The St. John Ambulance Service for South Australia

EMERGENCY CARE and TRANSPORT MANUAL

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Foreword

The Statewide ambulance service provided by St. John in South Australia is part of our heritage; it is unique in the world and something of which we can all be justly proud.

This manual, produced by experienced medical and ambulance officers, will play an indispensable part in the training of those who crew the vehicles. It is the latest volume in a series dating back to 1960; it is fully revised and includes the most up-to-date information and techniques of patient care.

I commend this book to all who have an interest in the transport of the sick and injured.

G. A. DAVIES
Chairman,
Medical Advisory Committee,
The St. John Council for South Australia

Preface

This book has arisen out of the Casualty Care and Transport Manual, of which three editions were published between 1975 and 1978. Because of the constant need for knowledge in areas important to patient management, the old book has been so extensively revised that a new title was felt appropriate. This new book has put a greater emphasis on the disorders of the nervous, respiratory and cardio-vascular systems, and also includes a chapter on diabetes. A further innovation has been a new look at psychiatric disease and how the Ambulance Officer should relate to the patient.

The text contains more detailed descriptions of medical and other disorders than the previous book. It is hoped that an understanding of the conditions described will allow an easier, more flexible approach to rendering appropriate therapy to those many persons in need of skilled help, either on the road-side or in their homes.

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Introductory Note

The St. John Ambulance Service for South Australia

This book is written primarily for Ambulance Officers working within the St. John Ambulance Service for South Australia. As this book may be read by persons interstate or overseas who may be unfamiliar with South Australia or with the traditions of St. John Ambulance, the following notes are included as background information.

South Australia is the third largest of the Australian States, occupying an area of over 984,000 square kilometres, or four times the area of the United Kingdom. The State's population is almost 1,300,000, more than 70% of whom live in the capital city, Adelaide, or its suburbs.

In metropolitan Adelaide, vehicles are manned by both volunteers from the St. John Ambulance Brigade and paid employees of the Council, who work together in an integrated service. The career staff man the vehicles during the day and have some crews working at night, whilst volunteers play a major role during the evenings and at weekends.

Most country services are manned entirely by volunteers. However, a few are staffed by career officers as well as by volunteers, in an organisation similar to the metropolitan area.

The service has 13 Ambulance Centres located throughout the metropolitan area, and 40 ambulances are housed and crewed in these Centres. In the country there are 80 branch services with 128 ambulances and, collectively, these 168 ambulances travel over 4,000,000 km per year.

In addition, there are more than 40 clinic cars in the State. These are station sedans used to transport patients with non-acute conditions to hospitals for routine appointments. If necessary, these clinic cars can be converted within minutes to stretcher-bearing ambulance vehicles.

The St. John Ambulance Service also operates three ambulance aircraft, two of which are based at Whyalla, and the third at Adelaide. The service also has the use of the State Government-sponsored rescue helicopter, as required.

St. John Ambulance in South Australia provides a centralised Training School in which all career officers attend regular training courses, and courses are conducted at the school for volunteer ambulance recruit members of the metropolitan divisions. In addition, some specialised courses are run for both country and metropolitan officers.

The Training School is situated in the St. John Administration Centre, and has been equipped with modern classroom facilities, a library and a laboratory. The

School also maintains a large ambulance equipment resource centre as support for Divisional ambulance training.

Standards of ambulance care are determined by a Medical Advisory Committee. These standards are then translated into courses which are taught to ambulance personnel. Courses are provided for all recruits and refresher courses are available for officers who wish to increase their knowledge or improve ambulance treatment skills.

All ambulance officers must show their proficiency at annual reassessments, based upon the text of the Emergency Care and Transport Manual.

St. John Ambulance in South Australia uses as its insignia the St. John emblem, and the following briefly traces the origin and significance of this insignia. The virtues represented by the emblem were revered by the Crusaders nearly 900 years ago. They should be no less relevant to Ambulance Officers today. In 1023 some merchants from Amalfi, a small republic south of Naples, rebuilt the Christian hospital at Jerusalem after it had been destroyed by Caliph el Hakim. The eight-pointed cross was the device on the flag of Amalfi, and it was adopted as the emblem of the hospital. Crusaders took the hospital under their protection in 1099 and formed the Order of St. John. Persons working in the hospital and Knights of St. John fighting to protect the Holy Land for Christianity wore the eight-pointed cross on their clothing.

The four arms of the white cross represent the Christian virtues – Prudence, Justice, Temperance and Fortitude. The eight points represent the beatitudes which spring from these virtues – Observance, Tact, Resource, Dexterity, Explicitness, Discrimination, Perseverance and Sympathy.

The emblem is sometimes incorrectly referred to as the Maltese Cross. This is because the Knights of St. John had Malta as their headquarters from 1530 to 1798, when the island was captured by Napoleon.

A Royal Charter was issued to the Order of St. John in England by Queen Victoria in 1888 and at about this time the Royal Beasts, the lions and unicorns, were added to the cross.

Following representations to the Grand Priory in England, a Commandery for The Order of St. John in Australia was formed in 1942. The Commandery was raised to the status of Priory in 1946.

The St. John Ambulance Service in South Australia operates in a rather unique way with regular and volunteer members. By constantly learning and implementing new techniques and introducing better equipment, it continues to fulfil the long-standing motto – *PRO UTILITATE HOMINUM* (FOR THE SERVICE OF MANKIND).

PART A – BASIC SKILLS

Chapter 1

Ethics, Responsibility, Professional Conduct

Every institution within society operates within certain accepted guidelines. The Ambulance Officer's work carries him across several institutions, each of which has its own regulations and customs. He belongs to an Ambulance organisation, but he enters the home situation daily, and has dealings with Medical Officers in their surgeries and with medical, nursing and other staff in a variety of hospitals. He has access to private and personal information, and is privileged to treat sick people.

To fit into this complex situation and to do his work effectively, the Ambulance Officer must possess or try and achieve a number of qualities, which include honesty, a sense of responsibility, and an ability to keep certain information confidential.

Ethics means moral principles, or the principles of what is right and wrong in conduct in a given situation, based on people's sense of what is right or just, not on legal rights and obligations.

Responsibility is a quality which indicates legal or moral obligation to duty, it implies trustworthiness and accountability.

Professional conduct implies behaviour which indicates that the person is skilled in an area requiring special knowledge and training.

GENERAL FUNCTIONS AND RESPONSIBILITIES OF THE AMBULANCE OFFICER

The principles outlined above can be illustrated in the following situations:

1. USE OF VEHICLES

The vehicle should be ready to respond at all times, should be driven with care and consideration for others, and parked appropriately.

2. SPECIAL DRIVING PRIVILEGES

Special driving privileges should be used only when warranted.

3. CONTROL OF THE SCENE

Patient care is the first consideration, but liaison with police, management of relatives and bystanders, and assistance to Medical Officers are essential to a good outcome for the patient.

4. PATIENT CARE

Establish priorities, assess carefully, treat considerately, transport at the appropriate time.

5. COMMUNICATIONS AND RECORDS

Procedures for these have been established to avoid confusion and assist patient care.

THE HOSPITAL

Hospitals have a complex organisational structure. The Ambulance Officer will come in contact with Medical Officers, Nursing staff, and Medical Orderlies, but he may also have contact with Scientific staff, Physiotherapists, Occupational Therapists, Clerical staff, and others.

When transferring patients to the Accident and Emergency Department, maintain management into the Hospital, and until relieved by Hospital personnel. Communicate vital information regarding the patient to attending staff, assist as required, and leave when assistance is no longer required.

When entering a ward or department, ask for the person in charge. If in doubt as to the procedure to follow in a particular area, always ask.

Much of this is common sense, but it is important to appreciate that the Ambulance Officer's general conduct, confidence and courtesy will be assessed by the patient, relatives, onlookers, officials and other health personnel, just as much as his ability to treat an injury or condition.

THE LAW AND THE AMBULANCE OFFICER

There are no laws relating specifically to Ambulance Officers in their duty, except those relating to driving an ambulance in an emergency (see Chapter 25). However, the following points are relevant to ambulance work.

1. An Ambulance Officer has a duty to exercise his skills with a high degree of care. If his actions fail to meet the standard of an average Ambulance Officer, with resultant harm to another, then he may be considered to be negligent and liable in civil law.

2. An Ambulance Officer involved in "voluntary rescue" of a person may exercise his skills to the standard expected of an average Ambulance Officer. He has **no obligation** to expose himself to unnecessary risks in such a rescue.

3. There is a medical Act which provides that medical advice and care of certain types can only be provided by a legally qualified practitioner. The dividing line between what an Ambulance Officer can do and what should be done by a Medical Practitioner depends on the circumstances, and varies from situation to situation.

4. The patient, if of sound mind, or the parent or person having temporary custody or control of a child, has the right to decide who has the authority to carry out a particular form of treatment.

Chapter 2

Examination of the Patient

Frequently throughout this book the injured or sick person is referred to as "the patient". It must be stressed that this "patient" is a person, and, as such, has worries, anxieties, thoughts and feelings which must be considered by Ambulance Officers.

Unlike machines, patients respond to kindness, courtesy and a sympathetic approach. If Ambulance Officers, through their demeanour and conduct, can gain the confidence of their patients, subsequent treatment and transport will often be accomplished more easily. Good manners, a few kind words and a smile are the basis of gaining this confidence.

It is important to remember that certain groups of patients such as the very young, the very old, and those undergoing anxiety-provoking treatments such as radiotherapy, may need special reassurance.

Figure 1 The Medic Alert Bracelet

An Ambulance Officer, besides having a good "stretcher-side" manner, must also have a well disciplined and logical approach to the examination, treatment and transport of the person in his care. The logical first step is to assess the patient's illnesses or injuries. The three points to consider in this assessment are:

HISTORY
SYMPTOMS
SIGNS

History may be verbal from the patient or from bystanders. In many instances, history can be deduced from the nature and state of surrounding objects or from sources such as a "Medic Alert" bracelet. (Figure 1).

Symptoms are the sensations such as nausea and pain which the patient may describe, and **signs** are the visible evidence of the patient's injuries or illness or associated complications, e.g., deformity—a fractured leg. An Ambulance Officer should check for injuries consistent with the history and he should always be alert for patterns of injuries. As an example, the driver of a car which has crashed may have chest injuries inflicted by the steering wheel and knee injuries caused by impact with the dashboard.

INITIAL STEPS IN EXAMINATION

1. Check that the patient has a clear airway and is breathing satisfactorily.
2. Check the patient's carotid pulse to ensure that his heart is beating adequately.
3. Check that no major bleeding is occurring.

Having carried out these basic but essential steps and having given appropriate initial life-saving treatment as necessary, the Ambulance Officer can then proceed with a general examination. Individual Ambulance Officers may prefer to conduct their examination in an order differing from the one outlined below. This does not matter provided a comprehensive routine is adopted; the important point is to detect and treat ALL the injuries or disorders. Ambulance Officers who do not work to a routine will, from time to time, miss significant abnormalities, to the detriment of the patient.

GENERAL EXAMINATION OF THE INJURED PATIENT

Begin by checking the patient's head. Note his level of consciousness and be alert for any changes in this level which may occur during the time this person is in your care. As a routine, Ambulance Officers should make a note of the time at which they perform the initial examination.

If there are no obvious scalp injuries, run your hands over the patient's head checking for swelling, tenderness or dampness. Inspect the ears to ensure there is no blood or cerebro-spinal fluid escaping from them. Cerebro-spinal fluid (CSF) is a clear fluid which bathes the surface of the brain and spinal cord. A leakage of CSF from the ears, for example, indicates that a fracture of the base of the skull has occurred.

Check the patient's pupils, noting their size and whether or not they –

(a) are equal,
(b) react to light, and how briskly they respond.

During daylight, the reaction of the pupils to light can be obtained by covering the patient's eyes for a few seconds and then removing the cover quickly while watching for a change in the size of the pupils. A normal reaction is for the pupils to constrict, that is, become smaller, as brighter light impinges on them.

Examine the patient's jaws for evidence of fractures. Check that there are no foreign bodies in the mouth and again make certain that the airway is clear.

Now check the spine. If the patient is conscious he may tell you of pain in his back or he may complain of unusual feelings such as a "pins and needles" sensation in his legs. He may even complain of a lack of sensation in his legs or find that he is unable to move them. The presence of any one of these clues is an indication to treat for a fractured spine. Failure to do so could result in permanent paralysis below the level of the spinal cord injury.

In unconscious, injured patients, a fractured spine should be assumed where the nature and violence of the accident suggest that such an injury is possible. Examination for a fractured spine involves feeling along the spine for swelling or irregularity. Care must be taken not to move the patient in a manner which may aggravate a fracture if one is present. In particular, the neck must not be flexed (the chin brought down towards the chest).

The chest and abdomen should now be examined. Feel along the line of both clavicles for evidence of fractures. Look for bruises. Next, press gently on the patient's ribs using the palms of both hands on the front and then the sides of the chest. Gently press on the abdomen to detect tenderness or abnormal rigidity of the abdominal muscles – features which suggest that there may be internal abdominal injuries. Place your hands on the hip bones and push backwards and then inwards, checking for pain or abnormal movement which would suggest that the patient has a fractured pelvis.

Now examine each limb in turn. Work systematically, checking for swelling, tenderness or dampness, which may represent haemorrhage.

Finally, the hands should be run gently over areas not easily examined, e.g., back of chest, abdomen and buttocks, to look for abnormalities which could otherwise be missed.

It must be stressed that the Ambulance Officer needs to develop a reasonable sense of priorities. Major life-saving resuscitation, with attention to the patient's airway, breathing, pulse and any bleeding, must precede a general examination for other less obvious injuries.

EXAMINATION OF THE SICK PATIENT

During assessment of the patient the Ambulance Officer should ask himself the following questions:

1. IS THE PATIENT UNCONSCIOUS?

If the patient is unconscious, then emergency treatment must be instituted, including clearing the airway and placing the patient in the coma position. This is

followed by an assessment of the possible causes and appropriate treatment with prompt transport to hospital.

2. IS THE PATIENT SHORT OF BREATH AND/OR CYANOSED?

Shortness of breath can be assessed rapidly by the Ambulance Officer. A check of the airway should be made and the patient placed in the most comfortable position (usually sitting upright). He or she should be given oxygen therapy. Cyanosis can be detected on the lips or tongue, but good light is necessary, and cyanosis indicates that at least one-third of the patient's circulating haemoglobin is not saturated with oxygen, and it therefore indicates severe hypoxia from whatever cause.

3. IS THERE NAUSEA OR VOMITING?

In this case, the patient should be given psychological support and not made to feel guilty if a mess is made. Preparation should be made to minimise difficulties in the vehicle by providing appropriate bowls and towels, as necessary. A careful ride to hospital will often minimise nausea and possibly vomiting.

4. IS THERE PAIN?

In the sick patient, the most common causes will be either in the chest, e.g., myocardial infarction, or in the abdomen, e.g., appendicitis or bowel obstruction. An attempt should be made to identify the problem if medical help is not available, and appropriate therapy commenced. It is most important to give analgesia whenever possible, as this not only makes the patient more comfortable, but it may also reduce shock.

5. IS THERE EVIDENCE OF HAEMORRHAGE?

In the sick patient, the likely bleeding sites are from the bowel (usually the stomach), the uterus via the vagina, and from the lung. If the haemorrhage is severe, a medical radio transmission to hospital may be necessary.

6. IS THERE EVIDENCE OF SHOCK?

The shocked patient may be pale, cold, sweaty, thirsty, with a rapid pulse and low blood pressure. Other signs are confusion and rapid breathing. If shock is present, appropriate therapy should be instituted early.

7. ARE THERE ANY DISORDERS WHICH NEED SPECIAL CARE PRIOR TO OR DURING TRANSPORT?

There are many such disorders, and experience will help in the assessment of the sick patient, but a number of symptoms and signs must be looked for. Examples include:

(a) If the patient has had a stroke (CVA), he may be unable to move one or more limbs, and a protruding hand or foot could be injured during lifting.

(b) A patient with myocardial infarction or severe hypoxia will be very anxious, and appropriate analgesia and/or oxygen therapy may well assist in reducing this anxiety.
(c) A patient with severe rheumatoid arthritis or cancerous bone disease will appreciate careful lifting on to the stretcher, with analgesia during the lift, if necessary.

GENERAL OBSERVATIONS

The Ambulance Officer should develop the ability to note his initial impression about the patient, including –

(a) demeanour and facial expression – is the patient alert, apprehensive, grimacing, or fatigued?
(b) posture – this is often a clue to the patient's symptoms or underlying disease. The observation of the patient's position will not only indicate the most comfortable position for the patient to lie in, but may also indicate success or otherwise of treatment. For example, the patient will often lie on his back with knees drawn up, attempting to relax the abdominal muscles when there is severe abdominal pain. The restless or dyspnoeic patient often sits up and leans forward to ease the breathing.
(c) skin appearance – whether pale (anaemia or shock), cyanosed (hypoxia), or flushed (high temperature).
(d) marks – e.g., skin rashes, abrasions, burns.
(e) deformities – e.g., swelling.
(f) artificial aids – e.g., contact lenses, artificial limbs.

Figure 2 Recording the Blood Pressure

RECORDING OF BLOOD PRESSURE

St. John Ambulances are equipped with sphygmomanometers (Figure 2), for taking and recording blood pressure. It is important that the observation and recording is accurate.

Blood pressure is the pressure of the blood against the inside of the walls of the blood vessels. The term refers to the pressure of blood determined by several factors, e.g.,

the pumping action of the heart,
the resistance to the flow of blood in the arterioles,
the elasticity of the walls of the main arteries,
the quantity of blood within the blood vessels,
the blood's viscosity or thickness.

Contraction of the heart, which forces blood through the arteries, is the phase known as systole. Relaxation of the heart between contractions is called diastole.

A sphygmomanometer is used to record the blood pressure. The scale of the sphygmomanometer is usually graduated in millimetres of mercury from 0 to 300.

PREPARATION OF THE PATIENT

See that the patient is comfortable and relaxed, either seated or lying down. If seated, the patient's arm should be slightly flexed and the forearm supported at heart level on a smooth surface.

MEASURING THE BLOOD PRESSURE

The blood pressure is determined by means of the palpatory method. The rubber compressor bag should be empty of air at the time of application. Remove air by pressing the bag flat. Place the centre of the rubber bag squarely over the brachial artery. Wrap the cuff smoothly around the arm. Make sure the lower border of the cuff lies about 2.5 cm (1") above the flexure of the elbow.

METHOD

The Ambulance Officer should place the fingers of one hand over the patient's radial pulse. With the other hand he compresses the bulb of the sphygmomanometer until the radial pulse disappears, then deflates the cuff until the pulse reappears. The reading on the sphygmomanometer at this point is the systolic pressure.

RECORDING THE BLOOD PRESSURE

When the palpatory method is used, record thus:

Systolic pressure 120 (palpatory)

PRIORITIES IN TREATMENT

The Ambulance Officer must develop a reasonable sense of priorities and provide any life-saving treatment needed before attending to injuries of a minor nature. Likewise, the recording of blood pressure should be delayed until the patient is in the ambulance, except in circumstances of major illness or injury where the patient cannot be moved immediately.

However, it is also necessary to check so that all injuries are detected and given appropriate treatment. Remember Medic Alert (Figure 1). Look for the Medic Alert bracelet which can lead to the early detection of medical conditions.

Chapter 3

Reporting to Medical Officers

It is essential that Ambulance Officers be able to report their findings and treatment to the doctor who is responsible for continuing the patient's care. Failure to communicate may adversely affect patient management, while passing on useful information may significantly improve it. One common example is in epileptic patients where the Ambulance Officer may either see the episode himself, or a bystander who witnessed the fit may describe it. Since the patient may have recovered by the time he reaches hospital, the description that the Ambulance Officer passes on may be all the information available to the doctor.

The St. John Ambulance Officers's Report is illustrated in Figure 3. It is printed on NCR (no carbon required) paper so that a duplicate is automatically produced. The Report should be the basis of an Ambulance Officer's communication with Medical Staff in the hospital. The top copy (white) is designed to be incorporated into the hospital's casenotes, whilst the duplicate copy (pink) is to be attached to the Ambulance Case Card for subsequent statistical analysis.

