jaws apart in order to prevent tongue biting; it is possible to knock out teeth and fracture the jaw. If the mouth is open, it is reasonable and safe to put in a gag. This is no more than wedge to keep the jaw apart. Such wedge is a piece of firewood with a clean handkerchief wrapped round it.

Another is a stout pencil, not less than 12 cm (5 inch) long. Never tell an epileptic patient what his fit is like, as he may be quite unnecessarily distressed. Unconsciousness during the fit is one natural blessing of the disease. After the attack is over, the patient should be advised to report to his own doctor as soon as possible.

19.5.3 Strokes

Strokes are caused by a bursting artery or a blood-clot in the brain. Though a stroke is sometimes fatal, but many patients have recovered. Good first aid care, as already described in 19.3 may save life.

The patient is usually elderly. He may feel giddy and may, or may not, pass out completely. As a result of the injury to the brain, he usually loses the ability to move one side of the body wholly or in part. This involves most obviously the arm or leg. At the same time, the other side of the face is also paralyzed. In an unconscious patient who has had a stroke, the paralyzed cheek may be seen flapping in and out each time the patient breathes.

The facts that the patient has had a stroke are as follows: his age in his 50s or 60s; the color of his skin, which is usually blue; loud harsh breathing, called stertorous breathing; the flapping cheek; and dribbling from the corner of the mouth.

Treatment is generally as set out above of course, the first aider must send for skilled help without delay.

19.5.4 Diabetes

Some employees hide the fact that they are diabetics from their workmates or the doctor which has disastrous results. It is in their own interest that their conditions should be known by those concerned.

The most usual cause of trouble in a diabetic is over-action of a normal dose of insulin, as a result of physical fatigue, excessive work or worry, or missing a meal. The patient may become giddy, confused, and even apparently mentally disordered. The treatment is to give sugar at once, preferably in the form of a sweet drink. Physician should be called at once.

19.5.5 Hysteria

The first aider should never assume that an unconscious patient is hysterical. Hysteria hardly ever causes complete unconsciousness.

Occasionally, however, a patient, usually a young girl but sometimes an older woman or a man, will become typically "hysterical". The situation usually occur when an unrest or anxiety, or natural disaster arise. Hysterical involve bad behavior, like screaming or violent weeping, may lead to panic. In such circumstances, firm physical measure are justified to prevent panic from breaking out.

More occasionally, hysterical behavior can follow serious injury or disease of the brain. In these cases, it appears to be caused by lack of oxygen to the brain tissue, and this is other than the hysteria of panic. Patient should be treated with gentle but firm kindness rather than the traditional slap.

20. RESCUE OPERATION OF GAS CASUALTY

20.1 General

20.1.1 As gas casualties are of considerable industrial importance, first aider should be fully trained and practiced in rescue work. The following are the general principles to be observed:

a) Before entering outdoor or indoor gas-filled areas the doors and windows, should be opened so as to blow gas or fumes away.

b) A damp cloth or towel tied round the face gives no protection against gas.

c) If two or more people are present, one should stay outside in case the rescuer himself needs rescuing. A life-line tied round the rescuer's waist should always be used to pull a man along the ground.

d) If the rescue worker has to make a dash into a gas-laden atmosphere, he should take slowly six really deep breaths, then hold his breath and dash in. He will be able to hold his breath for three-quarters of a minute to one minute at the most.

e) In gas-filled places, the light is often poor. Some gases for example carbon-monoxide and methane, are inflammable. The first aider engaged in rescuing a gas casualty should never use a naked flame.

f) Respirators should not be used by the inexperienced rescue worker or untrained first aider. The proper use of respirators requires a good deal of practice. The first aider who puts one on for the first time in a real action situation may easily panic.

21. TYPES OF RESPIRATORS AND BREATHING APPARATUS

Details are given in IPS-E-SF-300 and IPS-G-SF-140.

22. INDUSTRIAL GASES

22.1 There are four types of gas encountered in I.O.G.P Industries:

a) irritant gases;
b) asphyxiating or smothering gases;
c) issue-poisoning gases; and,
d) narcotizing gases.

22.1.1 Irritant gases

Irritant gases are immediately detected by their effects, particularly on the nose and eyes. The smell is powerful, and the eyes start to water. Those exposed will run away for their lives. These gases are less dangerous than those which are non-irritant. The common irritant gases are as follows:

Sulphur dioxide (SO_2) is used in the manufacture of sulphuric acid, and in fumigation and refrigeration; and in ordinary smoke.

Ammonia (NH_3) is utilized in refrigeration and ice-making, and number of other industrial processes.

Chlorine (Cl_2) is used in bleaching, paper-making, etc. Phosgene ($COCl_2$), mainly of importance as a war gas, is produced during the manufacture of some aniline dyes. It is also produced when trichlorethylene is inhaled through a lighted cigarette; hence the instruction that those using trichlorethylen should not smoke at work.

22.1.2 Simple asphyxiating gases

The air we breath consists of about four-fifths nitrogen and one-fifth oxygen. The nitrogen is inert; the oxygen is absorbed by the blood and carried throughout the body to enable the tissues to live; without oxygen the tissues die. Asphyxiating gases work simply by replacing the oxygen in the air. It follows that they should be present in very large quantities to get rid of enough oxygen to do harm. Most of them do no smell; this makes them the more dangerous. The following are the common asphyxiating or smothering gases.

Nitrogen (N_2) is important for practical purposes only in wells, mines, and other deep holes where all the oxygen have been used. Absence of oxygen is shown when a safety-lamp flame, lowered into the hole, goes out.

Methane (CH_4) is the gas most commonly found in mines, where it is called "fire damp" because it explodes if exposed to flame or spark.