There will frequently be occasions when direct attention to the patient will be more essential than taking time to complete this Report, but even verbal information given to the Medical Officer should encompass the types of observation listed on the form. Remember that change in any observations over a period of time may be of great significance. In instances where it is not possible to complete a written report during transportation, ensure that this is done as soon as is practical after arrival at the hospital.

Specific illnesses or accidents may require the reporting of other observations not listed on the report form. At times there may be evidence which should not only be reported to the Medical Officer, but which should be actually brought to him. For example, drugs or drug containers found next to an unconscious patient are obvious examples of this type of evidence.

It is in the interest of any patient being transported by ambulance that the attending Ambulance Officers know relevant details of his condition. In circumstances where a Medical Officer has examined or given treatment to a patient prior to transport, it is reasonable for him or her to give advice to the ambulance crew members. Ambulance Officers may, of course, ask for management guidelines from the examining Medical Officer. It is wise to record any such information on the Ambulance Officer's report. Any letter about a patient which has been written by a Medical Officer and addressed to another must, of course, be transported with that patient. Ambulance Officers should not open letters addressed to Medical personnel, except in an emergency, or when requested to do so by another Medical Officer.

ST. JOHN AMBULANCE – SOUTH AUSTRALIA – AMBULANCE OFFICER REPORT – CONFIDENTIAL

SEX M / F AGE [ ] (Known ◯ Approx. ◯

Name: Surname Given Names

PRIORITY RED ◯ GREEN 2 ◯ GREEN 3 ◯

Type of Incident:

Location of Incident:

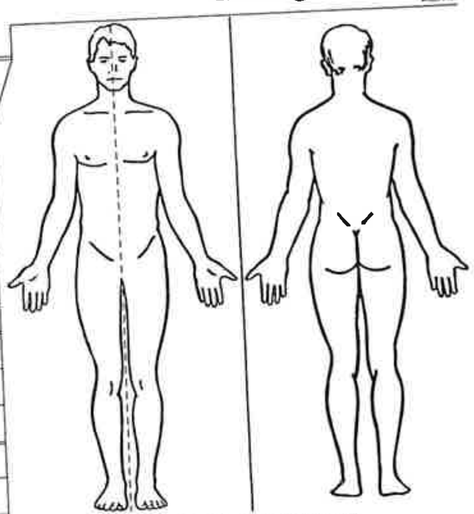
Time incident occurred ....hours

Time patient transported......................hours

PATIENTS CONDITION

Conscious State		TIME			
FULLY CONSCIOUS					
ABNORMAL					
RESPONSE	STIMULUS				
EYES OPEN	SPONTANEOUSLY				
	TO SPEECH				
	TO PAIN				
	NONE				
VERBAL RESPONSE	SPEAKS				
	GROANS				
	NONE				
MOTOR RESPONSE	OBEYS COMMANDS				
	TO PAIN				
	NONE				
Convulsions					
RESPIRATORY RATE					
BLOOD PRESSURE					
PULSE					
ECG TAKEN					
PUPILS	R size				
	reaction				
	L size				
	reaction				
	Eyes closed C				
	Oxygen				
	Entonox				
	Methoxyflurane				
	I/V line inserted				

DRUG GIVEN	AMOUNT	ROUTE			



INDICATE WHERE RELEVANT

Apparent Fracture= # Haemorrhage= H Abrasion= A

Laceration= L Pain= P Loss of Sensation= –S

Burns= B Paralysis= //// Swelling= SW Rigidity= R

SKIN CONDITION – Pale ◯ Flushed ◯ Sweating ◯ Dry ◯ Cyanosed ◯

Vomiting ◯ Diarrhoea ◯ Voided Urine ◯

TEMPERATURE: Feels HOT ◯ Feels COLD ◯

Pupil Size 1 ● 2 ● 3 ● 4 ● 5 ● 6 ● 7 ● 8 ●

Other Treatment Given:

Comments of Ambulance Officer:

Signature– Date–

Figure 3 The St. John Ambulance Officer's Report Form

Medical Officers will appreciate receiving a clear, concise history and relevant examination findings.

Chapter 4

Kinetic Lifting

Lifting and carrying are among the activities that subject the body of the Ambulance Officer to greatest strain. Very often injuries do not occur at once and may become evident only after cumulative strain, brought about by wrong muscle or body movements over a period of time.

Nearly all lifting injuries arise from the failure of the person involved to:

(a) appreciate the nature and mechanics of the body;
(b) use foresight in assessment of weight and physical surroundings;
(c) put into practice correct handling and lifting techniques.

The approved methods of manually lifting and carrying patients range from a simple cradle lift to specialised lifts requiring the use of such aids as spinal boards and the Jordon lifting frame. The decision on which type of lift is to used must be influenced by factors such as:

- nature of injuries or illness
- physical surroundings
- patient's weight
- available manpower
- personal safety

The implementation of the various lifting techniques adopted by ambulance personnel should embrace the science of kinetics to achieve the required efficiency. Human kinetics is the application to the human body of well-known mechanical principles such as the LEVER, CENTRE of GRAVITY and MOMENTUM. Correct use of these principles reduces the effort in heavy manual lifts, thus eliminating or reducing the hazard to the human frame. The following eight key points should be considered before attempting any lifting movement:

1. ASSESS THE SITUATION

As no two people are the same, it is impossible to state a load limit applicable to everybody. Make sure the lifting task can be achieved before attempting it. If there is any doubt, get assistance. In addition to weight, careful consideration should also be given to the following factors:

- position of vehicle
- placement of stretcher
- lifting aids available
- awkwardness of lift due to obstacles within the immediate area

2. POSITION OF FEET

In ambulance work this will vary according to the situation, for example, whether lifting the patient out of a vehicle, off the roadway, or on to a stretcher. The over-riding factor in all instances is to have both feet positioned so that the Ambulance Officer's body is balanced and stable throughout the lift.

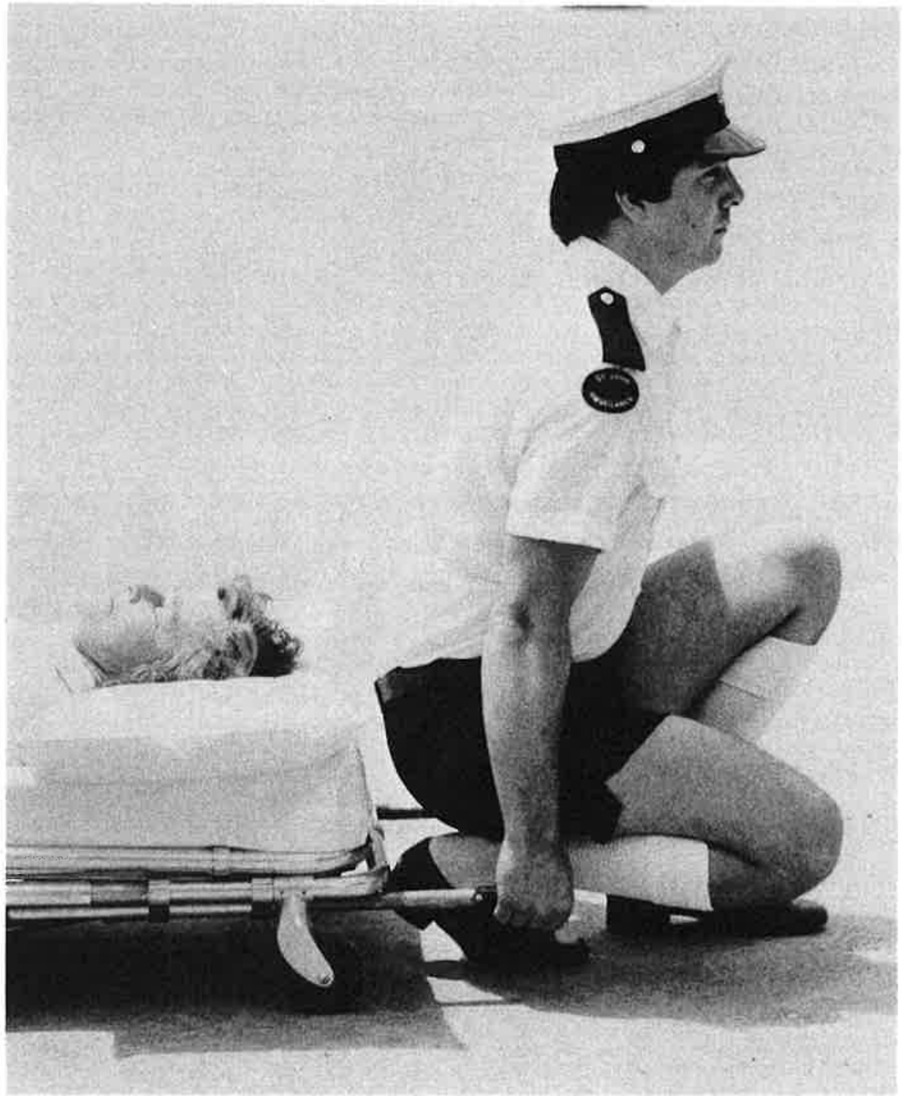


Figure 4 Correct Lifting Technique

3. OBTAIN A FIRM HOLD

Always use the palm of the hand, ball of the thumb and root of the fingers to obtain a firm, secure hold. The use of finger-tips only leads to excessive strain and fatigue, and could result in the dropping of a patient.

4. KEEP ARMS CLOSE TO BODY

The arms are suspension points so they should be kept as close in to the body as possible. Correct positioning of the arms will help keep the total weight to be lifted as near as possible over the centre of gravity, thus reducing the physical effort required.

5. STRAIGHT BACK

A straight back is the most important factor in avoiding injuries from lifting. A straight back spreads the load evenly over the surface of spinal discs and does not strain the back muscles. The lower abdomen is not compressed and the risk of hernia is reduced. A straight back is not necessarily a vertical back. Many lifts require initial inclination forward by bending at the hips (for example, a flat lift from the ground, blanket lift, etc.), but remember, the back must be kept straight.

6. KEEP HEAD ERECT AND CHIN IN

Keep the head erect and chin in, which helps to keep your back straight (Figure 4).

7. MAKE MAXIMUM USE OF LEG MUSCLES

These are the strongest muscles in the body and are designed to carry weight. Back and abdominal muscles are less powerful and undue tension on them can cause strains or a hernia.

8. USE BODY WEIGHT

The lift should be made in one easy flowing movement. Use body weight to create momentum and move forward as the lift is made. Experienced Ambulance Officers lift at a constant and steady speed, and without any jerky changes of pace (Figures 5 and 6).

At times, awkward situations may make it difficult to apply all of the key points indicated. However, in order that the risk of injury may be minimised, continued attention must be given to development and maintenance of practical skills relating to each key point.

When manually lowering a patient to the stretcher or a stretcher to the ground, the reverse procedure of lifting applies. Be alert to all the principles involved.

Figure 5 Correct Lifting Technique

Figure 6 Correct Lifting Technique

TEAM LIFTING

In the main, patient movement is undertaken by at least two people. Therefore it is essential for a team lifting method to be adopted. The Ambulance Officer should consider the following steps when organising or participating in a team lift.

1. SELECTION OF TEAM

Wherever possible the personnel undertaking the lift should be approximately the same height. This will help in achieving a level lift with the weight being distributed equally between each person.

2. TRAINED PERSONNEL

For many people a request to participate in a team lift is an indication that brute force is required. The Ambulance Officer must remember his objective is SAFE and EFFICIENT patient movement. Remember the eight key points of human kinetics. In particularly awkward or hazardous situations the Ambulance Officer may call for further trained assistance. A short delay in obtaining trained assistance is justified if a safe and efficient lift is the result.

3. CO-ORDINATION IN PATIENT MOVEMENT

Co-ordination in the movement of a patient is possibly the most important factor in achieving efficiency in team lifting. Identification of a team leader and effective communication within the team are two elements which will produce co-ordinated patient movement.

4. IDENTIFICATION OF A TEAM LEADER

Every group, regardless of the task to be performed, must have effective leadership. One member of the ambulance crew must accept the role of leader as soon as practicable and establish full control, particularly when using the services of bystanders. Prior to any movement of the patient the leader should position himself to ensure clear visibility of the total movement at all times.

5. EFFECTIVE COMMUNICATION

The recognised leader should give all instructions. Each instruction must be given in a clear and precise manner to ensure a simultaneous response from all team members, regardless of the size of the team.

LIFTING AIDS

In order that patients may be lifted and carried without aggravation of injuries and with a minimum degree of physical effort by everyone involved in the task, the Ambulance Officer must ensure that he makes full use of all appropriate lifting aids at his disposal.

Figure 7 The Blanket Lift

Figure 8 The Blanket Lift

It should be noted that development of proficiency in the use of lifting aids largely depends upon knowledge and capacity to implement the basic principles of Kinetic Lifting previously detailed in this chapter. A person does not perform well at sports such as golf or football without considerable instruction and practice to develop the necessary skill. A similar statement applies to the lifting of sick or injured patients. Use of the recommended methods will enable the lifting task to be carried out with less risk to all concerned.

Various lifting aids available, include:

The blanket

The Jordon Lifting Frame (described in Chapter 12)

BLANKET LIFT

This is demonstrated in Figures 7 and 8.

1. An Ambulance Officer positions himself to support the head of the patient and to apply gentle traction. This Ambulance Officer supervises the lift, using the help of available bystanders.
2. Gentle traction is also applied to the patient's ankles, and his legs are tied together with bandages about the thighs, knees and ankles.
3. A blanket is opened out lengthwise alongside the patient, and one edge is rolled towards the centre of the blanket until two-thirds has been rolled.

4. The rolled section is placed as close as possible to one side of the patient.
5. Three or four helpers kneel on the opposite side of the patient and, on the leader's instruction, carefully roll the patient towards themselves.
6. Other bystanders unroll the blanket under the patient.
7. The patient is then slowly rolled back. The rolling procedure must be carried out with extreme care to prevent any twisting or bending of the patient's spine.
8. Up to three bystanders are positioned on each side of the patient. They are instructed to roll the edges of the blanket in close to the patient, to grasp the rolled edges firmly and to lift steadily and evenly. Each bystander should have crossed his arms with the one alongside to achieve an even distribution of the weight when lifting.
9. Traction is maintained on the patient's head and feet during the lift.
10. The stretcher is wheeled in between the lifters' legs at the foot end of the patient.
11. On command, the patient is gently lowered to the stretcher.

Chapter 5

Ambulance Patient Care and Transport Skills

The greater part of this book is concerned with problem identification and treatment of injury or disease, and special knowledge concerning ambulances.

However, there are a number of other skills which could be of benefit in the care and comfort of patients. Knowledge of nursing skills by the Ambulance Officer may be of assistance when moving the patient to and from his bed prior to or after an ambulance journey, and while looking after a patient for prolonged periods, as on long-distance ambulance journeys from country centres. This is clearly of greater interest to country services, but the skills could also be of use to members in the metropolitan area who may be required to transport a patient for a long journey at any time.

Nursing skills which could be of value are:

1. How to give a bed pan and urinal.
2. Observation of urine, stools, and vomitus.
3. Care of special areas of the body.
4. Pressure areas.
5. Lifting and moving patients.

1. HOW TO GIVE A BED PAN AND URINAL

For certain patients being conveyed over a long distance, it may be necessary to use a bed pan or urinal. To do this, the vehicle should be stopped, any of the patient's comfort aids should be removed and the patient's clothing should be freed in the utensil area ensuring modesty as much as possible.

In the case of a bed pan, the patient's knees should be flexed, the buttocks raised, and the pan slid underneath with the broad end towards the waist. If required, the patient should then be sat up, placing one hand underneath the lower back whilst the other slides through the upper arm and grasps the patient's shoulder. The back should then be adequately supported with pillows.

To remove the pan, the above procedure should be reversed so that the supporting pillows are removed and the patient lowered. Then the knees are flexed, one hand is slipped under the back to allow removal of the pan.

The patient's toilet should be completed, and the patient's and the attendant's hands are cleaned using towel wipes. The bed pan is then placed in a plastic bag, tied, and taken to hospital for disposal.

If unable to sit up, the patient should be rolled on his or her side towards the attendant with the knees flexed and feet crossed in the direction of the move. The bed pan is then positioned against the buttocks and the patient rolled onto the bed pan, uncrossing the legs. This procedure is reversed for removal of the bed pan.

If a urinal is to be used, the utensil is carefully positioned between the legs to prevent soiling of the clothes and stretcher. The used bed pan or urinal is wrapped in a plastic bag for disposal of contents at hospital.

2. OBSERVATION OF URINE, STOOLS, AND VOMITUS

The relevance of observation of these excreta may not be immediately obvious to the Ambulance Officer, but careful notation of the observations to be described may well be of assistance to the attending Medical Officer, particularly when the relevant materials are no longer available. These observations are more likely to be useful for the sick patient in the home, but there are occasions when ambulance observation may also be of critical importance to the patient.

(a) Urine

Normal urine is clear, amber in colour, with a characteristic odour. Normally an adult will pass 1-2 litres in 24 hours, and a child may pass half this quantity, or less. Observations of urine should include:

- **Quantity**
  This will be influenced by the fluid intake and the weather. The quantity is decreased in fever, a number of kidney diseases, as well as vomiting and diarrhoea, which will, in turn, lead to dehydration. The output is increased in diabetes and chronic kidney disease.
- **Frequency**
  Normally urine is passed 4-5 times in a day, but in certain conditions the patient may pass very small quantities at frequent intervals. Increased frequency of micturition is a symptom of inflammation of the bladder (cystitis) when it is often accompanied by pain and burning. Increased frequency of urine can also occur if there is any pressure on the bladder from swellings in the pelvis. An obvious example of this is a normal pregnancy.
- **Colour**
  If the urine is dark, it may suggest bile in liver disease, or, if red, it may indicate blood. This may be normal, such as in a female having a period, or abnormal, as in people who have kidney or bladder tumours. Cloudy urine may or may not be of significance.

(b) Stools

The normal colour of adult faeces is brown, due largely to the presence of bile pigments. In infants, the stools are yellow, less formed, and passed more frequently. The following observations should be noted:

- **Frequency**
  In constipation the stools are infrequent and often very hard, due to absorption of water by the colon. In diarrhoea the stools are passed frequently, are watery and unformed due to rapid transit of the faecal material through the large colon with insufficient time for water to be reabsorbed. Continuous diarrhoea may lead to excessive loss of water (dehydration).

- **Colour**
  Normal brown colour is produced by a pigment of bile secreted into the intestine through the liver, with variations that may include –
- Clay or putty colour stools which are pale, owing to the absence of bile pigment. This occurs in certain types of jaundice, and the faeces are usually offensive-smelling.
- Black, shiny, tar-like and foul-smelling stools are caused by the presence of digested blood from the stomach or duodenum. This is called malaena.
- Dull black stools are often due to the presence of medicines such as iron. Motions are usually of normal frequency and not particularly offensive.

(c) Vomitus

Any vomitus which occurs from a patient being transported to hospital should be noted, and this information passed on to the Medical Officer either orally or on the Ambulance Officer's report form. Information which should be noted includes the quantity vomited, the time of vomiting, whether or not there was pain present, and, if so, where, and the nature of the material vomited.

It is particularly important, of course, to note whether there is dark or red blood in the vomitus (haematemesis), or whether there is solid material in the vomitus which the patient can identify from meals some hours or days before. In patients who vomit, the possibility of dehydration exists as in diarrhoea, and this is especially likely to happen in children.

3. CARE OF SPECIAL AREAS OF THE BODY

During the transportation of a patient, care must be given to areas of the body which are subject to pressure. Parts of the body most likely to be affected are where the bone is near the surface of the body –

- head, at the back of the skull,
- upper back, by the shoulder blades,
- lower back, over the centre bones of the spine; and over sitting areas of the buttocks,
- shoulders and elbows,
- hips and knees,
- ankles and heels.

In all of these areas, attention must be paid in a prolonged journey such that pressure areas do not develop. If necessary, soft blankets or other padding should be placed upon any areas which are sore or becoming reddened.