Carbon dioxide (CO_2) is produced by the living tissues of the body as a waste product and breathed out by the lungs. Large quantities are produced in brewing, aerating and fermenting. It may also be found in mines, tunnels, cellars and boilers.

22.1.3 Tissue-poisoning gases

Small quantities of tissue-poisoning gases exert a disproportionate poisonous effect. They are absorbed quickly into the blood from the lungs (or even from the mouth) and quickly poison the living tissues by preventing their intake of oxygen. The common gases under this heading are in the following clauses:

22.1.3.1 Carbon monoxide (CO)

CO is perhaps the most important industrial gas poisoning. It is produced when coke, coal or gasoline is burnt. In consequence a black flue which causes the combustible products to leak out into a workplace which is carbon monoxide poisoning gas. The same result may be brought about by gasoline engine when working in a closed space. Exhaust from this engine contains 7 percent carbon monoxide.

22.1.3.2 Hydrogen cyanide (HCN)

HCN is so poisonous that it is usually used only in the open air. Sometimes, however, it is used for fumigation of premises or dirty fabrics. It has a smell of bitter almonds and is almost instantly fatal. Wherever it is used, the maker's precaution card should be exhibited and antidotes should be immediately available.

22.1.3.3 Hydrogen sulphide (H_2S)

H_2S is evolved in glue making, tanning, mines and oil industry. In small concentration it is violently irritating and has a foul smell. In large concentration a man inhaling it may drop down dead.

The symtomes of gassing depend on the nature of the gas, the amount inhaled and the length of exposure. With the irritant gases, coughing and watering of the eyes and nose are immediately apparent. With the tissue-poisoning or narcotizing gases, the patient quickly becomes unconscious but may retain a good color. With the simple asphyxiating gases there are usually two stages:

1) Partial asphyxia

The patient feels dizzy and weak and may stagger and collapse. There may be difficulty in breathing, with panting and gasping. Occasionally there are convulsion, especially as the patient breathes out.

2) Full asphyxia

The patient is unconscious and blue, especially at the "tips" of the body, nose, ears, lips and fingers. Breathing is first intermittent and then absent. The pulse is first weak and then absent. The absent pulse does not necessarily mean, however, that the heart stopped.

22.1.4 Treatment of gassing

The treatment of gassing is briefly summarized:

- remove from danger area; artificial respiration if breathing has ceased; administration of oxygen; treatment of shock; and general care of the unconscious patient.

23. ARTIFICIAL RESPIRATION

23.1 General

Artificial respiration, or artificial breathing, is required when breathing has stopped, but life is not extinct. Patients who need artificial respiration are always unconscious; but most unconscious patients have not stopped breathing and artificial respiration is not required. The most usual causes of cessation of breathing are electric shock, drowning, carbon monoxide poisoning, and pressure on the chest; like person left under debris.

In such cases, the time between the cessation of breathing and the stopping of the heart beat is short. The purpose of artificial respiration is to give the heart and other tissues the oxygen they need and get rid of unwanted carbon dioxide from the body to encourage the lungs to start work again. Artificial respiration shall be started on the spot, unless the patient has to be moved out of contaminated air.

23.2 Methods of Artificial Respiration

Many ways of artificial respiration have been devised. There are five main headings as follows:

23.2.1 Push methods

In "push" methods the operator pushes on the outside of the chest to force air out, relying on the natural recoil of the ribs to suck air in. This method cannot be used if the ribs have been fractured.

23.2.2 Pull methods

In "pull" methods the operator moves the arms so as to stretch and expand the chest causing an intake of air. The best known "pull" method is that of Silvester, but experience has shown it is unsatisfactory.

23.2.3 Push-and-pull methods

See Clause 23.2.6.

23.2.4 Rocking methods

In rocking methods the principle is to use the diaphragm and the contents of the abdomen as a piston, first to compress and then to inflate the lungs. This is more efficient than any of the manual methods, but it requires special apparatus.

It is possible to improve a rocking stretcher, but this is not without danger. In a fully equipped industrial medical department or industrial health service, a proper rocking stretcher should be available.

23.2.5 Suck-and-blow methods

The lungs may be expanded and contracted in a natural way by applying first a positive pressure, then a negative pressure, either outside the walls of the chest or directly down the wind-pipe.

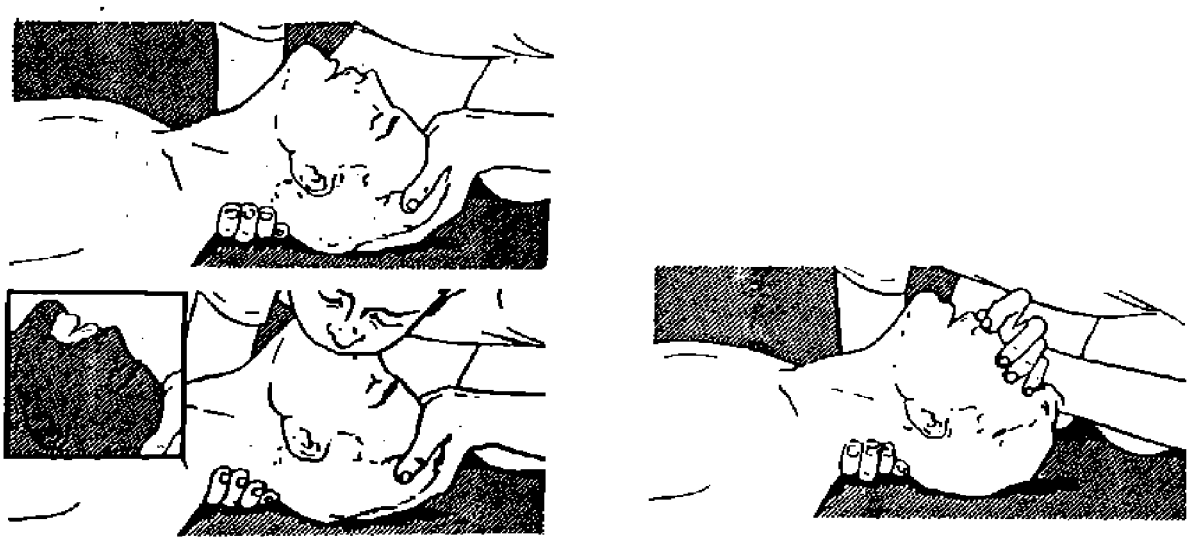
An outside pressure can be applied only with an elaborate mechanical apparatus. Direct inflation and deflation of the lungs by air or oxygen is achieved by alternately blowing and sucking through the nose and mouth and the air passage. Provided there is a clear "air way" such a method is completely effective. It is used by all modern anesthetists during operation when chest and other muscles have been temporarily paralyzed by special drugs. For first aider there are two possible "suck-and-blow" methods:

a) "Mouth-to-mouth".
b) "Resuscitator".

23.2.6 Mouth-to-mouth

The operator has to blow hard into the mouth of the patient, making sure that the patient's chin is well up, the mouth open, the tongue out of the way, the nostrils closed, and above all there is a good fit of lips to lips. The method is very effective and far easier to carry out than might be expected.

Every first-aider should know how to perform mouth-to-mouth artificial respiration. It can be learnt from books or lectures; but the most valuable method is to practice on a special human dummy.



MOUTH-TO-MOUTH RESPIRATION
Fig. 11

The details of the mouth-to-mouth are as follows (see Fig. 11):

a) The patient lies on his back (the so-called supine position). Compare this with the Holger Nielson method where the patient lies on his face, in the prone position.

b) Sweep the finger round inside the mouth, to remove weed or false teeth and to make sure that the tongue is forward.

c) Kneel comfortably on one side of the patient's head, so that one's mouth can come naturally over his.

d) Bend the patient's head right back, as far as it will go. This will open the air-passage behind the tongue.

e) With one hand, hold his chin up and back with the other, pinch his nose closed.

f) Take a deep breath. Apply your mouth to his, getting as good a fit as you can. Then blow, until out of the corner of your eye, you see his chest rise.

g) Take away your mouth, and watch his chest sink back.

h) Give the first six blow quickly, leaving in between each blow just time enough for the chest to sink back.

i) Thereafter, blow at the rate of ten blow a minute.

23.2.7 The Holger Nielsen method

23.2.7.1 General

Before starting the Holger Nielson method, the following steps should be taken as quickly as possible:

a) Roll the patient into the prone position.

b) Put the finger inside the mouth and sweep it around to remove any obstruction-for example, sea or pond weed or false teeth.

c) Make sure that the tongue is hanging in its normal forward position.

d) Loosen the collar.

e) Move out any "lumps" in the clothing from the front of the chest such as, a tin in a pocket. An object may harm the ribs when artificial respiration is started.

f) If the patient has been submerged or has been vomiting, the first aider should stand astride the patient, clasp the hands underneath his stomach and raise him quickly a short distance from the ground. Repeat twice. This helps to empty the air passages.

Wet clothing should be taken off immediately.

The steps referred to above should not take more than a minute. Artificial respiration should then be started. Doctor and ambulance to be called and arrangements for a rocking stretcher or a resuscitator to be made.

Artificial respiration should be continued rhythmically without stopping, until natural breathing starts again, or until the doctor pronounces the patient to be dead.

23.2.7.2 Artificial respiration the Holger Niclson method (see Figs. 12 and 13)

This method is also known as the "back pressure arm-lift" method, a good descriptive title:

a) Position

The patient should be placed in the prone position, with the elbows bent and projecting out sideways and the hands crossed under the head. The head will be turned slightly on one side so that the cheek rests on the hands. The nose and the mouth must be clear of any obstruction.

The operator kneels on one knee at the head of the patient and facing him. The knee is placed in the angle between the patient's head and his forearm. The opposite foot is placed near the patient's other elbow. Alternatively, the operator may kneel on both knees, one on either side of the head. If the one-knee position is used, he will find it an advantage to change the knee from time to time. The operator places his hand on the flat of the patient's back. The tips of the thumbs should be just touching, with the fingers pointing down-wards and the wrists on a level with the armpits.

b) Movements

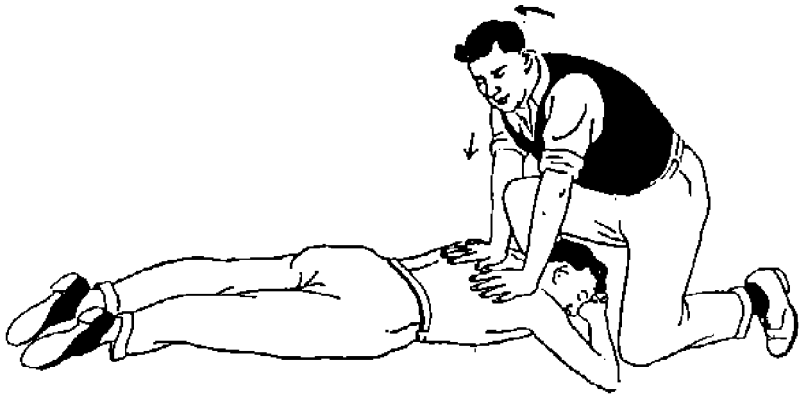
In making the movements, the operator's arms should be kept straight and the body weight is used to show the effects. All the movements should be made steadily, slowly and rhythmically, the operator counting out loud slowly as he proceeds.