4. PRESSURE AREAS

The name "pressure" or "bed sores" is often used to describe sores or ulcers which have developed as immobility and pressure causes tissues to be deprived of their blood supply and therefore their nourishment, resulting in cell death. Keeping the skin and deeper tissues alive and healthy is a very important part of caring for sick patients over any length of time. The immediate cause of a pressure sore is the failure to change the patient's position frequently. The effect of pressure can be aggravated by:

(a) **Friction** – such as from crumbs in the bed from food or plaster fragments, if limbs are encased in plaster; from creases or patches in bed linen; from splints too tightly bandaged in a position causing limb swelling, or from careless lifting of patients in placement of a bed pan.

(b) **Moisture** – from patients remaining in wet or soiled beds; from sweating, causing dampness of the clothes and bed linen.

Bedsores can be prevented by –

- relieving pressure through altering the position of the patient every two hours, and by protecting bony areas with foam rubber or sheep skin blankets, etc.
- eliminating friction.
- eliminating moisture.

5. LIFTING AND MOVING PATIENTS

Ambulance Officers are frequently asked by nursing staff to assist with the lifting of patients when delivering a patient to hospital. In addition, of course, they may be asked to position a patient they have lifted from a stretcher to a bed. The following methods are standard hospital lifts, and are illustrated.

Figure 9: Underarm Lift

Stand opposite patient's hips, lean forward, grip the patient firmly under the upper arms. Support the patient's shoulders with the other hand.

Figure 10: Shoulder Lift

Sit the patient forward using the underarm lift. Standing opposite the patient's hips, support the lower back with one hand while placing the other shoulder under the patient's armpit. The patient rests both arms comfortably over the lifters' backs, or across the chest. Lifters lock their free hands under the patient's thighs, brace and lift together, transferring their weight onto the forward foot.

Figure 11: Cradle Lift

Lock hands under the patient's thighs and support the back. Patient rests arms on knees or across chest. Lifter's other hands are clasped behind the patient's back.

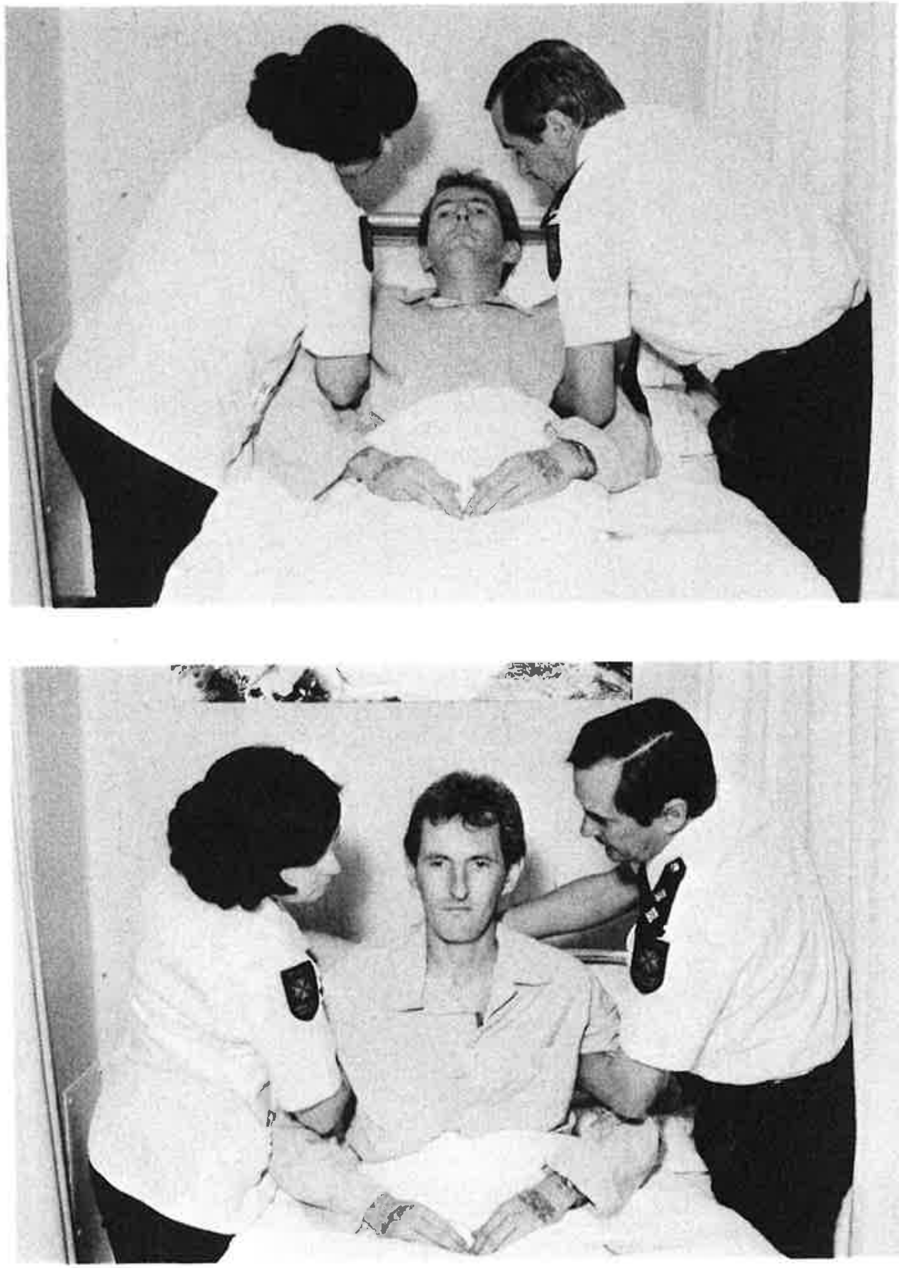


Figure 9 Underarm Lift (a), (b)

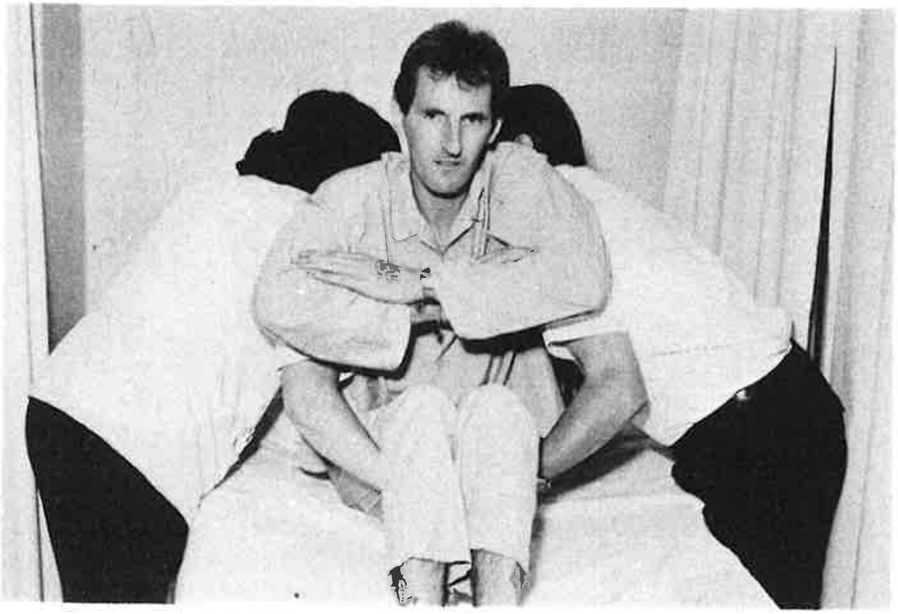


Figure 10 Shoulder Lift (a), (b)

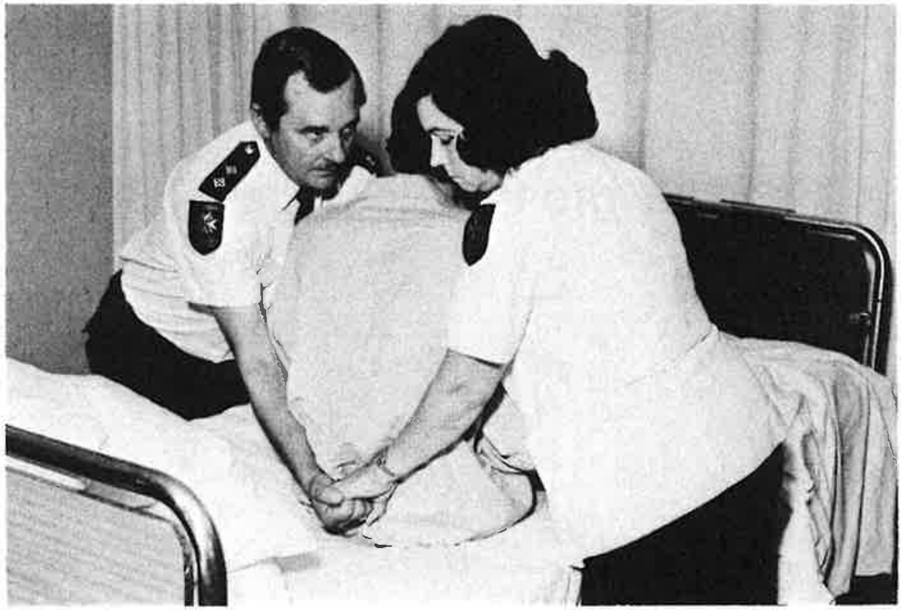


Figure 11 Cradle Lift (a), (b)

PART B – LIFE SUPPORT SKILLS

Chapter 6

The Unconscious Patient and Head Injury

The brain is a complex organ whose normal function allows us to wake, sleep, move, think, love, etc. Specific parts of the brain control movement, sensation, coordination of the limbs and other parts of the body. Other parts serve special functions such as speech, sight and hearing. Yet other parts control automatic (autonomic) functions of the body, such as breathing, circulation and body temperature.

Consciousness is that state in which an awake person responds to stimuli and indicates by his behaviour and speech that he has an awareness of himself and his environment. Depression of brain activity may result in confusion, disorientation, and progressive decrease in level of consciousness (coma). Other disorders of brain function, apart from coma, include excitation, convulsions and limb paralysis.

Being the most physiologically active of all the tissues, and not having the ability to store glucose or oxygen, the cells of the brain depend on a continual and adequate supply of oxygen and glucose at all times. Interference with this causes rapid loss of function (unconsciousness within 1 minute, and death within 4 minutes).

The brain is heavily protected by a thick layer of bone, the cranium, which forms a closed cavity about it.

Due to the closed nature of the cranial cavity, the brain is very susceptible to any pressure on it, whether from a haematoma, tumour, haemorrhage or oedema (swelling) of the cerebral tissue itself. This pressure causes not only interference with the blood supply to the brain, but also anatomical changes in shape and position which can be fatal, e.g., pushing part of the brain through one of the openings in the cranium.

CAUSES OF UNCONSCIOUSNESS

Any condition altering brain function may cause coma. These include:

1. DIRECT DAMAGE TO THE BRAIN

Head injury
Meningitis or encephalitis
Tumours
Cerebrovascular accidents

2. HYPOXIA

Cardiac arrest
Respiratory failure

3. ALTERED METABOLISM

Renal failure
Liver failure
Diabetic or hypoglycaemic coma
Hypo- or hyperthermia

4. DRUGS

Alcohol, sedatives

5. EPILEPSY

ASSESSMENT OF LEVEL OF CONSCIOUSNESS (see Report Form, Chapter 3)

The method of assessment used follows a system whose aim is to define what stimulus, if any, produces three responses:

1. EYES OPEN

spontaneously?
to command?
to pain
eyes closed.

2. VERBAL RESPONSE

speaks
groans
none

3. MOTOR RESPONSE

moves limbs on command
moves limbs in response to pain
no movement.

In addition, one makes the basic observations of pupil size and response to light, pulse, blood pressure, respiratory rate, rhythm and character. Note also whether the eyes are moving or still, central or deviated to one side, and whether there is paralysis or loss of sensation in one or more limbs.

Assessment of the initial neurological state and changes in it during transport are of great importance, irrespective of the cause of unconsciousness. With increasing depth of coma, there is progressive loss of responsiveness.

A painful stimulus is applied by pressing hard on a nailbed with a pen.

EFFECTS OF COMA

1. Inability of the patient to appreciate any danger in his surroundings and to take evasive action.
2. Inability to maintain a clear airway.
3. Likelihood of regurgitation or vomiting, and aspiration of gastric contents.
4. Loss of cough reflex.
5. Depression or cessation of breathing.
6. Concealment of other signs of injury, e.g., spine or abdomen.

MANAGEMENT OF THE UNCONSCIOUS PATIENT

1. Early and repeated airway clearance. All unconscious patients must be placed in the coma position as soon as possible, facing the Ambulance Officer (Figure 12).

Figure 12 The Coma Position

2. Administer oxygen via plastic facemask to all unconscious patients and any with severe head injury.
3. If the patient is not breathing adequately it may be necessary to assist ventilation with a bag and mask after placing him/her on his/her back.

4. Assess level of consciousness, pulse rate, blood pressure and pupil size as soon as practicable, and record. Repeat this as frequently as possible and at least every 15 minutes.
5. Open cerebral injuries require covering with sterile dressings, very light bandaging and Priority RED transport to hospital.
6. Obtain a concise history of the accident.
7. Do not neglect to thoroughly examine the patient for other injuries.
8. During transport and handling, be alert for vomiting and airway obstruction. Use suction to clear fluid from the mouth, if necessary.
9. Always transport as a stretcher patient.
10. Where conscious level declines (as measured from eyes open, verbal response, motor response) or a pupil enlarges, then a blood clot may be developing which is pressing on the brain. This situation is life-threatening, is a Priority RED condition. Alert the hospital by radio, and transport without delay.

HEAD INJURY

More than in any other cause of coma it is vital to record accurately the initial assessment of the neurological state, and changes with time.

The Ambulance Officer must initiate the assessment of neurological state and this information forms the basis for future comparison. At any time, he must be able to answer the question, "*Is the patient getting worse or better?*".

Most head injuries are mild and whatever is done for them they will make a good recovery. However, all who are unconscious, no matter how briefly, run the risk of respiratory obstruction; and a few of the mildly injured will develop complications, such as intracranial bloodclots or brain swelling. All patients with a head injury must be adequately observed (repeated coma scale, pulse, pupils, etc.) in case complications (e.g. blood clots, hypoxia) develop and the brain suffers further. The development of an intracranial blood clot can transform a seemingly mild head injury into a life-threatening situation within an hour.

Blood clots are classified by their site (i.e., extradural, subdural, intracerebral) (Figure 13). An extradural haematoma develops between the skull bone and the dura covering the brain. A subdural haematoma forms between the dura and the brain.

In patients with head injury, always be alert to the possibility of neck injury.

SIGNS AND SYMPTOMS OF A COMPLICATED HEAD INJURY

Indications of a Life-Threatening Intracranial Clot

1. Deteriorating level of consciousness is the most consistent clinical feature.
2. In patients who are conscious, headache can be an early indication. Vomiting, irritability and restlessness developing in a patient previously unaffected should arouse suspicion.

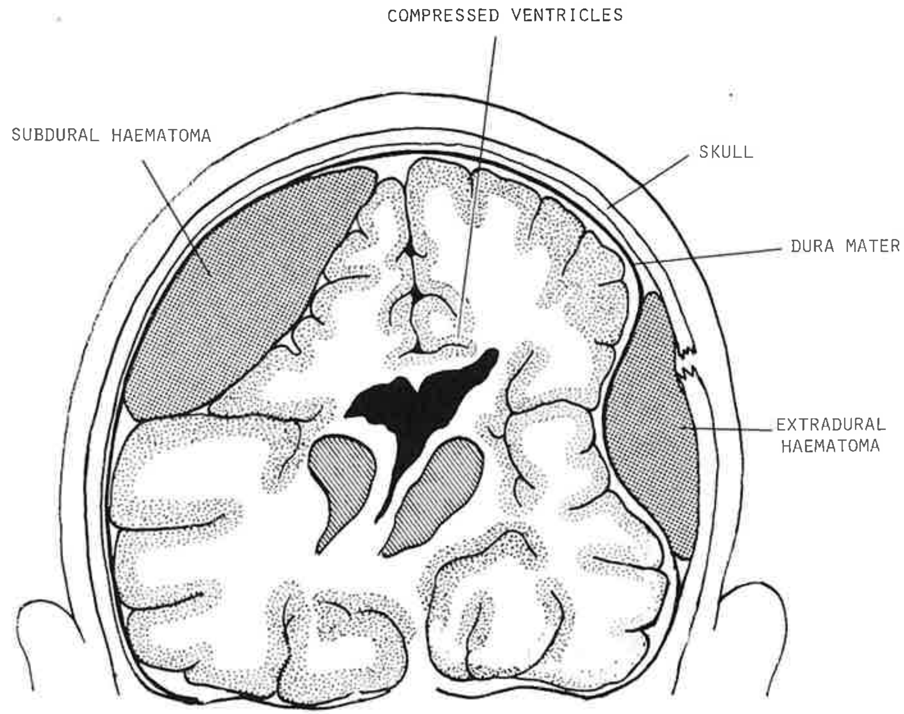


Figure 13 Intracranial Haematoma

3. Deteriorating consciousness is often associated with weakness of limbs opposite to the side of injury.
4. Pupil changes are very significant when it is known that the pupils were previously equal in size and reacted normally.
5. Change in respiratory rate or rhythm, slowing or rising pulse rate.

Chapter 7

Cardiopulmonary Resuscitation

This chapter considers cardiopulmonary resuscitation (CPR) in the setting of the Ambulance Officer. A full knowledge of First Aid Basic CPR is assumed.

Elements of CPR may be required in a variety of emergency situations which cause respiratory or cardiac arrest. In the first case, untreated hypoxia eventually leads to cardiac arrest. In the second, respiratory arrest follows quickly after the heart stops.

It is in the situation of sudden and unexpected cardiorespiratory arrest that CPR aims to restore the vital physiological functions of circulation and respiration.

Hypoxia of the brain for more than a few minutes may result in brain damage – action must therefore be immediate and effective if this is to be avoided. Initially, expired air resuscitation (EAR) may be required, or EAR plus external cardiac compression (ECC). Combined EAR and ECC is known as CPR.

INDICATIONS FOR CPR

The need for EAR and/or ECC must be assessed in sudden, unexpected respiratory or cardiac arrest. Some of the causes of this are:

1. *RESPIRATORY ARREST*

Airway obstruction in the unconscious patient, due to the tongue, inhaled vomitus, neck oedema, neck trauma, or inhaled foreign body.

Respiratory centre depression in the unconscious patient due to drugs or head injury.

Respiratory failure due to chest injury, pulmonary oedema, drowning, asthma, pneumonia or chronic obstructive lung disease.

2. *CARDIAC ARREST*

Due to myocardial infarction, shock, electrocution, or secondary to hypoxia from respiratory causes.

RECOGNITION

In a patient who has collapsed, the level of consciousness is usually easily established by shaking the patient and speaking loudly. A painful stimulus should

not be applied to establish unconsciousness, but may be required later in assessing the level of consciousness.

Respiratory arrest is characterised by absent respiratory effort, failure of chest or abdomen to move, absence of air movement through nose or mouth, and absence of airway noise.

Cardiac arrest is recognised by the absence of a pulse in an unconscious patient who looks dead. The carotid artery is the best indicator of presence or absence of a pulse because it is often still present when other pulses cannot be felt. Circulation to the brain via the carotid artery is selectively maintained to the last, even when circulation to less important parts of the body has almost ceased. Do not waste time looking at the pupils.

MANAGEMENT

If the patient has had a respiratory or cardiac arrest, follow the sequence **A-B-C**.

A AIRWAY CLEARANCE

The most important action for successful resuscitation is immediate clearance of the airway, which can be achieved by the following three steps:

Figure 14 Incorrect Positioning of the Head

Figure 15 Correct Positioning of the Head

Figure 16 Correct Positioning of the Head for EAR

1. Check for foreign bodies in the mouth and pharynx by turning the patient's head to one side and sweeping out any debris with the fingers. Suction apparatus may be used to assist in clearing the mouth.
2. Tilt the head backward by firm pressure with the palm of the hand on the forehead (Figures 14 and 15).
3. Support the chin with the fingers, using the pistol grip to cause forward movement of the lower jaw, pulling the tongue away from the back of the throat (Figure 16).