MOVEMENT	TIME	COUNT
First Movement:		
Compression of patient's chest	2 seconds	"one, two"
Second Movement:		
Slide hands to patient's elbow	1 second	"three"
Third Movement:		
Raise patient's elbow	2 seconds	"four, five"
Fourth Movement:		
Lower elbows and slide hands to patient's back	1 second	"six"

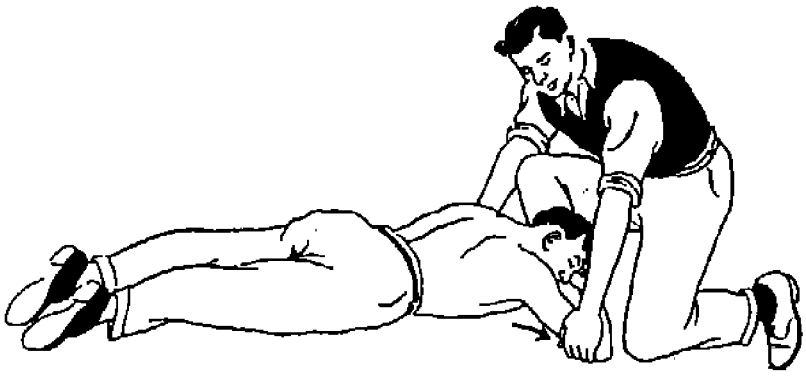
Compression of patient's chest cause breathing out or "expiration". Raising the patient's elbows cause breathing in or "inspiration". The state of the cycle of movements on the patient is as follows:

Breathing out	2 seconds
Relaxation	1 second
Breathing in	2 seconds
Relaxation	1 second

The full cycle takes six seconds, giving a rate of artificial breathing of ten to one minute.



HOLGER NELSON METHOD (a)
Fig. 12



HOLGER NELSON METHOD (b)
Fig. 13

23.2.8 Oxygen therapy

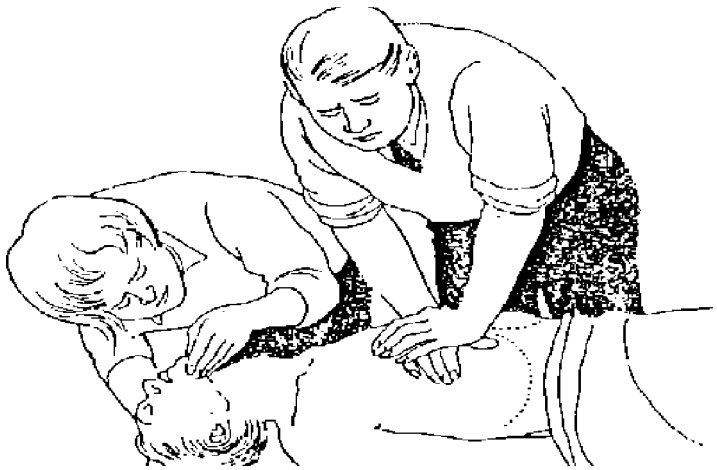
Oxygen should be obtained and administered to the patient during artificial respiration.

23.2.9 Ventilatory resuscitation

Full details are in IPS-G-SF-140 Clause 11.

24. EXTERNAL HEART MASSAGE

If the heart has ceased to move the blood around the body, artificial respiration is no use. It is sometimes possible to re-start the heart by pressing over the lower half of the sternum or breast-bone. This is external heart massage.



EXTERNAL HEART MASSAGE
Fig. 14

If after twelve breathings with the "mouth-to-mouth" method the patient still looks dead, and no change in the color of the skin or lips and no signs of spontaneous breathing movement, it is worth trying external heart massage. Place the ball of one hand over the lower half of the breast bone. This will be found at the top of the inverted V made by the lower ribs. Place the second hand over the first. Give six sharp presses at one-second interval (Fig. 14). Then give a mouth-to-mouth lung inflation, and repeat the whole cycle. Stop the external heart massage as soon as the color improves. But continue with the mouth-to-mouth artificial respiration. If two first aiders are available one can give heart massage while the other gives mouth-to-mouth artificial respiration.

25. THE EYE IN INDUSTRY

25.1 General

More than one in ten of all accidents involve the eye; and the most common of these is a "foreign body" in the eye. It is therefore the eye injury which constitutes a most important part of the first aider's work.

Most industrial eye casualties never reach hospital but are dealt with by first aiders, nurses, medical officers, or general practitioners. 50% of casualties are caused through working with an emery wheel. When a foreign body separated from the surface of the wheel travels slowly, and does not penetrate too deeply into the eye. It is usually composed of metallic dust, abrasive and bonding material, and is non-magnetic. Other industrial eye casualties are related to turning, milling, spinning, boring, hammering and chipping.

25.2 Examining the Eye

Any first aider who may be called upon to deal with a colleague's eye an injury should know how to examine it. The sequence is as follows:

25.2.1 The patient should be seated, with a good light shining on his face and eye. The first aider should stand behind the patient and support the head against his own body.

25.2.2 The patient's head should be tipped well back and the eye then held open with two fingers. It will make much easier to examine the bad eye if the patient is asked to keep both eyes open. The patient should be asked to look slowly and in turn at each of the four points of the compass, so that the whole of the exposed eye may be carefully inspected. There should be no hurry. It is particularly important to inspect the front of the cornea (the transparent curved surface covering the pupil and iris).