When the airway is clear, check for breathing with a combination of **Look, Listen and Feel**:

Can you see or feel the chest and abdomen rising?
Can you hear the movement of air from the nose or mouth?
If breathing is present, place the patient in the coma position.
If there is no breathing, begin EAR immediately.

USE OF AIRWAYS

For the Ambulance Officer, greater efficiency in maintaining an airway can be achieved by using an artificial airway, either a standard oropharyngeal airway (Guedel type) or an S-tube airway (Resuscitube). There are three sizes of regular airway: infant size OO, child size 1, and adult size 3. The standard oropharyngeal airways (Figure 17) are curved, semi-rigid tubes which are placed between the

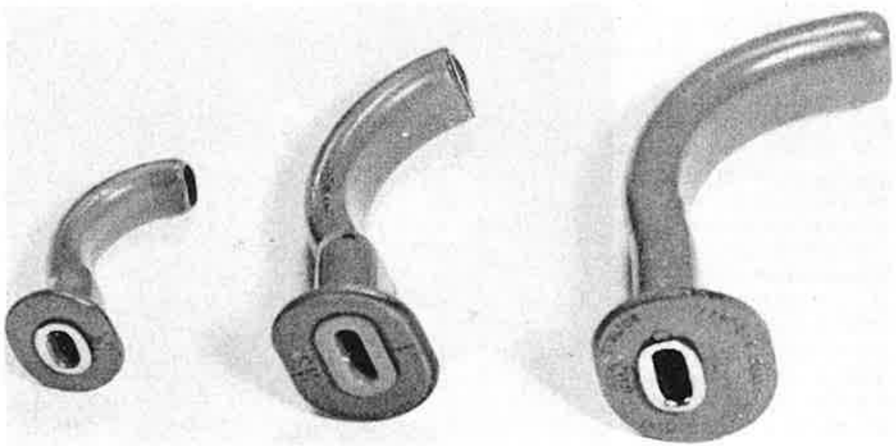


Figure 17 Guedel Oropharyngeal Airways

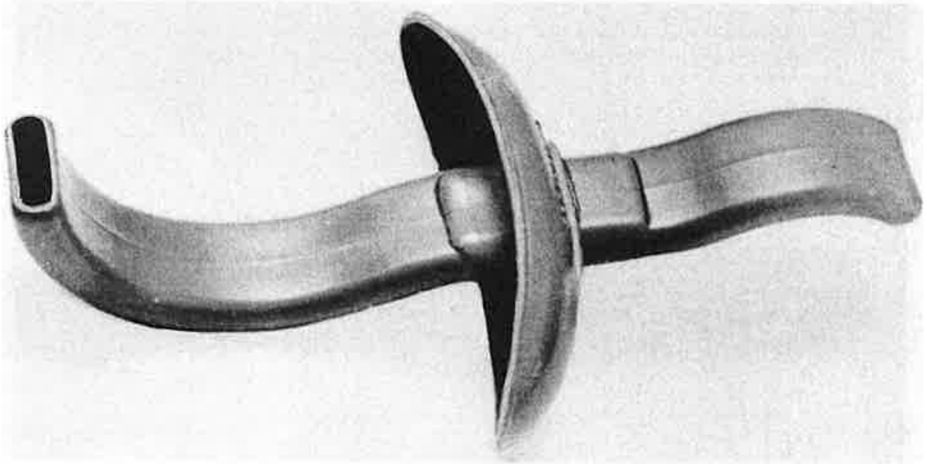


Figure 18 An S-shaped Airway

Figure 19 Inserting an Oropharyngeal Airway

patient's teeth and lie over the tongue, the end lying in the pharynx. The tube is reinforced where it normally lies between the teeth to prevent it being clamped shut. Even with an oral airway in place, the head must be kept in the fully extended position. With the airway in place, mouth to mouth ventilation is more readily carried out.

The double-curved airway (Figure 18) is especially designed for expired air ventilation. The double curve enables the airway to be sealed with the lips without coming into direct contact with the patient's face. The double-curved S-tube has a long and a short curve. The appropriate end is selected according to the patient's size. When using the short curve for children, make sure the cupped flange is inverted to seal the patient's mouth around the airway. Air leakage is prevented by pinching the nostrils shut and pressing the flange firmly over the mouth. Keep the head fully extended at all times.

To insert an artificial airway, open the patient's mouth widely using the thumb and index finger of one hand. With the other hand, insert the airway between the teeth with the natural curve upside down (Figure 19). Once the airway is halfway inserted, rotate and slide it fully in. This twisting manoeuvre prevents the tongue being pushed back into the pharynx. The airway must be inserted over the tongue and the natural curve will keep the tongue forward. Ensure that the lower lip is not pinched between the patient's teeth and the artificial airway.

Note that insertion of an airway in a patient who is not deeply unconscious may cause vomiting. Should the patient begin vomiting, remove the artificial airway and place the patient in the coma position so that no inhalation of vomitus occurs. Use the suction equipment.

B BREATHING – ARTIFICIAL VENTILATION OF THE LUNGS

The most commonly used method of emergency artificial respiration is expired air respiration. Bag and mask ventilation with fresh air, supplemented by oxygen, should be used when available, but only after a clear airway has been established. EAR should be continued by the first rescuer until the second operator has prepared the bag and mask apparatus.

1. MOUTH TO MOUTH

With the hand on the forehead, pinch the nostrils shut with the thumb and forefinger. Take a deep breath, open your mouth wide, seal off the patient's mouth with your lips, and breathe into the patient. Watch and see the patient's chest rise. If the chest does not rise, common faults are that either the head is not fully extended or the lower jaw is not pulled upwards sufficiently. Unless expansion of the chest occurs, there has not been adequate filling of the patient's lungs.

At the end of the forced expiration, turn your head towards the patient's chest, maintain head tilt and jaw support, keep the nostrils pinched, watch the chest fall, and listen for escape of air. Take another deep breath and repeat the cycle. Initially, 5 breaths are given and then 12 breaths per minute, if a carotid artery pulse is present. If this pulse is absent, EAR and ECC are used, with a ratio of 2 breaths to each 15 ECC (one operator) or 1 breath to each 5 ECC (two operators). Check for presence of a pulse every 2 minutes.

2. MOUTH TO NOSE

Keep the head tilted back, maintain jaw support and close the mouth. Take a deep breath, seal your lips around the patient's nose, and blow until the chest rises. Remove your mouth, watch the chest fall, and hear air exhale. It may be necessary to open the mouth to allow expiration.

3. MOUTH TO TRACHEOSTOMY STOMA

If the patient has a tracheostomy, e.g., following laryngectomy, EAR should be performed via this route, and NOT via mouth or nose.

4. BAG AND MASK VENTILATION

The hand operated bag and mask artificial ventilator provides a means of ventilating the patient's lungs which is less tiring for the Ambulance Officer, does not require face to face contact, and allows an oxygen supplement to be added. There are two types in common use – one has springloaded expiratory and air inlet valves, the other has rubber flap expiratory and air inlet valves.

The Laerdal type unit has rubber flap valves, an oxygen inlet port, and an oxygen reservoir bag. Addition of oxygen at 8 L/min will provide an inspired oxygen concentration of about 50%. Use of the reservoir bag allows ventilation with 100% oxygen.

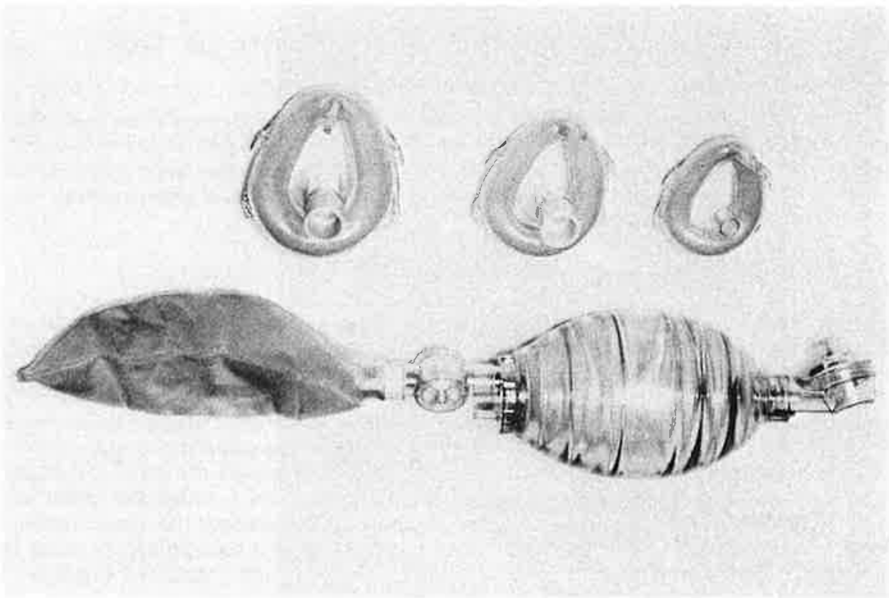


Figure 20 Self-inflating Bag and Mask Unit

A mask of appropriate size is coupled to a non-return valve and the self-inflating bag (Figure 20). Squeezing the middle of the bag forces air out of the bag, through the valve, and into the mask. By placing the mask over the nose and mouth and sealing by firm pressure, this air can be forced into the patient to inflate the lungs. The natural recoil of the chest forces the air out of the lungs and into the mask where it is then released through the one-way valve to the atmosphere.

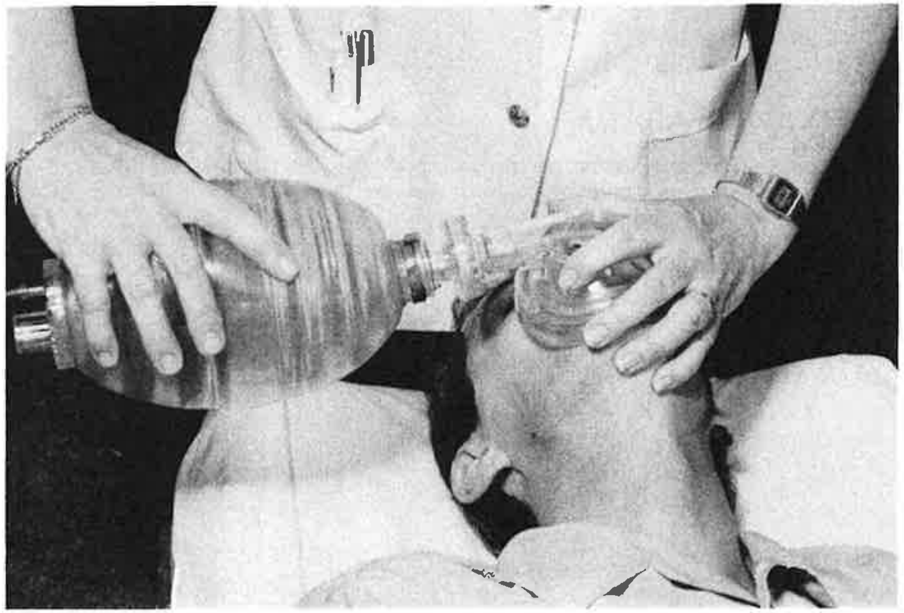


Figure 21 Method of Holding the Mask on the Patient's Face

Check that the rim of the mask is inflated to a degree that is firm but can be indented by the finger. The mask must be tightly sealed against the patient's face. Maintaining this seal is the most difficult task in providing this form of ventilation. Press your thumb over the nose part of the mask and your index finger over the chin part; use your third, fourth and fifth fingers to pull the chin upward and backward (Figure 21). Take a firm grip, but never force your fingers into the patient's neck. Do not push the mask down on to the chin, as this is likely to flex the head and obstruct the airway. It is mandatory to insert an oro-pharyngeal airway into the mouth before attempting to ventilate with a bag and mask unit. It may be difficult to ventilate a patient who has had his dental plate removed. If this difficulty is encountered, try placing the dentures back in the mouth.

Do not delay artificial ventilation while obtaining or setting up equipment. Begin immediate ventilation by expired air methods while your assistant gathers and assembles equipment.

5. MOUTH TO MASK

In the event of the bag assembly malfunctioning, mouth to mask ventilation may be preferable to returning to mouth to mouth ventilation.

WARNING

The expired air method of artificial ventilation is TOTALLY FORBIDDEN when treating patients poisoned with organo-phosphate compounds or cyanide. In this situation the Ambulance Officer is himself likely to be poisoned and bag and mask ventilation is mandatory.

SUCTION APPARATUS

As an important aid in maintaining a clear airway, and allowing ventilation, the Ambulance Officer can apply suction to remove secretions, blood, vomit, or any other fluid which may collect in the upper airway. Solid matter such as partly digested food, loose teeth or any foreign particles must be wiped out of the mouth and pharynx with a sweep of the fingers, with the patient's head turned to the side.

Away from the ambulance a portable foot-operated suction unit can be used to remove fluid from the airway (Figures 22 and 23). A plain, plastic suction catheter, size 10 for children and size 14 or 16 for adults, is applied direct to the connection

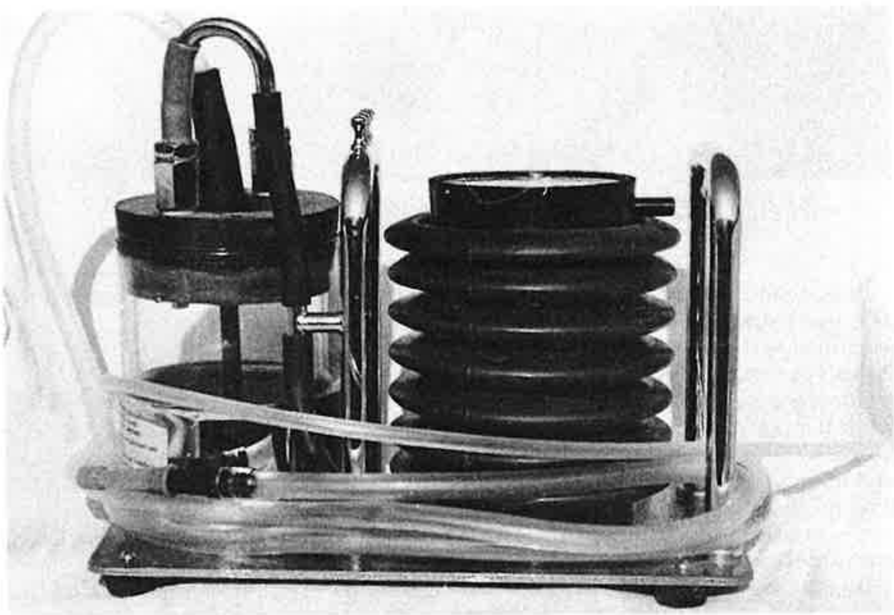


Figure 22 Foot-operated Suction Unit

Figure 23 Suction Unit in Use

of the portable unit. Intermittent suction is then developed by the foot pump as desired. It is suggested that the pump be operated at approximately 90 pumps per minute.

In the ambulance, the suction provided from the engine manifold is much more effective but it must be remembered that the vehicle engine must be running for the suction to work. In the vehicle, the Y control, plastic suction catheter is used in corresponding sizes. The vehicle unit produces continuous suction. The catheter should be inserted with the Y thumb control open so that no suction occurs at the catheter tip (Figure 24). Once the catheter tip is in the pharynx the thumb closes the port in the Y piece and the catheter is slowly withdrawn (Figure 25).

To insert the suction catheter, the mouth is opened with the thumb and index finger of one hand and the other hand passes the suction catheter tip into the mouth and pharynx. Suction is created by foot pump or Y control closure and the catheter withdrawn. Intermittent initial suction to clear the airway of blood and vomit must be carried out quickly. Suction should then only be repeated as needed to maintain a clear airway. Suction should not be applied continuously for prolonged periods. If stridor develops, breathing stops, or cyanosis occurs, stop suctioning and give oxygen. Stimulation of the pharynx may cause vomiting or laryngeal spasm.

Figure 24 Insertion of Y-Suction Catheter

Figure 25 Withdrawal of Y-Suction Catheter

C CIRCULATION – EXTERNAL CARDIAC COMPRESSION

ECC is begun in the patient who is unconscious, not breathing spontaneously, and has no palpable carotid pulse. Do not waste time looking at the pupils.

With the patient lying flat on his back on a firm surface, kneel at the side of the patient's chest. Apply the heel of one hand over the lower half of the sternum, place the heel of the other hand on top of the first, and keep the fingers off the chest (Figure 26). With the arms straight, press forcefully vertically downwards to depress the sternum 4-5 cm (1.5″-2″). Allow the sternum to spring back naturally by completely relaxing your weight on it. The time allowed for release should be equal to the time required for compression. The compressions must be regular, smooth, and uninterrupted. There is no place for jerky movements or sharp stabbing compressions.

Figure 26 External Cardiac Compression

One rescuer performs ECC and artificial ventilation with a 15:2 ratio. Because of interruptions for lung inflation, the 15 chest compressions should be performed at a rate of approximately 80 per minute. The two full lung inflations must be delivered in rapid succession.

Two rescuers perform ECC and artificial ventilation with a 5:1 ratio. Each breath is interposed between the 5th compression and the first of the new cycle, with no pause in ECC.

After interposing a breath, the second operator palpates the carotid artery to ensure adequate compression is being performed by his partner. Once the artificial pulse has been confirmed, the operator performing compression should be asked to stop to check the need for ECC. If the pulse fades away, it is clearly necessary to continue CPR, but if the pulse continues, then reassessment is necessary. In prolonged CPR, operators may tire, and should change activities in mid-cycle. The operator performs the single ventilation, then moves to a compressing position. The other operator stops compressing mid-cycle, and moves into an airway position.

This sequence may be briefly interrupted every two minutes to feel for a pulse. If a pulse is felt, continue ventilation. Once started, cardiopulmonary resuscitation must be continued until the patient is handed over to medical care. It must continue until a Medical Officer takes over or advises that resuscitation should cease. Do not cease on the advice of any other party once you have recognised the problem and have begun resuscitation.

When moving the patient, use the help of available personnel. Ideally, one Officer should ventilate the patient and the other apply sternal compressions while other helpers move the stretcher. Naturally a slight interruption is unavoidable as you move the patient on to the stretcher, but having done this, apply emergency resuscitation again for a minute or two before starting to move the stretcher to the ambulance.

On the move to the ambulance, stop every 30 seconds and apply resuscitation for two minutes.

Once in the vehicle it is necessary to continue the smooth sequence of ventilation/compression. One Ambulance Officer will take on this responsibility.

While you are continuing resuscitation in the ambulance it is necessary for the driver to use all his skill and road sense in making the journey as smooth as possible.

A radio communication to the hospital should always be made.

This emergency treatment will not work every time, but cases have been reported where normal recovery has followed lengthy periods of cardiopulmonary resuscitation. In cases of drowning, do not be put off by statements that the patient has been submerged for as much as 15 or 20 minutes because the circulation may have stopped only a short time before the patient was removed from the water. Also, cooling of the body will have protected the brain from the effects of hypoxia to some extent. In this situation, recovery may occur even after prolonged immersion.

RESUSCITATION OF CHILDREN

The principles of CPR in infants and children are identical to those in adults, with a number of differences in technique.

1. AIRWAY CLEARANCE

Head tilts should not be extreme in children. Jaw support should be performed taking care not to compress the neck. In infants, jaw support alone is sufficient, and head tilt may obstruct the airway.

2. BREATHING

In infants and small children, the rescuer must cover both mouth and nose. A respiratory rate of 20-25/minute is used. Ventilation should be limited to the amount necessary to cause the chest to rise and fall – usually small puffs. In larger children, larger volumes will be required.

3. ECC

In infants, one or two fingers are used to compress the mid-sternum 1.5-2.5 cm (3/4-1"). In children, the heel of one hand should be used to compress the mid-sternum 2.5-3.5 cm (1-1.5"). Compression rate should be 80/minute in a child, 100/minute in an infant. Ratio of ECC to artificial ventilation remains 15:2 for one operator, and 5:1 for two operators.

In infants, the carotid pulse may be hard to locate, but it is possible to feel for a heartbeat immediately below the left nipple.

CONTROVERSIAL ISSUES IN CPR

Since CPR was introduced in the early 1960's there have been a number of controversial issues. Many of these have been resolved, others still exist. In the light of present knowledge, the following issues are considered.