25.2.3 If nothing can be seen, the lower lid should be pulled away from the globe while at the same time the patient looks upwards. This enables foreign body under the lower lid to be seen. It is possible to turn up the upper lid in such a way that its under surface can be seen, but as this maneuver needs considerable experience if it is to be satisfactorily performed, it is best not done by first aiders.

A foreign body may be seen on the front of the cornea, on the white of the eye, or on the red inside lid. It may be black or glistening, and may be fixed or moving.

25.3 Removal of Foreign Body

A foreign body which moves will probably come out of the eye very easily. Nature's method is to flush the eye with tears from the tear-gland. Flushing can be exercised by getting the patient to blow his nose strongly, and blinking several times. On no account shall the eye be rubbed.

Should this fail, the eye should be washed out with an eye-bath, using ordinary water. The bath is completely filled and the eye lowered until in contact with it. The bath is then raised and the patient blink under water; this is easier if both eyes are blinked at once. If this fails to remove the foreign body, it is certainly stuck to the surface of the cornea. The eye-bath should be washed and dried after use, before putting it away.

The first aider who feels confident and has been properly instructed may make only one more attempt, to remove a foreign body if failed to get it out by washing. But if expert medical or nursing help is readily available, it is better to pass the patient on for skilled attention.

The attempt to remove the foreign body should be made with clean cotton wool on an applicator. When one has been used it should be thrown away immediately. The eye should be held open and a single sweep with the cotton wool should be made over the foreign body. If it is loose, it will be seen attached to the tip of the cotton wool.

The first aider should never use a matchstick or the corner of a handkerchief. Neither will be sufficiently clean to be safe. A camel-hair brush is also unsatisfactory because it is too soft; moreover, if not sterilized after use, it will carry germs from eye to eye. Unless the first aider is completely certain that a foreign body has been removed, the patient should be referred to a nurse or doctor at once. If the patient complains of any pain at all after removal, this also is an indication of referral. In any case, to make sure that the foreign body has been taken out, the eye should be carefully inspected under a good light.

A foreign body so well embedded in the surface of the cornea that it does not project may at first, cause no pain. Any patient who complains of pain and thinks that the foreign body entered at some earlier time should be referred straight away to a nurse or doctor.

It is essential that the first aider should take no risk in dealing with eye injuries. If there is slightest doubt, the patient should be sent to a nurse or doctor at once. Always cover the eye with a medium-size dressing or eye-pad before referral.

All first aid boxes must contain "an approved eye ointment". Small magnets are sometimes used by first aiders. In practice, these are virtually useless, as almost all easily-removed foreign bodies are non-magnetic.

25.4 Glass in the Eye

It may be very difficult to see glass in the eye. Moreover, a piece of glass is liable to cut the surface of the eye, sometimes severely. The first aider must on no account wash out the eye, for fear of the washing-fluid getting into the glob through the cut. Nor must any drop, ointment or liquid paraffin be put into the eye by the first aider, he should not attempt to remove glass from the eye. The eye should be covered with a medium-sized individual sterilized dressing, and the patient sent for expert treatment as quickly as possible.

25.5 Dust in the Eye

Dust may blow in through the open doorways of a factory or be blown up following the use of compressed-air hose for cleaning debris. The eye should be washed out, using water and an eye bath.

If the irritation is not speedily relieved and there is a scratch of the cornea the patient should be sent to a nurse or doctor.

25.6 Foreign Bodies within Globe of Eye

A foreign body which penetrates the globe of the eye will not be visible when the eye is examined, through a small cut in the cornea or the white of the eye may be seen. Such an accident usually happens by hammering or chipping with a mushroom-headed chisel. A mushroom-headed hammer is equally dangerous. An eye accident following the use of such a chisel or hammer must be assumed to be serious, and should be sent for immediate treatment. The eye should be covered with a medium-sized individual sterilized dressing and then patient should be transported by ambulance; movement of the head and upper part of the body must be kept to a minimum for fear of starting bleeding within the eyeball.

25.7 Welding and the Eye

Exposure of the unprotected eye to gas or electric welding or cutting is the most common cause of conjunctivitis in industry. There are three common types of welding:

25.7.1 Spot welding

The operator shall wear goggles or have the eyes protected with a mica or other transparent shield. The only risk to the eye is from sparks. Eye injuries from spot welding should be referred for expert treatment, as tiny pieces of metal are usually stuck to the burnt conjunctiva.

25.7.2 Gas welding oxygen 2204°C (4000°F) and acetylene 3315°C (6000°F) are the common flames used.

25.7.3 Electric arc welding

The temperatures here are similar to those with gas welding.

Welding or cutting places should be well ventilated, as certain that harmful gases are not present; they should also be screened to prevent exposure to the strong ultra-violet rays which are produced, particularly with gas and electric welding.

25.8 Arc-Eye or Welder's Flash

25.8.1 Eye injury of welder's flash is due to exposure of the unprotected eye to gas or electric welding or cutting. The operator shall use dark goggles or a dark shield.

For the sake of safety, all cases of arc-eye should be referred for treatment. The first aid treatment is to wash out the eye with water or a simple solution, but a special "arc-eye-lotion".

Exposure of unprotected eye to infra-red rays from furnaces, molten glass or white-hot metal can, over many years, damage both the lens and the cornea.