1. HEAD TILT – NECK LIFT

This method is not as universally effective in opening the airway, and it has been replaced by head tilt with jaw support.

2. RATES AND RATIOS

In Australia an initial 5 breaths are recommended prior to commencing ECC, rather than 4. Ratios of ECC to artificial ventilation of 15:2 for one operator, and 5:1 for two operators are now universally accepted.

3. FOREIGN BODY AIRWAY OBSTRUCTION

If a foreign body is thought to be lodged in the upper airway, but the patient is breathing, leave him to cough it out. If not breathing, the two manoeuvres which may be of value are:

(a) up to 4 sharp blows with the heel of the hand between the shoulder blades;
(b) artificial ventilation following the ABC sequence. First check the upper airway for the cause of the obstruction, then begin EAR to either blow air past the obstruction, or to displace the foreign body out of the trachea and into a bronchus.
Note that the chest thrust (sudden sharp compression of the chest with the operator's arms around the victim's lower chest) is not recommended.

4. PRECORDIAL THUMP

This manoeuvre is not recommended, except under specific conditions in an ECG monitored patient, or in a patient who has been electrocuted.

Chapter 8

Oxygen Therapy

Oxygen is a colourless, odourless gas which forms 21% of the atmosphere. Oxygen supports combustion and increases the rate at which objects burn. Oxygen is essential for animal life because the chemical processes of all cells, and hence of all organs of the body, use oxygen as their fuel supply.

OXYGEN DELIVERY TO CELLS

All cells require oxygen to keep functioning. Without oxygen, cells die. Oxygen gets to cells via a complex route. When breathing fresh air, oxygen passes down the airways to the alveoli, across the alveolar membrane into the blood, and combines with haemoglobin in the red blood cells. Blood flow carries the red cells back to the heart and out in the arteries to all organs of the body. There, haemoglobin releases oxygen to the cells, and picks up carbon dioxide to transport back to the lungs for excretion. Nearly all the oxygen carried in the blood is carried attached to the haemoglobin in the red blood cells.

CONDITIONS PRODUCING HYPOXIA

Hypoxia is a term used to describe a deficiency of oxygen at the tissue or cellular level. This may be due to a number of causes:

1. DECREASED OXYGEN IN THE ATMOSPHERE

altitude
gas, vapour or smoke inhalation

2. DECREASED VENTILATION

coma (e.g., drug overdose, head injury)
pulmonary oedema
pneumonia
asthma
chronic obstructive lung disease
chest injury

3. DECREASED AMOUNT OF AVAILABLE HAEMOGLOBIN

anaemia
carbon monoxide poisoning

4. DECREASED BLOOD FLOW

myocardial infarction
blood loss
severe infections
anaphylaxis
cardiac arrest

5. EXCESSIVE OXYGEN CONSUMPTION

heat stroke

SIGNS OF HYPOXIA

Lack of oxygen, whatever the cause, may cause altered function in the brain leading to anxiety, agitation, confusion, irritability, drowsiness, coma. Hypoxia of the cardiovascular system may cause tachycardia, and cardiac arrhythmias. If the patient can, he will increase his respiratory rate and depth in response to hypoxia. If he is unconscious, or exhausted, he may not be able to respond in this way. Cyanosis, due to a decrease in the amount of haemoglobin carrying oxygen, is a late sign of hypoxia. A patient with progressing hypoxia will eventually have a cardiopulmonary arrest.

INDICATIONS FOR OXYGEN THERAPY

Any patient with a condition known to produce hypoxia should be given oxygen immediately and continuously until delivered to hospital.

In some patients it is obvious why oxygen should be given, for example, in respiratory distress. In other patients the reasons for oxygen therapy may not be as clear. For example, a patient suffering from trauma may require oxygen because he has respiratory distress from a partially obstructed airway or chest injury. He also requires oxygen because he has lost blood, resulting in decreased blood flow to all tissues, and a decreased amount of haemoglobin present in the blood.

ADMINISTRATION OF OXYGEN

Before oxygen therapy is begun, the procedure should be explained to the patient and then the appropriate apparatus set up and applied. Some patients will not tolerate a mask. Use the type of equipment which best suits the patient. Oxygen may be administered to the patient by mask, nasal cannula, or by improvised methods.

Figure 27 Universal Face Mask

Figure 28 Venturi Face Mask

1. *UNIVERSAL FACE MASK*

These fit over the patient's nose, cheeks and chin (Figure 27). An elastic strap over the head retains the mask in position. Oxygen is delivered to the mask and mixed with air drawn in through side holes. Exhaled air is vented through the side holes. The percentage of oxygen inhaled by the patient depends on the depth and rate of respiration and the oxygen flow rate. The flow rate should be set at 8 litres/minute to give an oxygen concentration of approximately 40%. Unlike the following two methods, disconnection of the oxygen supply will result in rebreathing, with potential increase in the patient's blood level of carbon dioxide, and hypoxia.

2. *VENTURI MASK*

Applied carefully (Figure 28), these masks deliver 24% or 28% oxygen at a flow rate specified on the mask, irrespective of the rate and depth of respiration. They are used specifically for patients with known chronic obstructive lung disease, some of whom use the masks at home.

Figure 29 Nasal Cannula

3. *NASAL CANNULA* (Prongs or Specs)

This is the simplest, most comfortable means of oxygen delivery. The patient can talk, drink, cough and have airway care without interrupting oxygen flow (Figure 29). Two soft plastic tubes insert into the nostrils. An elastic strap around the neck retains the cannula in place. An oxygen flow rate of 2-4 litres/minute will provide an oxygen concentration of approximately 30%-40%. Mouth breathing may reduce this concentration, but the patient still receives a higher oxygen concentration than is present in air.

4. IMPROVISATIONS

If none of the above methods can be used, oxygen can be added to the inspired air by holding the end of the oxygen tubing in the cupped hand near the patient's nose and mouth. Inspired oxygen concentrations will be variable and high flow rates of oxygen will be necessary. This will, of course, rapidly deplete the oxygen supply.

5. CHOICE OF METHOD

If the patient is breathing, a universal face mask or nasal cannula is chosen, whichever is best tolerated by the patient. A flow of 2 litres/minute of oxygen via a nasal cannula will provide about 30% oxygen, and is suitable for use in chronic obstructive lung disease.

6. BAG AND MASK

If the patient is not breathing, or is breathing, but is cyanosed and unconscious, he needs artificial ventilation by bag and mask. Oxygen can be coupled to a bag and mask unit and the flow rate set at 8 litres/minute.

7. OXYGEN ADMINISTRATION TO PATIENTS WITH PAIN

Patients requiring both oxygen and analgesia should be given Entonox, which contains 50% oxygen and 50% nitrous oxide.

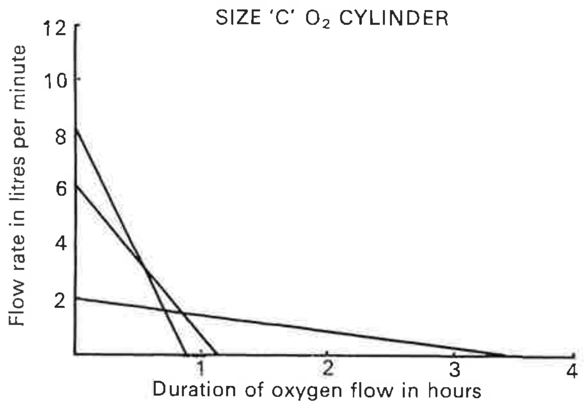


Figure 30 Duration of Oxygen Flow from a C-size Oxygen Cylinder

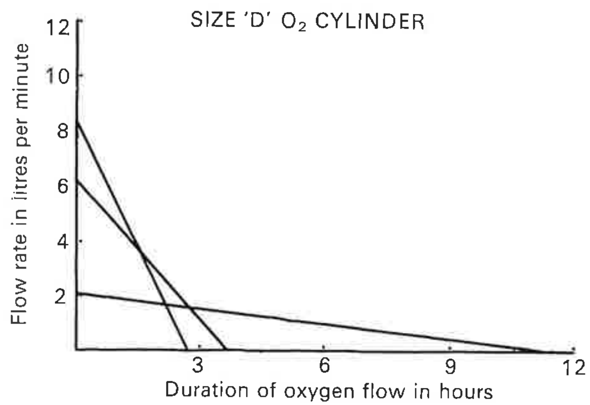


Figure 31 Duration of Oxygen Flow from a D-size Oxygen Cylinder

OXYGEN CYLINDERS

Oxygen for therapy is supplied in metal cylinders under a pressure of 13,400 KPa (2000 psi or 132 atmospheres). The most commonly used cylinder in service is the emergency portable C size, which contains 408 litres. Figures 30 and 31 show the length of time that oxygen can be supplied at 2, 6 and 8 litres/minute flow rate from size C and size D cylinders.

Oxygen is delivered from the cylinder via a pressure reducing valve, which reduces the high pressure of oxygen in the cylinder to a safe working pressure of 400 KPa (60 psi or 4 atmospheres). The valve is of the yoke type, which has pin fittings which match holes on the valve stem of the oxygen cylinder. This Pin-Index safety system prevents application of an incorrect regulator to the oxygen cylinder. Oxygen at reduced pressure is delivered by the vertical oxygen flow regulator at 1-14 litres/minute (Figure 32).

SAFETY PRECAUTIONS

The following safety precautions should be taken when using oxygen therapy:

1. Check that it is an oxygen cylinder – read the label, check the black and white colour coding on the cylinder shoulders. Check that the valve/flowmeter assembly is of the correct type.
2. Oil, grease or other combustible material must never come in contact with cylinders, or their fittings.
3. Valves should be closed when the cylinders are not in use.
4. When opening a cylinder, remove the plastic seal on the cylinder outlet and apply the yoke. Open the valve slowly to prevent sudden escape of high pressure oxygen into the pressure reducing valve.
5. Smoking, naked flames or sparks are always prohibited in an area where oxygen is in use or on standby. Always remember the possibility of sparks and flames in rescue situations.

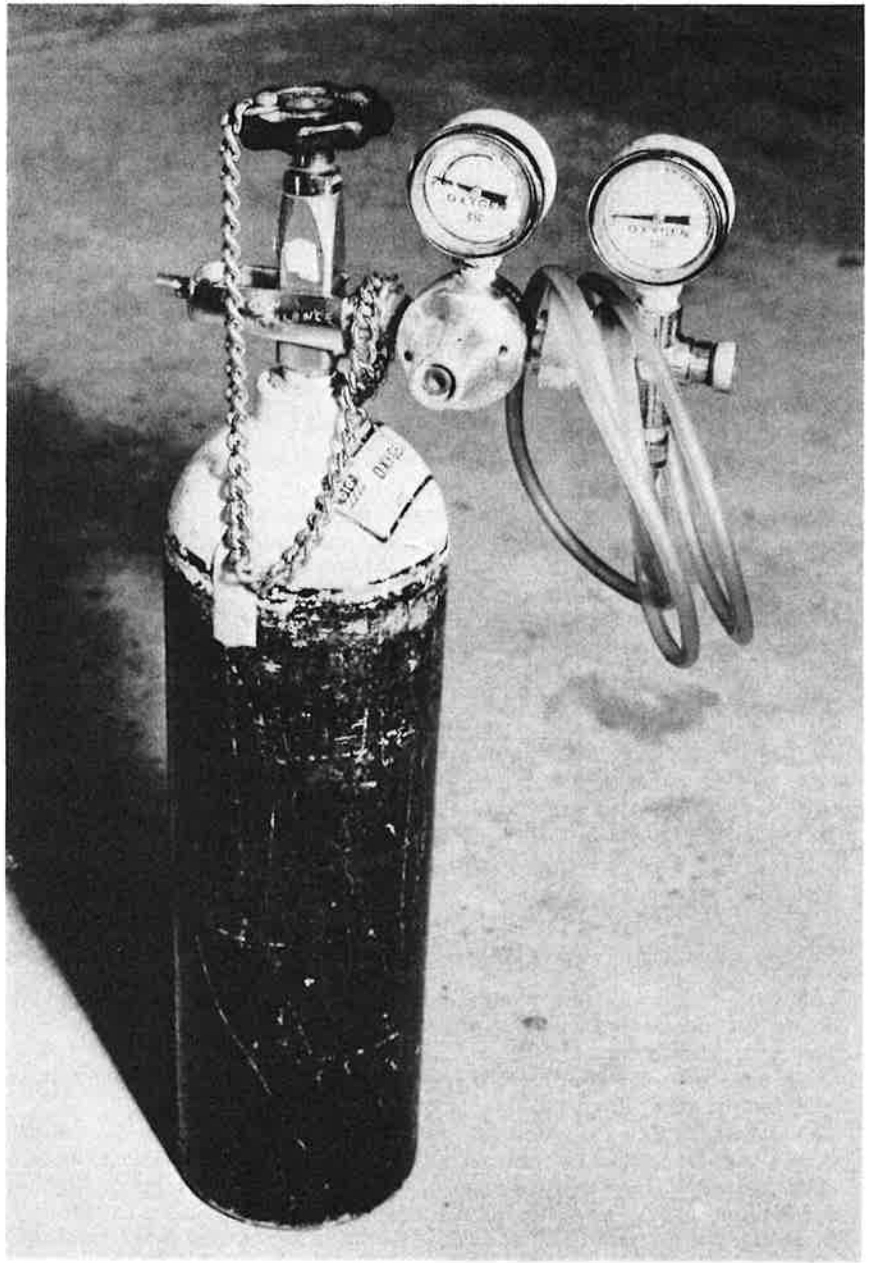


Figure 32 Oxygen Cylinder, Reducing Valve and Flow Meter

6. Cylinders should not be subjected to temperatures above 52°C (125°F).
7. Cylinders should always be safely secured, and transported in a proper carrier. Dragging, sliding and bumping cylinders should be avoided. Cylinders should never be stored upside down.
8. Never attempt to use a cylinder without a safely functioning and properly fitted regulating device.

Chapter 9

Analgesia

Pain is a common symptom which is both valuable, because it indicates the site and nature of injury, and limits activity which may cause further damage; and harmful, because it causes discomfort and contributes to shock. Pain is often difficult to interpret, because it depends not only on the injury, but also on the patient's response to it. Because it is a symptom, pain can only be present in a conscious patient. Similarly, any patient who complains of pain has pain.

Pain relief (analgesia) begins with standard techniques of wound care, dressing, bandaging, support, splinting and correct lifting. Appropriate psychological support for the patient also helps. Once physical and psychological causes of pain have been reduced, analgesia can be achieved by the use of the inhalational anaesthetic gas, nitrous oxide, in the form of Entonox. The other inhalational anaesthetic agent used to produce analgesia is Methoxyflurane (Penthrane).

INDICATIONS FOR PAIN RELIEF

Patients most likely to need pain relief are those with:

1. Crush and soft tissue injuries.
2. Fractures.
3. Burns.
4. Chest pain.
5. Chest injuries.
6. Obstetric problems.
7. Animal bites or insect stings.

There is no need to provide pain relief for those patients who, regardless of injury, do not complain of or show signs of distress from pain. Patients who are unconscious do not require analgesia.

NITROUS OXIDE/OXYGEN – ENTONOX

This gas has a long history of satisfactory analgesia and can be used safely in all patients needing pain relief. It is administered with specific apparatus. Entonox is stored as a compressed gas in standard cylinders (Figure 33). The labelled cylinders are colour-coded BLUE with WHITE shoulders. A yoke regulator fits the valve stem and has a Pin-Index safety system. From the outlet side of the regulator a

flexible hose connects to a hand piece on which is mounted a standard anaesthetic type face-mask or moulded mouth-piece. On the hand-piece there is also an exhaust valve for exhaled air. Opening the needle seal valve delivers Entonox into the regulator. Entonox is delivered to the patient through a demand valve. The patient's breathing effort opens the demand valve and breathing out closes it. The regulator has a simple gas volume gauge mounted on it.

Entonox contains 50% oxygen and 50% nitrous oxide and therefore provides relatively high inspired oxygen concentrations to the patient. It can be safely used

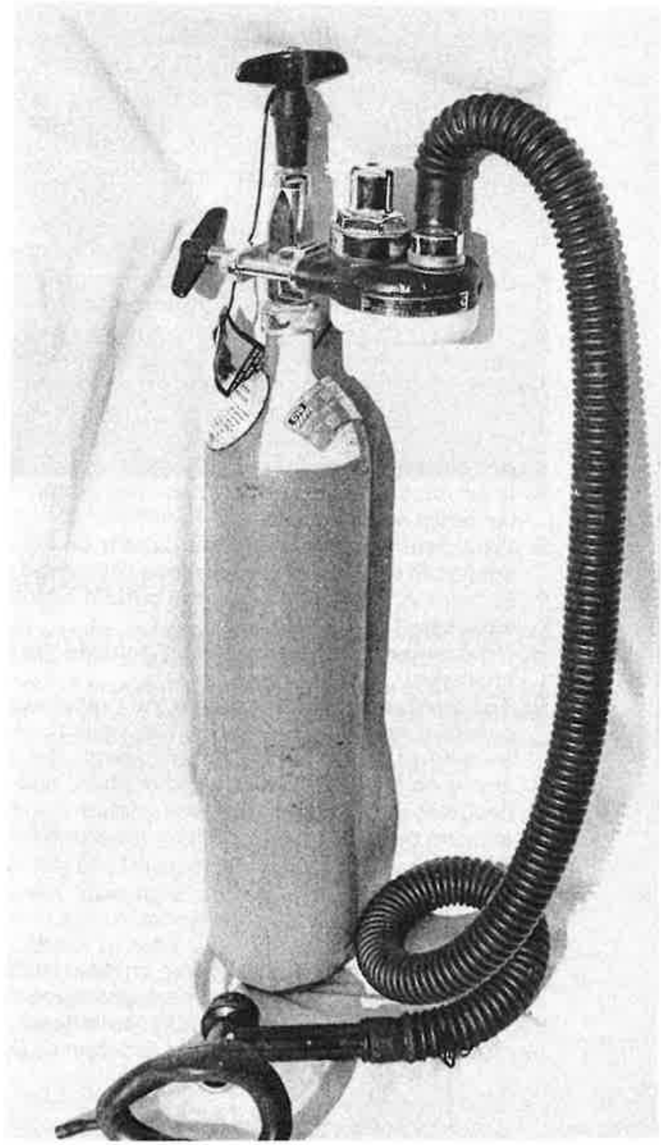


Figure 33 An Entonox Cylinder

for pain relief in those patients requiring analgesia who also require oxygen therapy, e.g., patients in respiratory distress and patients with chest pain. The gas is relatively odourless and certainly not unpleasant. The analgesic effect takes place quickly and is not accompanied by nausea. Some patients feel drowsy once their pain is relieved, but soon become alert again when the gas is stopped. There is no masking of physical signs on stopping administration, and there is no problem with subsequent anaesthesia. If a patient has been given a narcotic by a Medical Officer, Entonox will have an increased effect.

Entonox is inflammable and care must be exercised in rescue situations where the possibility of sparks and flames exists. If exposed to freezing temperatures the gas mixture issuing from the cylinders is not in 50/50 proportion. This dissociation can be reduced by shaking the cylinders, but it is better to store them at temperatures above 5°C.

ADMINISTRATION OF ENTONOX

1. Instruct the patient that you are going to give him the mask to hold and that if he breathes gently and regularly he will get pain relief.
2. Obtain his verbal consent in the presence of a third party. For minors, parental consent should be sought where practicable.
3. Turn the cylinder on and instruct the patient to place the mask over his nose and chin. The mask must be firmly sealed on to the patient's face for analgesia to be effective. Keep the patient's hands and bedding away from the exhaust valve.
4. Encourage the patient to breathe gently and slowly. Be aware of the problems of over-breathing.
5. Insist on self-administration so that administration is stopped if the patient becomes unconscious.
6. Whenever possible, have the patient on his side so that there is less risk of inhalation of vomitus or secretions should the patient become drowsy.
7. Entonox is not to be used if the patient is not fully conscious or if he is plainly intoxicated.
8. If the patient behaves irrationally, remove the Entonox for a few breaths until he improves.
9. Administration of Entonox with the Ambulance Officer holding the mask on the patient's face is permitted if the patient cannot hold the mask (e.g., arms trapped or fractured). In this situation, the Ambulance Officer must keep a check on the patient's conscious state, and remove the mask if the patient becomes unconscious. Under no circumstances should the Ambulance Officer activate the valve mechanism for the patient.