25.9 Chemical Splashes in the Eye

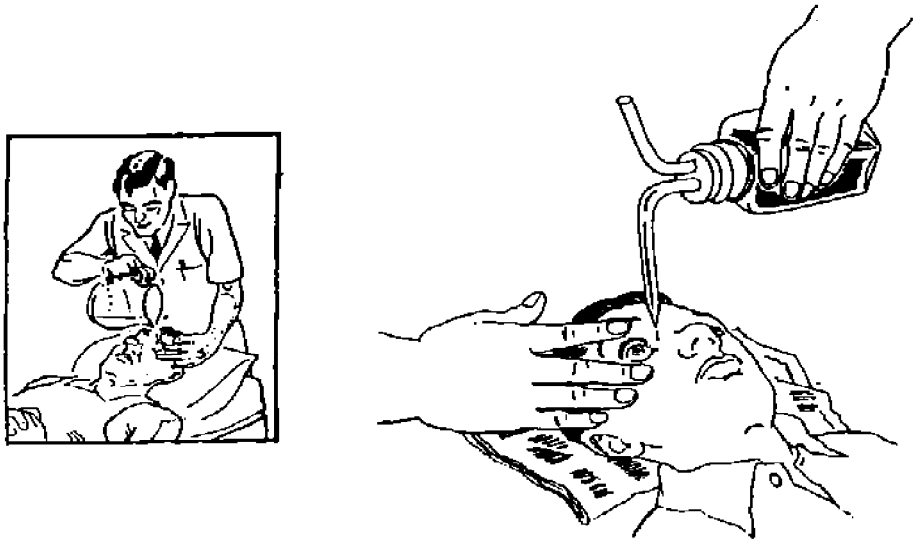
In dealing with chemical splashes, first aid is of utmost importance, since it can, if done promptly and efficiently, save sight. As with chemical burns of the skin alkalis are more dangerous even than acids. Unless the alkali is removed at once, it combines with tissues of the eye and goes on acting on the tissues long after the eye has been thoroughly washed out. A neglected alkali burn of the eye will in consequence continue to increase in size and depth despite washing with antidote, and this may cause loss of vision.

25.10 Treatment and Prevention

25.10.1 Treatment

Unless antidote is immediately available, the head should be held under a tap, or plunged into a bucket to clean water; the victim should blink vigorously. Eye wash fountain gives quite a good eye-irrigating jet. The patient may have difficulty in opening the eye. He should be told to try to hold both eyes open. If the first aider is trying to irrigate the eye with water or antidote, the patient should sit or lie with the head tilted right back, and an assistant should hold the eye open; if he is not available, the first aider may use the first and second fingers of the left hand. The jet of water or antidote should not be directed right on the front of the eye; instead, the patient should be told to look outwards and the jet directed on to the inner angle of the eye (Fig. 15). Every industrial first aider should have experience of irrigating an eye. Wherever there is a high risk of alkali or acid splashes, buffered phosphate can be supplied with an irrigating bottle or strong canister.

Irrigation should be continued, with short rest pauses for five to ten minutes. The patient should then be transferred as swiftly as possible to expert nursing or medical care. After alkali splashes, this irrigation may have to continue for up to an hour.



TREATMENT OF EYE INJURY
Fig. 15

25.10.2 Prevention

If goggles or protective face-shields were more widely worn in industry, eye injuries whether from chemical splashes or foreign bodies, would be far fewer.

Here are some practical points about the relative dangers of different processes and materials:

a) grinding wheels should be eye-guarded;
b) transparent plastic shields to be fitted;
c) wear goggles.

The first aider has a real part to play in encouraging the use of eye protectors whenever there is a risk of eye injury.

26. ACHES AND PAINS, TRANSPORT, RECORDS

26.1 General

In dealing with illness as a result of injury, the first aider should make some simple practical decisions as follows:

26.1.1 Is it a minor condition, which will get better quickly at work site?

26.1.2 Is the patient sufficiently ill to be sent to the industrial medical center?

26.1.3 Is the patient so ill that skilled help should be in attendance at once?

26.2 Care of Minor Aches and Pains

The first aid box contains four items for use in appropriate cases of aches and pains: a clinical thermometer; magnesium trisilicate tablets; sedative and aspirin tablets.

Every first aider should take a patient's temperature and read a clinical thermometer. If the temperature is above normal the patient shall be referred to a doctor and if patient looks ill referral is essential.

Magnesium trisilicate tablets (1-2 tablets) may be safely and beneficially given to the patient with a hang-over, or to the regular gastric sufferer who is under medical treatment. Severe stomach pain should never be treated by the first aider.

Sedative tablets (1-2 tablets) relieve the mild headaches of ordinary or a headache accompanied by any other symptoms, should always be referred to a trained nurse or doctor.

26.3 Moving an Injured Person

26.3.1 General

Any severely injured or ill person should be moved as little as possible until experienced ambulance personnel, nurse or a doctor are available. The transport of the injured is a specialized branch of first aid, calling for considerable practical training and experience. The industrial first aider may occasionally have to move injured person out of a position of immediate and continuing danger, and in emergency may have to transport him to an ambulance or clinic center. To meet these emergencies, some practical experiences, on the lines set out below, are essential. For the demonstration of work described hereunder a stretcher, two blankets and a strong scarf are the only equipment needed.

It is difficult but not impossible to move an injured person safely without a stretcher. It is easier to move a patient without a stretcher with two bearers than with one. It is easier both to load and to carry a stretcher with four bearers than with two. But in emergency one person can move another provided that the proper techniques have been carried out.

26.3.2 Preparing a stretcher

If two blankets are available, they should be arranged on the stretcher which is known as the "fish-tail" position.

The patient's feet and legs should be covered with the "fish-tail" and the body and head wrapped in the lower blanket, tucking in firmly with the longer side.

If only one blanket is available, it should be arranged on the stretcher diagonally. The patient should be folded into the blanket, with the longer angle being turned over on top and tucked in.

26.3.3 Loading a stretcher

There should be four loaders, one of whom must give orders so that all act together. Three men lift the patient; the fourth pushes the stretcher, with blanket or blankets, under the lifted patient, so that he can be gently lowered in the right position of the stretcher.