AT THE HOSPITAL

Continue the administration of Entonox until the Medical Officer assumes responsibility. Then remove the mask and close the cylinder valve.

Record the use of Entonox on the Ambulance Officer's Report and check your assessment and diagnosis with the Emergency Department Medical Officer.

Return the Entonox apparatus to its correct storage place in the ambulance, making sure the cylinder valve is closed. Remember to clean the face mask after use.

Figure 34 The Penthrane Analgizer

METHOXYFLURANE (PENTHRANE)

This liquid is vapourised in a lightweight disposable Analgizer inhaler (Figure 34) and self-administered by the patient. The inhaled vapour is an air/Penthrane mixture and the apparatus does not permit supplementary oxygen to be administered. Penthrane is a good analgesic, but it takes a little time to relieve pain. Penthrane has a reasonably pleasant smell, does not sensitise the myocardium to adrenaline to any degree, and does not complicate subsequent anaesthesia in hospital.

ADMINISTRATION OF PENTHRANE

1. It is important not to delay unduly the transportation of the patient to medical aid by persisting with pain relief. Pain relief should also wait until you have adequately assessed the patient's injuries and general condition.
2. Explain the actions you are about to take with the inhaler and that it will relieve pain. Your confidence will help the patient.
3. Obtain the patient's verbal consent in the presence of a thrid party before allowing him to use the inhaler. It the patient is a minor, obtain parental consent where practicable.

4. Hold the Analgizer inhaler vertically with the mouthpiece down. Slowly pour in 3 ml of Penthrane. Shake the unit lightly to dispel any excess liquid, and wipe the mouthpiece.
5. Fasten the cord around the patient's wrist. Tell the patient to inhale by mouth, but to exhale through the nose. The patient should leave the oblong diluter hole near the mouthpiece uncovered for 8-10 breaths while becoming accustomed to the taste and odour of the agent. Thereafter, the patient may cover the hole with the finger, if necessary.
6. Once his pain is relieved, instruct the patient that he may need only one or two breaths in five from the inhaler to maintain analgesia. Repeated encouragement and instruction may be required.
7. Pain relief may take up to 3 minutes to be complete.
8. At no time should the patient be allowed to become unconscious. Keep constant watch to avoid this. Failure to respond to simple commands is a sign that the patient is getting too much Penthrane, and administration should be stopped by removing the inhaler. Self-administration by the patient should prevent this situation.
9. During transportation to hospital, continue to reassure the patient and observe his conscious state closely.
10. If pain relief is obtained, but then fails, the Analgizer may need reloading with a further 3 ml Penthrane.
11. The shoulder of the inhaler adjacent to the mouthpiece fits into a standard anaesthesia face mask, but not a Laerdal face mask.

AT THE HOSPITAL

Stay with the patient and continue the use of the inhaler until a Medical Officer takes over management. Make sure the Ambulance Officer's Report is completed, showing Penthrane was used.

RE-EQUIPPING

The inhaler should be disposed of after use, and the ambulance restocked with a new one.

Chapter 10

Intravenous Therapy

An intravenous infusion may be set up by a Medical Officer or, in certain circumstances, by a specially trained Ambulance Officer, for a number of reasons. The most common ones are:

1. to infuse blood or a blood substitute such as Stable Plasma Protein Solution (SPPS), Haemaccel or Macrodex to expand the blood volume in patients who are shocked;
2. to infuse a salt containing solution such as Normal Saline or Hartmann's Solution (similar solutions are Plasmalyte and Normasol) in patients who have lost fluid in burns, diarrhoea, vomiting, or in shocked patients when blood or blood substitutes are not available;
3. to infuse 5% Dextrose in patients who need to have access to a vein to allow urgent drug administration, as following myocardial infarction.

With increasing frequency the Ambulance Officer is now assisting in starting IV infusions and in managing them during transportation. The equipment necessary for an intravenous infusion is shown in Figure 35. An intravenous infusion pack is shown in Figure 36.

SETTING UP INTRAVENOUS THERAPY

The solution to be infused may be in a glass bottle or plastic pack. The outlet of the container will have a protective cap under which the outlet bung will be sterile. Do not touch any of the protected area on removing the cap.

The sterile infusion set consists of a large spike needle to which is connected a drip chamber and a filter chamber. There is a length of tubing ending in a tapered tip which plugs into the needle or cannula inserted into the patient's vein. An adjustable clamp is fitted on the tubing and can be moved along its length. The spike and terminal tip are sterile and protected with simple covers. There is also an airway which may be simply a sterile needle, or a needle with a short piece of tubing and a filter.

The spike cover is removed, taking care not to touch the spike, which is then pushed firmly through the bottle bung. The protective cover is removed from the airway needle and the airway needle also pushed through the bung. Without an airway, glass bottles will not allow fluid to run out. An airway is not required with collapsible plastic packs.

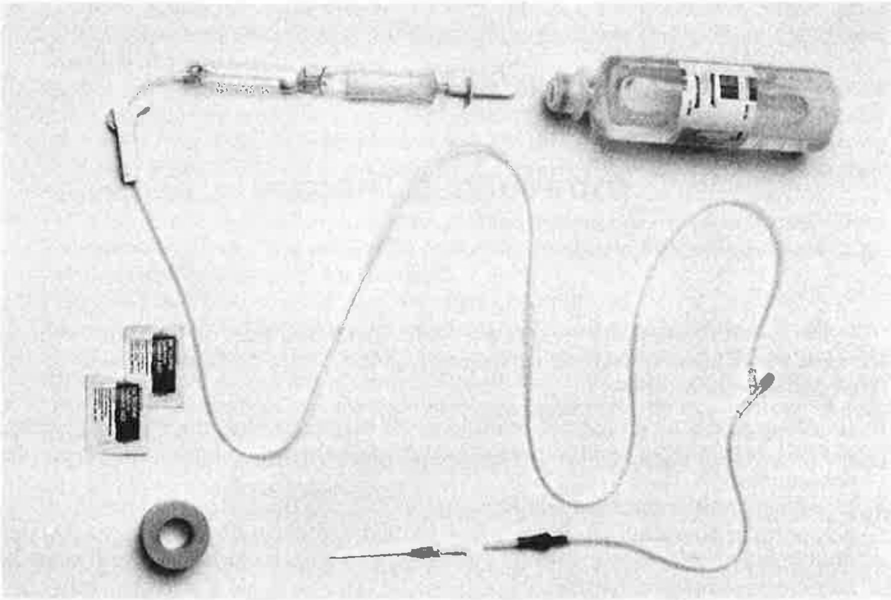


Figure 35 Intravenous Infusion Components

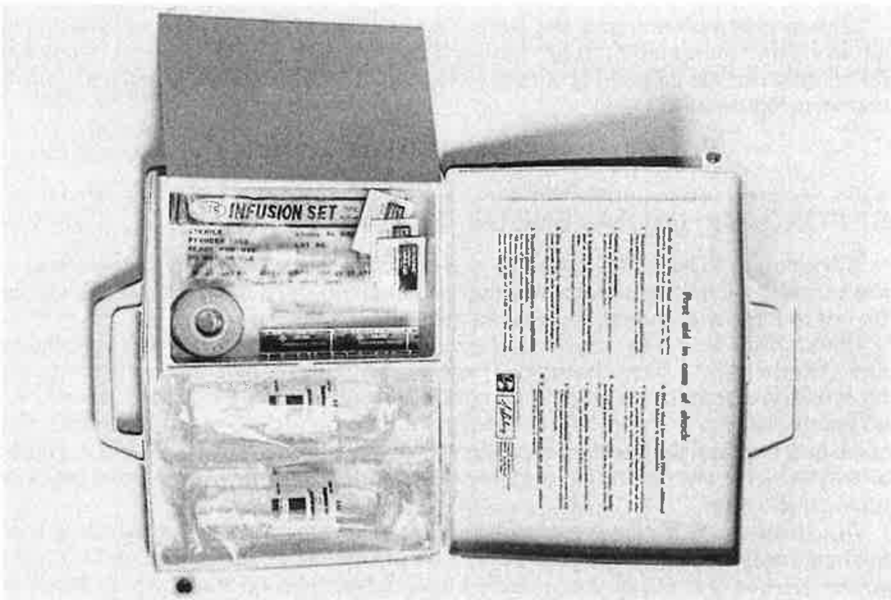


Figure 36 An Intravenous Infusion Pack

With the pack and infusion set assembled, and the clamp closed, the pack is inverted. Half fill the drip chamber by squeezing it, then open the clamp and allow the fluid to fill the tubing. Care should be taken to exclude air bubbles from the entire length of the tubing.

The Medical Officer or specially trained Ambulance Officer will place the cannula in the vein. He may need assistance with holding the limb, providing good light, holding equipment, or securing the IV cannula with strapping. Remember that much of the IV equipment must remain sterile, therefore handle with care.

When the IV cannula is inserted the infusion set tubing is connected to it and fluid is allowed to run in by releasing the tubing clamp. When the fluid is running properly and the limb is secure, the Medical Officer will determine the required rate of flow in terms of drops per minute. If medical orders for rate of flow have not been given, the Ambulance Officer must ask for this information. The rate can be altered by adjusting the tubing clamp. Carefully count the drops per minute in the drip chamber and adjust the clamp to achieve the prescribed rate.

The slowest rate at which a drip can safely be run to prevent it stopping is at about 20 mls per hour. As standard adult drip sets deliver 15 drops per ml, 20 mls per hour = 5 drops per minute or 1 drop every 12 seconds.

Figure 37 Intravenous Infusion in Progress

The pack must be supported as high above the patient as is practicable (Figure 37). In an ambulance, hooks on the roof or an IV stand attached to the stretcher will support the bottle at working height. The bottle should be secured firmly to the hook or stand and not be allowed to swing and sway. If necessary the pack should be tied in position with lengths of bandage.

If a pack of solution empties and a new pack is required, the procedure is as follows. Stop the flow before the pack is empty, using the tubing clamp. Remove the infusion set spike from the old pack and push it into the sterile top of the new pack. The changeover must be done quickly to prevent the cannula blocking off with blood clot. Remember that the bung, spike and airway are sterile and must not be touched. Open the tubing clamp to re-commence the infusion. Re-adjust the clamp for the prescribed rate of flow.

PRECAUTIONS WITH INFUSION

Care must be taken to stop the tubing from becoming kinked or pinched shut. Traction must not be applied to the tubing as this may dislodge the cannula from the vein.

The drip rate must be constantly supervised to maintain the prescribed rate of flow. If the drip rate seems too fast it must be slowed down, but it should not be allowed to stop as this will allow the needle to block with blood clot and prevent further infusion.

As the cannula is commonly in a hand or forearm, movement of that limb should be minimal. Rough handling of the limb may cause the cannula to perforate the vein wall and fluid may infuse into the surrounding tissue. If this occurs, the drip rate will probably not be maintained, a swelling will occur around the point of the cannula, and the patient may complain of discomfort. If it is obvious that the cannula has become displaced into the tissues, the tubing should be clamped off. The services of a Medical Officer should then be obtained as soon as practicable to re-insert a cannula, even if this means breaking a long journey by making an unscheduled stop at another hospital.

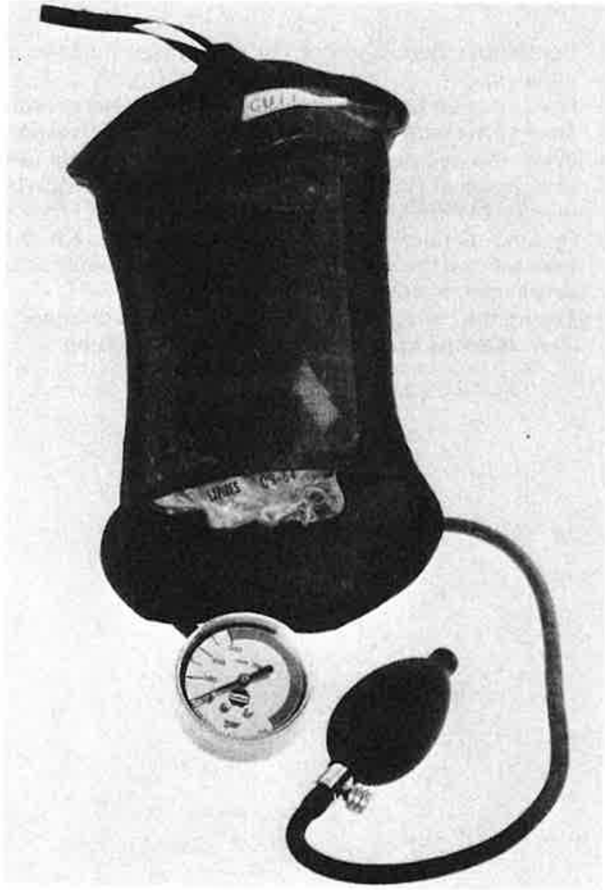
TRANSFUSION OF BLOOD

A patient receiving a blood transfusion may be transported by Ambulance.

The same infusion apparatus is employed and the same precautions in handling the apparatus to maintain sterility are necessary. Blood is generally stored in plastic packs. The spike of the infusion set plugs directly into the outlet tube of the pack. If the set becomes parted from the inverted blood pack all the blood will rapidly pour away. Always check that the connection is firm. Blood packs do not require an airway as external air pressure causes the blood to flow, the pack collapsing as it empties.

Blood is a more viscous fluid than saline (salt) solutions and hence is more difficult to infuse. In ambulances the limitation on the height to which the infusion pack can be raised above the patient may prevent the attaining of as rapid a rate of infusion as required. In addition, where a patient is being transported by air ambulance, lowered atmospheric pressure will further slow the infusion rate. Where there is difficulty in maintaining the prescribed rate of flow it is possible to resort to pressure infusion. Blood may only be put up after checking by a Medical Officer. Transfusion of the wrong blood group may be fatal.

Figure 38
Pressure Infusor



PRESSURE INFUSION

Pressure infusion is safe for ambulance use only when soft plastic packs of blood or fluid are used. There is a specific pressure infusor in the form of a sleeve with an inflatable back and a non-flexible front (Figure 38). This can be inflated to apply pressure to the contained pack, allowing the flow rate to be maintained. The pressure infusor must be pumped up only to the extent necessary to achieve the required flow rate. In the absence of a specific pressure infusor, an improvised device can be made using a sphygmomanometer cuff. NEVER attempt to pressurise a glass bottle – infusion of air may result.

Note. Rapid infusion of any fluid under pressure is only performed under supervision of a Medical Officer.

SUMMARY

1. Remember that much of the equipment must be sterile and requires careful handling.
2. Fluid must be kept running into the vein at the prescribed rate.
3. Take all measures necessary to protect the intravenous cannula.
4. When it is necessary to change bottles, take care to exclude air from the tubing.
5. Only Medical Officers are to prescribe the fluid to be infused, and to prescribe the rate of infusion.
6. On long-distance transfers, be prepared to break the journey to obtain medical assistance if the infusion is not proceeding satisfactorily.
7. An air inlet must be used for glass bottles.
8. Ensure the container of intravenous fluid is changed when almost empty. Never allow the fluid to be replaced by air in the tubing.

PART C – MANAGEMENT OF INJURY

Chapter 11

Haemorrhage, Abdominal and Soft Tissue Injury

The circulatory system distributes oxygen and nutrients to body cells and removes their waste products.

The average blood volume in adults is 5 litres. The actual volume will vary from individual to individual with changes in weight, height, age and physical condition. Infants and children have consierably smaller blood volumes, e.g., an infant of 2-3 years has approximately 1 litre; a child of 10 has about 2.5 litres.

Blood is transported through the intricate network of the circulatory system and is normally confined within the blood vessels. If these vessels are damaged then the blood may escape in the process called bleeding or haemorrhage.

The speed and quantity of haemorrhage therefore has an importance that varies with the age of the injured person. Weight for weight, children tolerate blood loss badly and may die rapidly from what may be negligible bleeding in the adult. Haemorrhage may be internal or external, obvious or hidden.

CLINICAL SYMPTOMS AND SIGNS OF HAEMORRHAGE

SYMPTOMS:

may complain of faintness, light-headedness or giddiness
may complain of feeling cold and being thirsty
may give a history of blood loss in the immediate past

SIGNS:

pale, cold and clammy skin
sweating
rapid pulse, soon becoming feeble if bleeding is not controlled
low blood pressure
obvious haemorrhage from wound, mouth, bowel, urine, etc.
rapid breathing.
restless, anxious patient.

EXTERNAL HAEMORRHAGE

Blood from an artery is bright red in colour and is often noted to be spurting in time with the pulse.

Venous bleeding is dark red and is seen as a steady flow. It is not as dramatic as arterial bleeding, but the steady flow may be copious and dangerous if unchecked, e.g., as from a lacerated varicose vein.

When severe haemorrhage occurs, natural blood coagulation (clotting) may not take place due to the continual washing action of the blood and lack of natural tissue back-pressure. If this is not quickly rectified, blood volume and pressure will drop below a safe level. Profound blood loss causes a reduction in available blood flow to the brain, heart, lungs, kidneys, liver and other vital organs which cannot get sufficient oxygen to meet their needs.

CONTROL OF HAEMORRHAGE

DIRECT PRESSURE METHOD

1. Apply direct pressure to the bleeding part, preferably with a sterile dressing to provide initial control.
2. Cover completely with a sterile dressing. The use of dressings will assist natural clotting by trapping blood cells and protein within the meshes of the cloth as well as protect the wound from further infection and damage. For complete protection, the dressing must extend well beyond the wound edges.
3. Firm pressure must be maintained; conforming roller bandages exert firm even pressure and will do much to stop bleeding. Triangular bandages folded to narrow or broad forms may also be used with care. If blood seeps through, do not remove the initial dressing as this disturbs any formed clot. Apply a firmer bandage over the previous one.
4. If the wound is located on a limb, elevate the injury, as gravity will help to retard the flow of blood.
5. If the wound is near or involving a joint, it is necessary to completely immobilise the limb.
6. Treat for shock which always accompanies severe bleeding.

INDIRECT PRESSURE METHOD

When part of a limb has been severely mutilated it may be difficult to maintain control of haemorrhage by the direct pressure method. In this case a standard 6.5 cm (2.5") wide rubber constrictive bandage must be applied with sufficient tension to compress major blood vessels against the bone between the heart and the site of injury. Apply to thigh or upper arm.

Whilst a bystander or other assistants stem the flow by the direct pressure method,

1. unwind sufficient bandage from the roll to complete the initial locking turn;
2. progressively increase the tension with each turn. If the bandage is not tight enough it will only compress the veins and not stop the arterial flow. This increases the haemorrhage. If it is too tight, blood flow to the limb may be cut off;
3. insert two fingers at the second-to-last turn, and separate the bandage layers, allowing the final turn of the bandage to be locked;
4. cover the wound with sterile dressings;
5. record the time of application of the constrictive bandage and display this time on the patient;
6. transport the patient by stretcher, frequently checking the dressings;
7. never cover the constricting bandage;
8. do not release the bandage until directed by a Medical Officer.

On arrival at the hospital, INFORM THE DUTY MEDICAL OFFICER that a constrictive bandage has been applied.

INTERNAL HAEMORRHAGE

The possibility of internal bleeding must always be kept in mind in any injury to the patient. Some disease processes also cause major internal haemorrhage, e.g., peptic ulcers, aortic aneurysm, diverticular disease of the bowel.

Internal haemorrhage may be obvious (with discharge of blood from the mouth, bowel, urethra or vagina) or concealed.

The clinical signs and symptoms of internal haemorrhage (concealed or obvious) are the same as in external bleeding.

VISIBLE INTERNAL HAEMORRHAGE

Blood from any body orifice, with the exception of normal menstrual bleeding, provides a visible indication of a serious internal haemorrhage.

STOMACH

Recent bleeding into the stomach is indicated by vomited red blood. Blood that has been in the stomach for some time will resemble coffee grounds. Blood-flecked vomitus is less significant if there has been bleeding from the nose or mouth.

BOWEL

Blood from the bowel is usually passed with faeces and if originating from the upper bowel will have a black tarry appearance (melaena). Some medicines produce similar faecal appearance (e.g., iron tablets). From the lower bowel, blood is more normal in appearance.

URINE

Kidneys, bladder and urethra – blood is passed with the urine, giving it a smoky appearance. There may be a history of a blow to the back and early bruising may be seen. A pelvic fracture may cause damage to the bladder or urethra.

BLEEDING PEPTIC ULCER

A peptic ulcer is an ulcer involving the lining of the stomach or duodenum, and is caused by a comination of acid and digestive juices eroding the tissues of the stomach.

The inflammation which results causes pain – the best known symptom of peptic ulceration. If the ulcer goes untreated (or occasionally even with treatment) then complications may follow. The major complications are:

1. SCARRING AND OBSTRUCTION TO OUT-FLOW OF FOOD FROM THE STOMACH

This is called pyloric obstruction. The patient usually comes to medical attention with persistent vomiting of previously ingested food.

2. PERFORATION OF THE ULCER

When the ulcer penetrates through the whole thickness of the stomach wall the stomach is perforated and highly irritating stomach contents are spilled into the peritoneal cavity. These patients complain of a sudden onset of very severe abdominal pain.

3. HAEMATEMESIS AND MELAENA

In this situation the ulcer erodes a blood vessel wall and allows the artery (or vein) to rupture with often quite severe haemorrhage into the stomach. The blood may be vomited up (haematemesis) and is then either bright red, if it has not remained in the stomach long, or "coffee grounds", if it has been in the stomach for a while and has been altered by the digestive process. Clearly, coffee grounds vomitus indicates slower but not less severe bleeding. Melaena is blood which is passed through the intestine and has been emptied from the rectum as a black, tarry, foul-smelling semifluid mass, and again indicates severe bleeding.

MANAGEMENT

There may be a history of previous ulcer pain, indigestion, or previous bleeding, and the patient may well be taking medication to counter the acidity of the stomach. These patients should be treated as any with a severe haemorrhage. The amount of obvious bleeding seen by bystanders often belies a larger amount of concealed bleeding still inside the abdomen. The patient should be put at rest, reassured and transported to hospital at a rate depending on the severity of the bleeding as determined by pulse rate, blood pressure and skin colour. Severe shock requires urgent treatment so the hospital should be notified in advance. Nothing should be given by mouth during transport.

ABDOMINAL AND SOFT TISSUE INJURY

ABDOMINAL INJURY

This may be a closed or open injury.

CLOSED ABDOMINAL INJURY

The possibility of internal haemorrhage must always be kept in mind. Bleeding from the liver, spleen or other organs may be caused by a bruising, tearing force

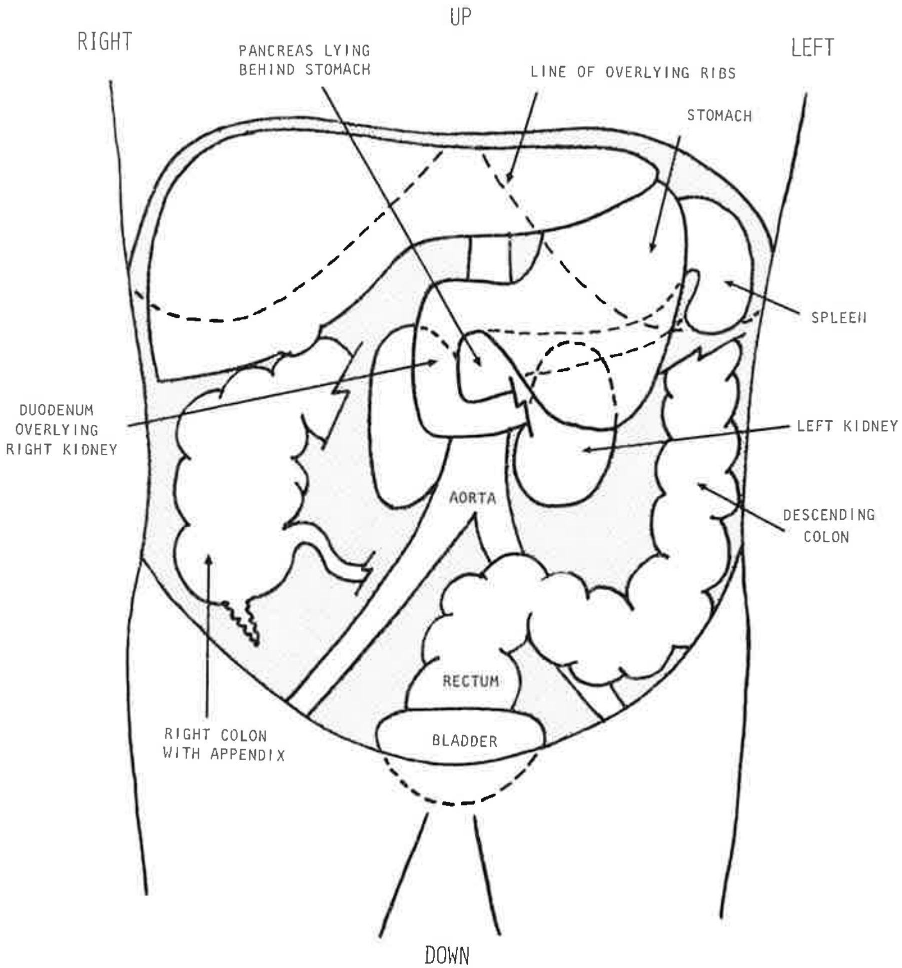


Figure 39 Abdominal Cavity Contents

that has ruptured one of these organs (Figure 39). The bleeding may be into the abdominal (peritoneal) cavity and may remain concealed. It is extremely dangerous and may prove to be fatal.

A history of a blow to the area, possible "winding" and a bruised or red, swollen, tender area may provide early indication. This, plus the physiological changes that accompany severe haemorrhage, are a warning to the Ambulance Officer.

RECOGNITION

1. History
   - seek a description of what happened or preceded the injury.
2. Signs
   - evidence of a blow to the area. Redness and swelling may precede bruising. Particularly check the region of the liver and spleen.
   - a rapid, feeble pulse
   - pale, cold, clammy skin
   - restlessness.
3. Symptoms
   - thirst, nausea, anxiety, pain.

OPEN ABDOMINAL INJURY

Incised wounds of the soft unprotected belly may cause exposure or protrusion of the intestines.

1. Do not touch or attempt to reduce the protrusions.
2. Follow the recommended rules for infection prevention.
3. Cover with a large sterile dressing. Unfold a universal dressing until it extends beyond the wound edges. If available, soak the dressing with sterile (intravenous) saline.
4. Secure the edges of the dressing to the skin with wide adhesive.
5. Do not give anything by mouth.
6. Knife and gunshot wounds may have only a small entry wound but be associated with a great deal of internal injury. These always need hospital treatment and should be treated as serious injuries. Remember to look for, and dress, the exit wound.

SUMMARY OF MANAGEMENT OF ABDOMINAL INJURY

1. Control any external haemorrhage.
2. Treat shock.
3. Do not disturb the patient unnecessarily.
4. Reduce pain, using Entonox, if necessary.
5. Administer oxygen if pain relief is not required.
6. Do not give anything by mouth.
7. Record blood pressure, pulse and respiration rates on several occasions and note the time at which these observations were made.
8. Transport promptly and smoothly.
9. Notify hospital in advance.

CARE OF A SEVERED PART

1. Place the part into a thin clear plastic bag without washing it. If available, add a small quantity of sterile (IV) saline solution.
2. Seal the plastic bag and make water-tight.
3. Put the bag into a second container of crushed ice or cold tap water. Do not pack the part in direct contact with ice or freeze it, as this may destroy tissue and make microsurgery impossible.
4. Convey the part and patient to the hospital.

OPEN SOFT TISSUE WOUNDS

Various degrees of soft tissue damage may occur, involving skin and muscle. These wounds are subject to contamination which leads to infection.

1. Do not touch the wound.
2. Do not breathe directly on to the wound.
3. In the emergency situation do not attempt to clean the wound with anything. Do not apply creams or lotions.
4. Check for other injuries, e.g., fractures.
5. Completely cover with a dry sterile dressing.
6. Bandage firmly. On limbs, a universal dressing may be secured with a conforming bandage spiralled around the limb.

SCALP AND FACE WOUNDS

The head and neck are well endowed with blood vessels and even small cuts may bleed profusely.

Remember that there may be an underlying fracture of the skull, cheek or other facial bones.

1. Examine the wound for small foreign bodies, e.g., glass. These can sometimes be removed by lightly brushing the wound with a dressing. If not, leave them for the Medical Officer.
2. Close the wound edges together with a dressing held tightly between thumb and fingers until haemorrhage is controlled.
3. For the scalp, cover with a universal dressing and maintain even pressure by a conforming bandage, roller or triangular bandage.

OPEN FRACTURES

Infection is a major complicating factor in open fractures, so the principles of infection control and prevention must be enforced to the highest possible degree. Haemorrhage control, however, is still the first priority.

1. Do not touch the bone fragments or ends.
2. Do not breathe directly on to the wound.
3. Surround and cover protruding bone with thick sterile dressings.
4. Retain in position with a suitable bandage. Refer to Chapter 12 for method of fracture immobilisation.

Chapter 12

Fractures

Fractures are among the most common injuries treated by Ambulance Officers. Two types are noted (Figure 40):

1. OPEN (COMPOUND)

These fractures are associated with a breach of the skin overlying the break, allowing micro-organisms to enter the fracture site.

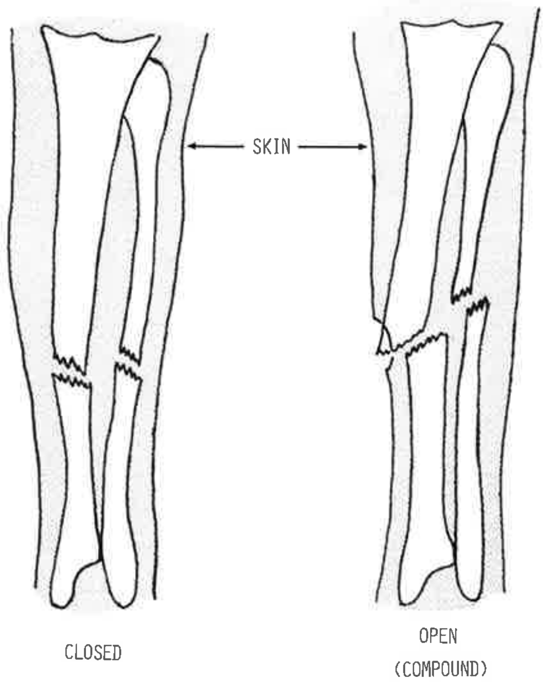


Figure 40 Basic Types of Fractures

2. CLOSED

There is no wound leading to the fracture site.
Fractures may also be –

(a) Stable

sufficiently supported (by impaction, muscle or ligaments) preventing free movement of one bone end in relation to the other.

(b) Unstable

the fracture ends move freely in relation to each other.

(c) Complicated

associated with injury to important surrounding parts such as artery, veins, nerves or internal organs.

(d) Uncomplicated

the injury is confined to bone.

SIGNS AND SYMPTOMS OF A FRACTURE

SYMPTOMS

pain
loss of power and/or function of the limb

SIGNS

swelling
discolouration (bruising)
tenderness
deformity
abnormal mobility and/or crepitus.

GENERAL PRINCIPLES OF FRACTURE TREATMENT

1. The first aim must be to immobilise the fracture to prevent further tissue damage. This may be modified if there is a threat to the life of either the patient or the Ambulance Officer.
2. In limb fractures, effective immobilisation must involve the joint above and below.
3. When in doubt, treat as a fracture.
4. If you must move a fractured limb, do so gently, keeping gentle but steady traction on the lower fragment to keep it in alignment and ease the pain.

5. When wooden or metal splints are used, avoid pressure on bony prominences by using adequate padding.
6. It is important to check repeatedly that the circulation has not been impaired by any bandage which may have been applied too tightly.
7. Many fractures require later treatment under general anaesthesia, so do not give the patient food or drink.
8. Oxygen must be given to patients with major fractures as soon as practicable. This reduces the incidence of major complications, e.g., fat embolism later in the hospital. Remember that Entonox contains 50% oxygen, a higher concentration than can be administered by face mask or nasal cannula.

Management of an airway always takes precedence over the treatment of a fracture.

INFLATABLE SPLINTS

Inflatable splints, correctly applied, are a quick and effective means of immobilising a fracture below the knee or elbow (Figure 41). Only those made of transparent plastic should be used, as they allow observation of the affected limb for changes in colour, etc.

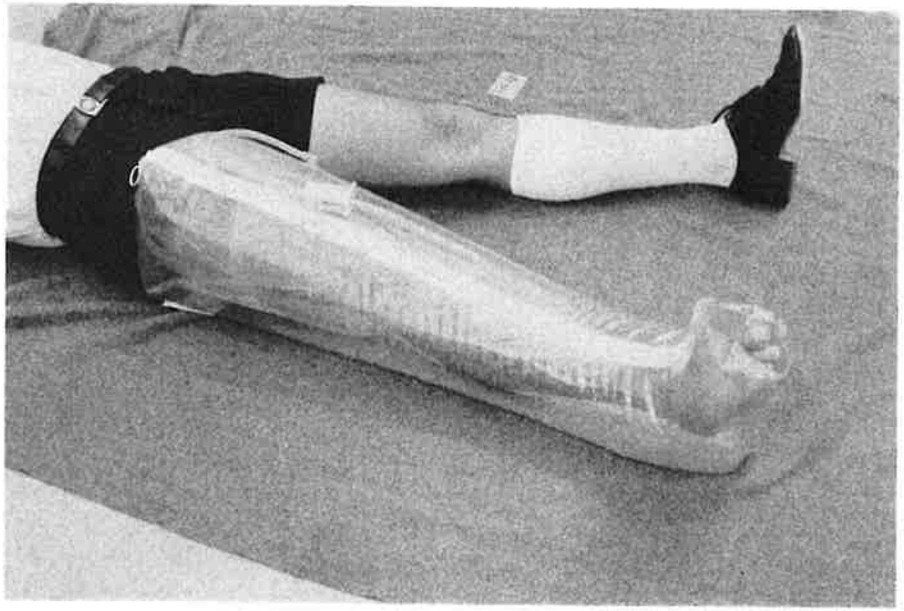


Figure 41 An Inflatable Splint

APPLICATION OF INFLATABLE SPLINTS

1. Select a splint of appropriate size to immobilise the joint above and below the fracture site. Use alternative methods of splinting if a sufficiently large splint is not available.
2. The splint should be applied directly over skin, if possible. Clothing should be removed to allow observation of the limb within the splint. Dressings should be used over any wounds.
3. A limb deformed by fracture may be straightened with gentle traction and the splint applied while the traction is maintained. Use pain relieving measures as required.
4. The amount of air in the splint is determined by the patient, if conscious, who should experience a feeling of comfort and support. Inflation should be by mouth and not mechanically, and always to the maximum comfort of the patient. Over-inflation may cause tingling or numbness, and change in colour of the limb.
5. Observe for accidental deflation of the splint, often associated with return of pain.
6. Splints can be left on until definitive treatment is undertaken by a Medical Officer. Once removed, they should be cleaned with soapy water, dried thoroughly and stored rolled to keep them free of cracks.

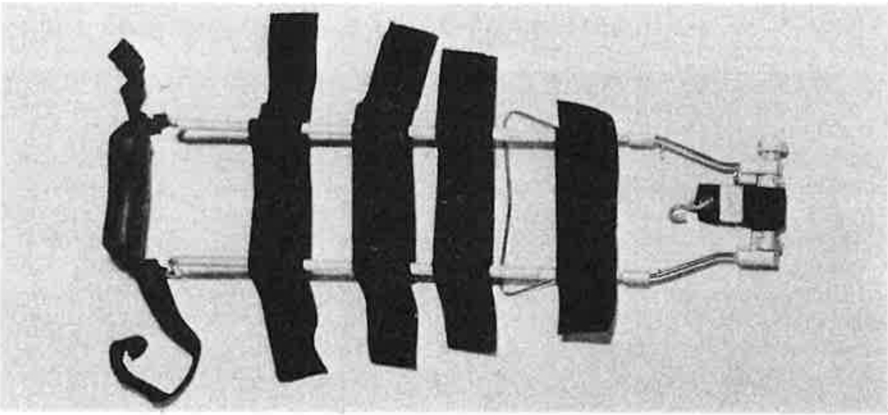
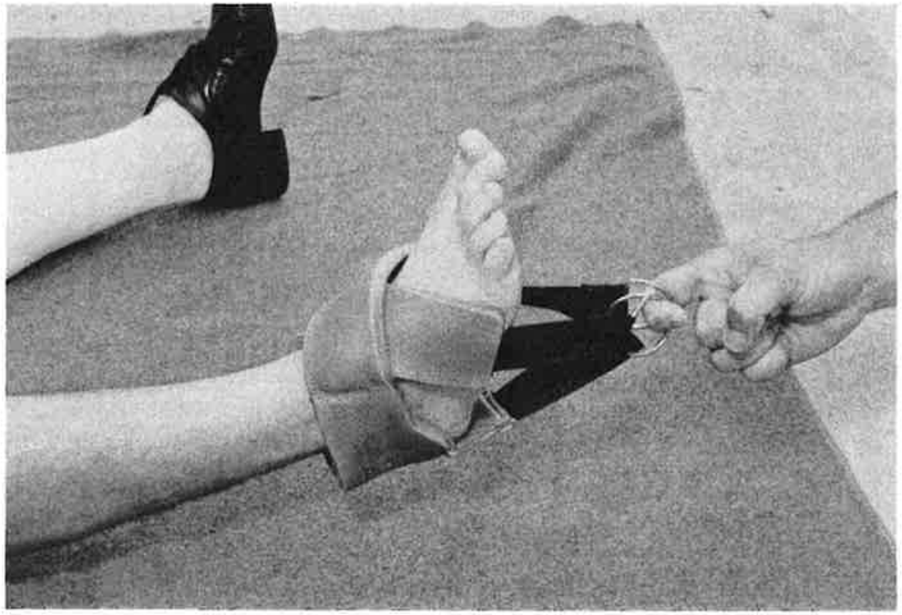


Figure 42 The Hare Traction Splint

HARE TRACTION SPLINT

This piece of equipment (Figure 42) can provide both splinting and traction for fractures of the lower limb. Quick fastening adjustable straps, ankle hitch and a mechanical tension device eliminate the need to fashion improvised splint beds or hitches.

It is designed for treatment of fractures of the femoral shaft, but may also be used for splinting fractures of the knee or upper third of the tibia and fibula, pro-



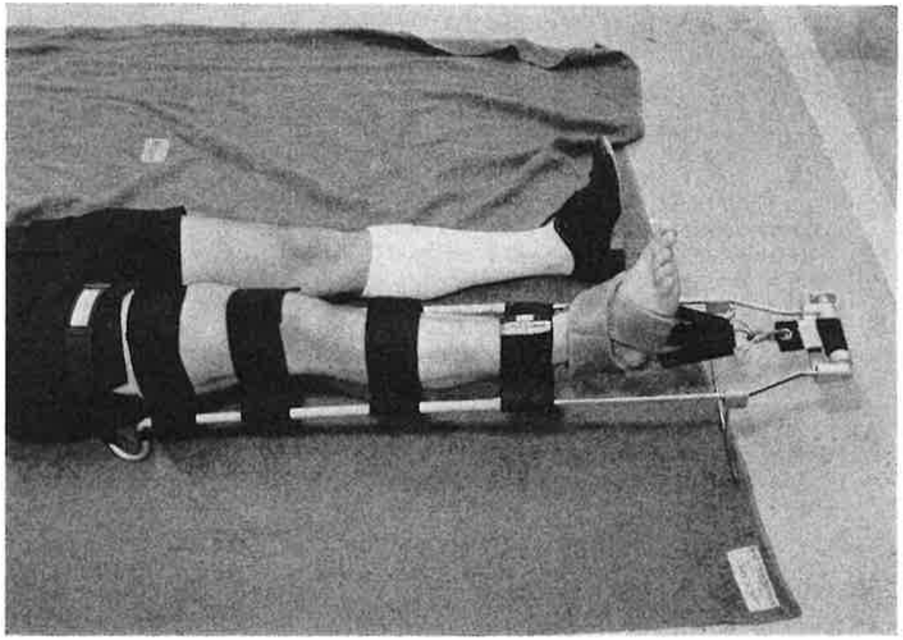


Figure 43 Hare Traction Splint Applied (a), (b)

vided that minimal traction is used (enough only to steady the leg within the splint).