The "three man lift" is an art to be implemented by practice. Its object is to lift the patient while keeping the head, body and legs in straight line. All three men must be on the same side of patient. They all kneel on one knee, in each case the knee nearer the patient's feet. Their other knees nearer the patient's head from a shelf on which the patient can be rested. Hands and arms are gently but firmly insinuated right under the patient. The first man has to raise the head and shoulders. The second man, who should be the strongest, has to raise the chest and abdomen. The third man has to raise the legs, with one arm under the thighs and the other under the calves; he should take care not to let the feet sag and the knees bend (Fig. 16). When all are ready, the leader gives the command to lift, and the patient is raised and rested on the lifter's bent knees, so that the stretcher can be slipped into position. Again, the leader must give the command to lower, so that all three move as one.

The "three-man lift" may also be used for carrying a patient a short distance. It is then spoken of as the "human stretcher". If only three loaders are available, they will be "three-man lift" and carry the patient on the stretcher.

If there are only two loaders available, both should stand astride the patient facing his head. The first passes his arms under the patient's shoulders; the second passes one arm under the buttocks and the other under the calves. When both are in position, the man in the rear gives the command to lift. With short steps, they then walk over the stretcher, and lower the patient on to it. This procedure is known as the "straddle-walk".

It is sometimes necessary to load an unconscious patient on to a stretcher. In that case lift in the prone position; carry in the semi-prone position. Attempts to lift in the semi-prone position are dangerous, as the unconscious patient may roll out of the lifter's arms. Carriage in the prone position is difficult because of the position of the patient's arms; also the air-way be obstructed.

The transport of the patient with a broken back or neck has already been dealt with under the care of fractures.

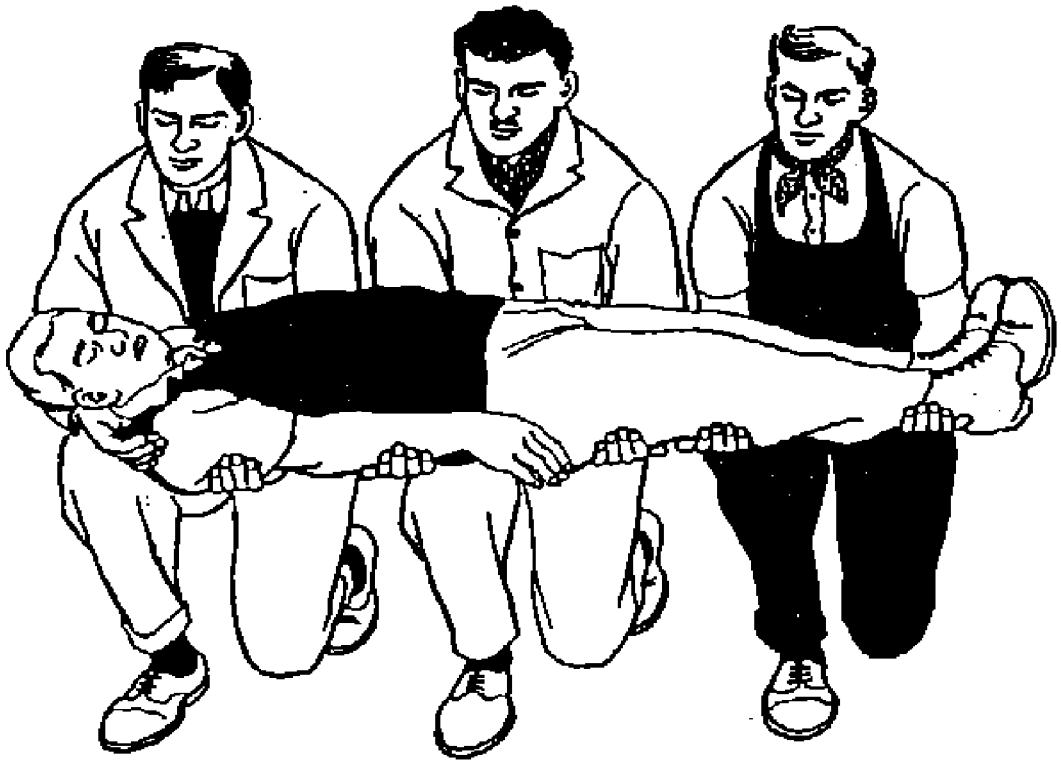
26.3.4 Carrying a stretcher

Carrying a stretcher is more difficult than it looks, practical experience is needed both as a bearer and as a "patient". It is easy for the unskilled to tip a patient off a stretcher.

There has been much discussion as to whether it is better to carry a patient head first or feet first. The conventional method of carrying feet first should be considered, though there are exceptions to this, such as lifting into an ambulance. The strongest man or men should be at the head. This is because the upper half of the body is heavier than the lower half. The command to "lift", "move forward" and "stop" should be given by one of the men at the rear and of the stretcher. The smoothest carry is achieved by all four bearers adopting the rhythm.

26.3.5 The blanket lift

Four men can carry a severely injured man, making use of a single blanket. The blanket must first be inserted under the injured man. This is done by rolling up the blanket longways and placing the roll beside the patient. Three people pull the patient towards them and a fourth inserts the roll under the patient (Fig. 17a). The patient is lowered on to the roll, then pulled or pushed up to other way (Fig. 17b); this enables the roll to be pulled through. The patient is then lowered on to the blanket. At the outset, the blanket should be so placed that, when the patient is in position, a small roll can be made along each side of the patient. For lifting, one man takes hold of a half each of these small rolls, and the blanket is lifted and moved like a stretcher (Fig. 17c). Note particularly the position of the bearer's hands. The hands in the middle of each roll must be closed together. Otherwise it is impossible to maintain the tension of the blanket needed to keep it flat. An efficient blanket lift is impossible with fewer than four bearers.



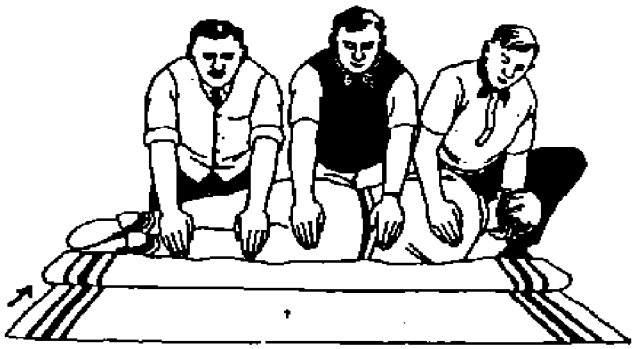
LOADING A STRETCHER
Fig. 16

26.3.6 The chair lift

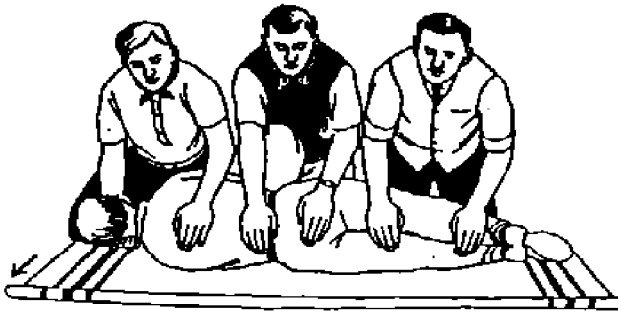
If a patient can stand or sit but cannot walk, two men can move him by means of a "chair lift".

The familiar "bandy chair" needs no equipment, but the patient must be able to use his arms to grip round the neck of his carriers.

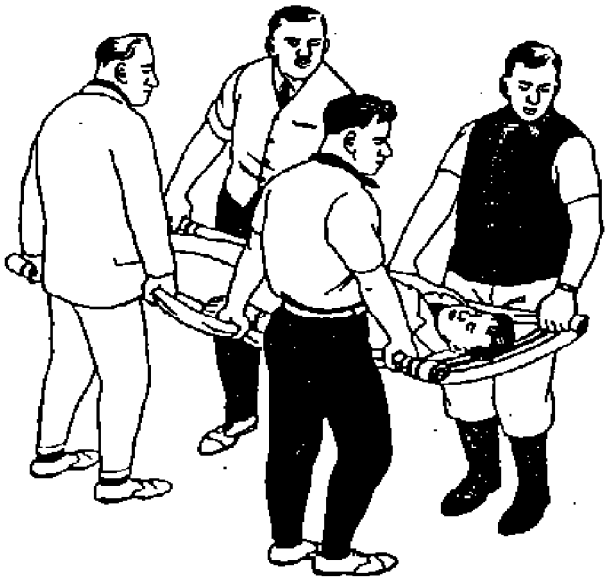
Much better is a real chair. This is carried by two men facing each other; each man grasps the back of the chair and a front leg, close to the point where it joins the seat. Care has to be taken not to tip the patient forwards. The "real chair lift" makes it comparatively easy to carry a patient up or down stairs.



a) THREE PEOPLE PULL BLANKET UNDER THE PATIENT



b) THE PATIENT IS LOWERED ON TO THE ROLL



(c) BLANKET IS LIFTED AND MOVED LIKE A STRETCHER

Fig. 17

26.3.7 Single-handed lifts

If a patient can just stand and has the use of his arms, the familiar "pick-a-back" is useful. For the pick-a-back, the rescuer must use both his hands and cannot therefore climb a ladder.

The "fireman's lift" leaves a hand free, and so makes ladder-climbing possible. It demands considerable strength on the part of the rescuer, and a good balance; it cannot therefore be used if the patient is very heavy, unless the rescuer is proportionately strong.

The patient must be helped to stand upright, facing the rescuer. The rescuer grasps the patient's right wrist with his left hand, then bends down until his head is just under the patient's right hand. This brings the rescuer's right shoulder level with the lower part of the patient's abdomen. He then puts his right arm between the patient's legs, and grasps the leg firmly. The weight of the patient is then taken on his right shoulder. As he rises to stand upright, the patient is pulled across both shoulders. The patient's right wrist is then transferred to the rescuer's right hand, thus leaving his left hand free.

A little practice will soon demonstrate the value and the limitation of the fireman's lift.

26.3.8 Transport with helicopter

In the off-shore platforms which are located at sea or other sites that are far from hospitals or medical centers a medically equipped helicopter should be available for transporting patients who are suffering from serious accidents or illnesses.

27. RECORD-KEEPING

Certain records of industrial accidents should be kept, but for the most part, minor accidents are excluded. The first aider in charge of a first aid box or post should keep a complete record of all that have happened. Such a record may be kept in an ordinary exercise book, appropriately ruled up; it is called a Day Book. The Day Book should give the date and the name of the patient, the nature of the injury or condition, the cause if this can be stated, the treatment given, and the disposal (back to work, to industrial nurse or doctor, or to own doctor or hospital as the case may be). Simple abbreviations will soon be devised. Writing must be kept to a minimum, or it will soon be neglected. The Day Book should be kept in the first aid box.

The accident book is a special book. it is the statutory duty of the employer to provide this book and safety officials should investigate circumstances of accidents and make whatever arrangements are necessary in accordance with procedures in hand.