The purpose of traction is not to reduce, but to align the fracture and effectively immobilise the bone ends to prevent further damage to the tissues. Traction splintage will ease pain (thus reducing shock) and help prevent additional nerve, blood vessel and bone damage.

APPLICATION:

1. Administer a suitable analgesic (e.g., Entonox). Explain to the patient what you are doing.
2. Steady, support and apply traction to the injured limb whilst the splint is prepared. Maintain traction by hand until the splint is applied.
3. Expose the limb as much as possible by cutting along seams of trousers, etc. Dress wounds. Loose-fitting shoes are best removed.
4. Place the splint parallel to the injured limb, unlock the collet sleeves, and adjust to the desired length, approximately 20-25 cm (8″-10″) beyond the foot.
5. Slide heel stand along the splint to about 15 cm (6″) from the foot and leave in flat position.
6. Position leg support straps (two above and two below the knee) and open out all straps.
7. Place tri-ringed ankle strap under the heel, padded side against the foot. The bottom edge of the strap must not extend beyond the edge of the heel. Cross the rings over the instep (Figure 43a).
8. Grasp all three rings, bottom ring first, and apply traction to align the leg, using a slow firm pull.
9. Steady the foot by placing one hand under the heel and support the fracture site. Maintaining traction and support, raise the limb slightly, allowing an assistant to position the splint under the limb. Ensure the ischial pad is placed just below the buttock. Fold down the heel stand until it locks into place.
10. Insert the S hook into the D rings and turn knurled knob to apply traction until the strap is firm.
11. Fasten all Velcro straps around the limb (Figure 43). Do not place straps over the site of a fracture. The Velcro straps are to hold the leg steady within the splint and do not need to be over tight. The traction from the ankle strap is the main support to the leg.
12. To adjust the splint, loosen collets slightly, and turn knurled traction knob until desired length is achieved. Retighten collets and move the stand into position approximately level with the ankle.
13. Constant observation should be maintained to ensure that circulation is not compromised by straps, dressing or bandages. If the splint is on for a long time, e.g., over 1 hour, adjust the Velcro straps to allow for swelling of the limb.

FRACTURES OF THE SKULL

These are classified in the same way as other fractures, but with the addition of the category "Depressed Fracture" (Figure 44). Bone is pushed inwards and may

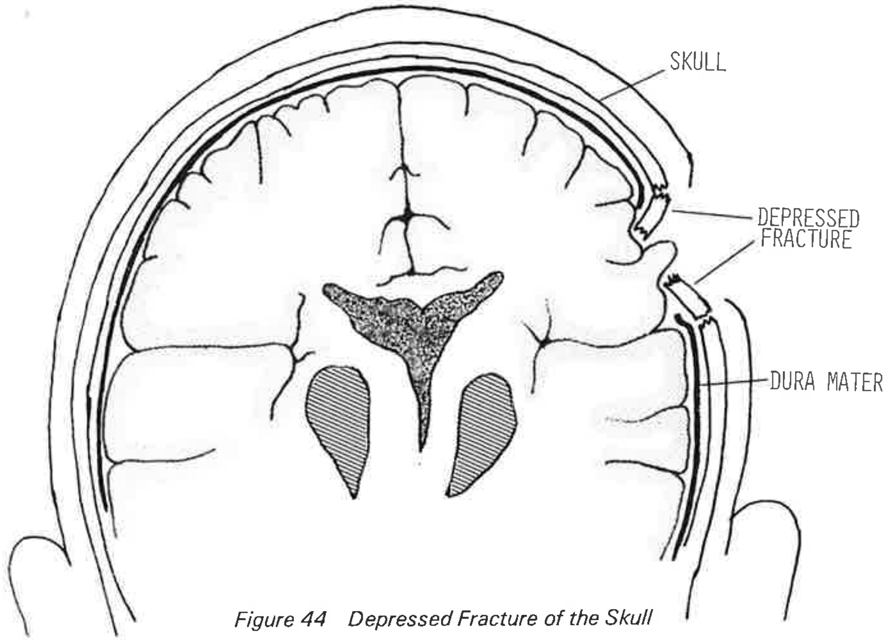


Figure 44 Depressed Fracture of the Skull

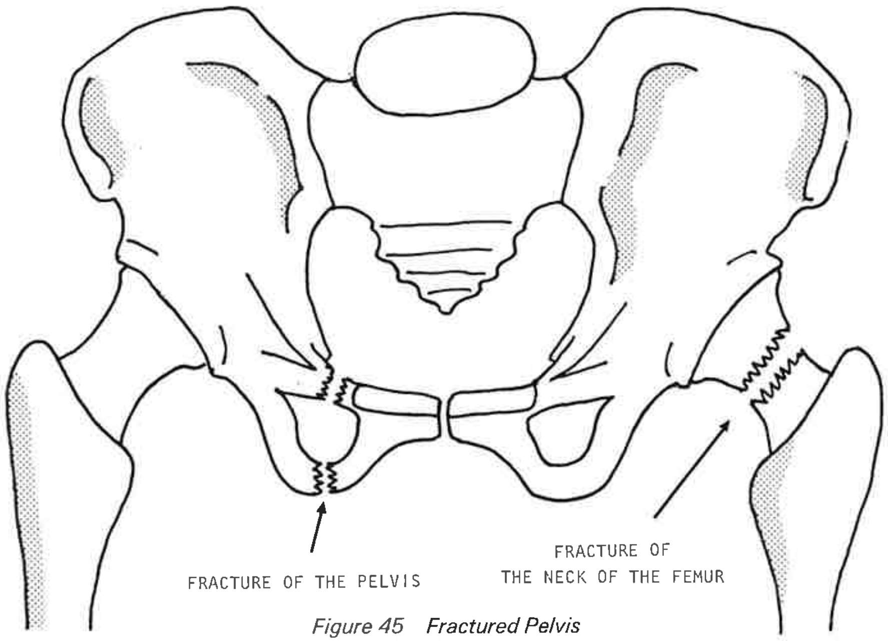


Figure 45 Fractured Pelvis

damage underlying cerebral tissue. Fractures of the skull bones are not in themselves serious, but the complications caused by damage to the underlying brain are often life-threatening.

Fractures of the base of the skull may be evident only by slight bleeding from the ear, or by the appearance of bilateral orbital haematomas (black eyes) or subconjunctival haemorrhages. The discharge of clear fluid from the nose (cerebro-spinal fluid) may be the only other sign of this serious injury to the astute observer.

FRACTURES OF THE PELVIS

Commonly relatively minor injuries, fractures of the pelvis (Figure 45) can cause serious complications. They are usually caused by severe direct injury, or by violence transmitted through the femur.

Two types of fractures are seen:

(a) Isolated fractures not destroying the integrity of the pelvic ring.
(b) Fractures with disruption of the pelvic ring.

COMPLICATIONS

Rupture of the bladder
Rupture of the urethra
(In these complications the patient may have an intense desire to pass urine, but cannot, or passes only a small amount of blood. The desire to pass urine is due to urethral trauma and not necessarily to a full bladder. Calm the patient and explain this.)
Injury to major blood vessels with considerable loss of blood, shock.
Injury to rectum – a very rare possibility.

TREATMENT

The same general principles of fracture management apply. Take care to immobilise the pelvis before moving the patient to a stretcher. He should not be allowed to walk.

FRACTURES OF THE SPINE

The spinal cord, which contains nerve fibres in direct connection with the brain, is enclosed and protected by the spinal column, which consists of the vertebrae and associated muscles and ligaments.

If the spine is fractured at any point, the spinal cord may be crushed, cut or otherwise damaged, with resultant paralysis and death. Any twisting or bending of the spine, whether occurring in the original accident or in subsequent handling, is likely to cause permanent damage to the spinal cord.

COMMON CAUSES OF A FRACTURED SPINE

1. *Cervical Fractures:*
   whiplash injuries
   diving into shallow water
   falls from a height onto the feet (often with other fractures)
2. *Lower or Mid-Back Fractures:*
   falls from heights, especially if onto solid objects
   direct force, e.g., heavy weight across back
   impact, as in vehicle collision

RECOGNITION OF SPINAL INJURIES

The conscious patient can assist with the diagnosis by indicating –
(a) pain at the site of fracture
(b) tingling and numbness in the limbs
(c) loss of function, e.g., paralysis
(d) loss of sensation.

Remember that a spinal fracture does not always injure the spinal cord, so the patient is not always paralysed. The only indication of a fracture is often local pain

Figure 46 The Four Widths of the Medishield Cervical Collar

Figure 47 Cervical Collar in Use, (a) and (b)

and tenderness. If in doubt, treat as a spinal fracture. Prepare the patient for transport to hospital without further damage to the spine.

MEDISHIELD CERVICAL COLLAR

This collar is designed to support and immobilise the cervical spine without pressure on the patient's trachea. The collar can be adjusted for length of neck by folding, as shown in Figure 46, providing four different widths. The Velcro fastening enables the collar to be used on necks of various thicknesses.

The main aim in dealing with patients with suspected cervical spine injuries is to ensure that no further damage is caused to the spinal cord or spine during extrication from wreckage or transport to hospital. It is possible for a patient who has suffered a severe head injury to be also suffering from a cervical spine injury. This may not be obvious, particularly if the patient is unconscious. The cervical collar should always be used where and whenever there is a possibility of neck injury.

APPLICATION

(a) Ensure support of head and neck (Figure 47a)
(b) Select appropriate collar width
(c) Mould collar to suit circumference of neck (Figure 47b)
(d) Secure Velcro strapping at back of neck.

The cervical collar will not interfere with subsequent hospital treatment (X-rays will pass through) and should not be removed once applied.

LIFTING A PATIENT WITH SPINAL INJURIES (LYING)

When the patient is already lying down and is in a clear space, apply a cervical collar and use one of the following methods of lifting:

(a) The lift described in the St. John First Aid Manual.
(b) Jordon lifting frame.

Note that the blanket lift is only used for minor skeletal injuries, and not for suspected spinal injury.

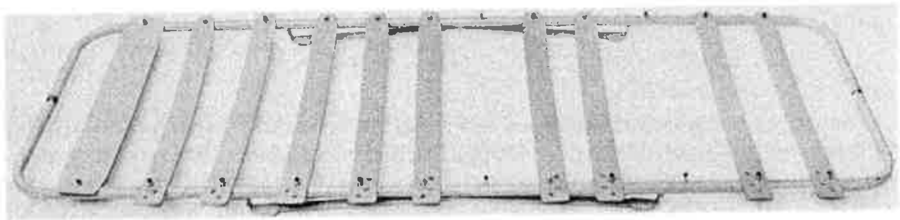


Figure 48 The Jordon Lifting Frame

JORDON LIFTING FRAME

This frame can be used to lift an injured person from the ground, using only two lifters and without causing any bending or twisting of the patient's spine.

The split frame is made of light tubular steel to standard stretcher measurements. Twelve spigots are evenly spaced on the upper edge of each side of the frame to allow for the attachment of the 10 gliders (Figure 48). The same frame is kept slightly off the ground by small legs on each side. There is a broad glider for the head end. The gliders are stored in a vinyl carry bag (Figure 49).

Figure 49 Carry Bag for Jordon Lifting Frame Glides

The two halves of the frame can be put together around the patient or the frame can be pre-assembled and then lowered over the patient. The first spigot should be in line with the patient's ear. Should the patient exceed 180 cm (6 feet) in length, his feet (never his head) should extend over the frame.

Starting at the head end, gliders are passed under the patient and clipped at the single-holed or tapered end to the nearest spigot. The gliders are then tensioned and the most appropriate of the four holes at the non-tapered end are placed over a spigot.

Having ensured that all gliders are firmly attached, the frame can be lifted and placed on a standard stretcher. The patient may remain on the Jordon frame during transport to and within the receiving hospital.

EXTRICATION OF A PATIENT WITH SPINAL INJURIES (SEATED)

Ambulance Officers are often faced with the problem of removing an injured, sitting patient from a crashed car. If spinal injuries are suspected, a short spinal board and a cervical collar should be applied to the patient before any attempt is made to lift him from his vehicle.

SHORT SPINAL BOARD

This board is illustrated in Figures 50 and 51. It is constructed of polished wood and has two belts of different colours attached to the back. These belts can be cleared from the front or body contact side of the board during application. The head section has a series of retaining grooves for attachment of the head-securing bandage.

Figure 50 Front of Short Spinal Board

Figure 51 Back of Short Spinal Board

APPLICATION:

1. Explain to the patient what you are about to do.
2. Steady and support the patient's head and neck, avoiding any forward or backward bending of the neck.
3. Loosen clothing from about the neck.
4. Apply a cervical collar. This should be applied even if the fracture is suspected lower down on the spine.
5. The spinal board is now gently manoeuvred in behind the patient.
6. The patient's head is supported against the upper portion of the board by a triangular bandage tied off at the front.
7. The buckle end of the belt is passed over the patient's shoulder on each side. The lower belt on each side is passed over the hip, between the legs, and around the upper portion of the patient's thigh again, then up to the opposite shoulder (Figure 52).
8. Belt ends of the same colour are then connected together at the front of the patient and shortened until they fit firmly.
9. Bandages are placed around the patient's knees and ankles to immobilise his legs.
10. The patient, secured to the board, can now be moved to a waiting stretcher.

MOVING PROCEDURE:

1. If removing a patient from a car, first apply the spinal board and then gently rotate the still sitting patient until his feet are pointing towards the door through which he is to be moved.
2. Slowly lower the patient backwards until he is lying on his back. At the same time bend his legs up to prevent any discomfort from the securing belts.
3. Moving only small distances at a time, lift the patient slowly towards the exit door.

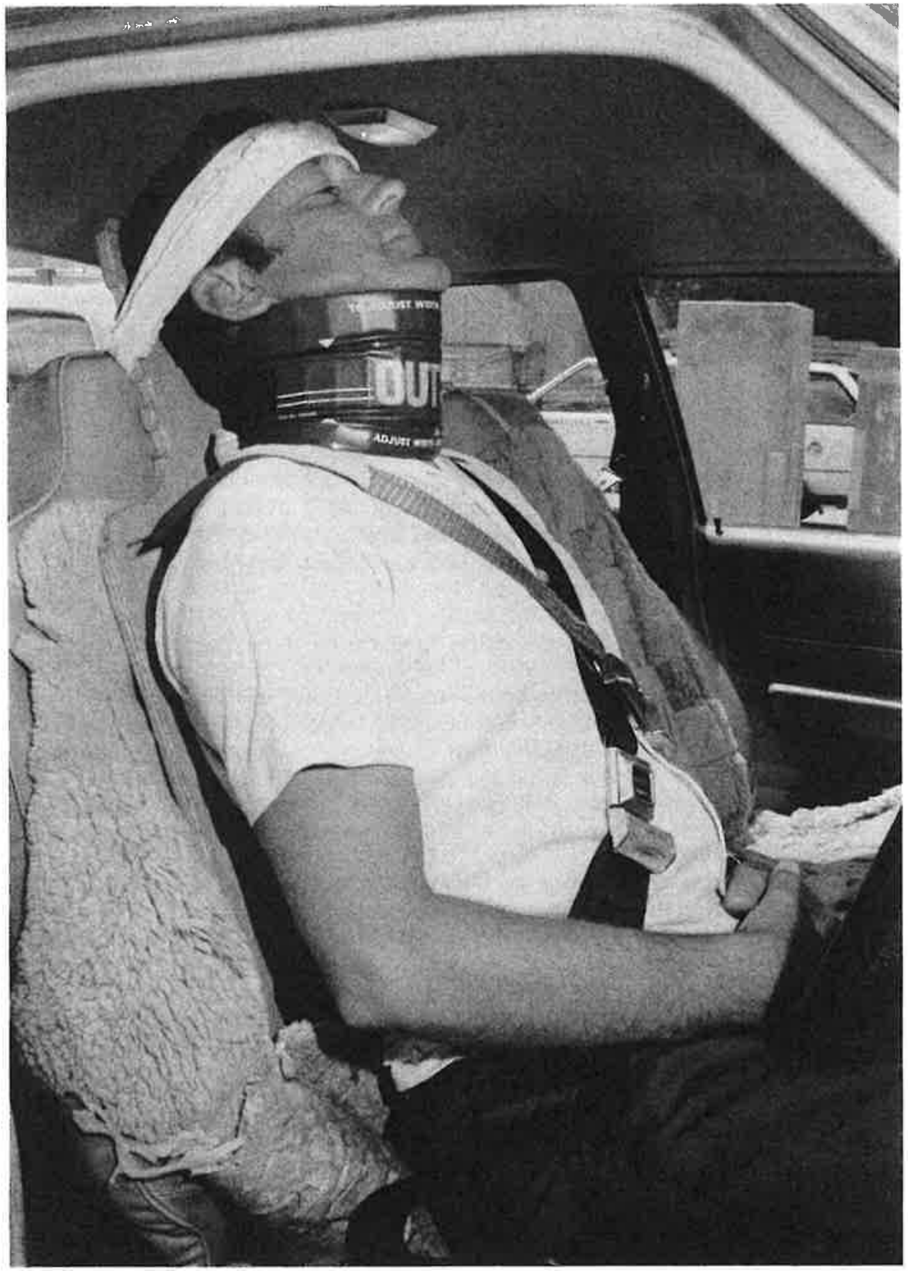


Figure 52 Patient Secured to Short Spinal Board

Figure 53 Placing Patient with Short Spinal Board on Stretcher

4. Never attempt to:
   (a) lift when the board is vertical,
   (b) pull the patient, or
   (c) slide the board across the car seat, as these attempts will move the board either up or down the patient's back.
5. Remember to keep the patient's legs bent and head lowered.
6. Once on the stretcher the buckles can be released and the patient's legs slowly straightened (Figure 53).
7. If unconscious, the patient can be placed on his side before the buckles are released.
8. Normal blanketing and securing of the stretcher is carried out.
9. The board should remain in position on the patient until after a Medical Officer has examined him. Always ask the attending Medical Officer for permission to remove the board from the patient.

Efficient use of the short spinal board requires practice and team work. The great advantage of this method, however, is that it virtually eliminates the risk that a patient's spinal injury may be made worse while he is being extricated from a crashed vehicle.

Chapter 13

Burns

A burn refers to the damage caused to the skin and sometimes deeper structures by heat (flame, scald, contact, electricity), chemical agents or radiation (solar or nuclear). The basic damage to the skin is dependent upon the temperature of the heat source and the length of time that the tissues are exposed to it, irrespective of the nature of the insult.

Approximately 60% of burns are sustained at home and only 15% occur whilst at work. Flame burns from open fires, barbecues, incinerators, etc., account for approximately 40% of burns encountered. The majority of these will be in adults. Scalds from cups, saucepans, baths, teapots, car radiators, etc., account for a similar number, but in these the majority of patients will be children.

Injuries to the respiratory tract in association with burns occur most frequently in those burns which are sustained in a closed space such as house fires, industrial plant explosions, etc. However, respiratory tract damage can be seen in patients burnt in open areas.

Respiratory burns may produce respiratory distress due to lung damage, or due to oedema of the face and neck.

CLASSIFICATION

Burns may be classified according to a number of factors: the percentage of the body surface area which is burnt, the depth of the burn, the age and general condition of the patient.

AREA OF BURN

The larger the burn the more fluid will be lost from the circulation, with a consequent greater risk of shock. An estimate of the body surface area which has been burnt can be made by using the rule of nines (Figure 54). For smaller areas it can be assumed that the patient's open hand represents 1% of the patient's body surface area.

DEPTH OF BURN

On occasions it is difficult for even the most experienced person to accurately assess the depth of a burn. They may be divided into three types; superficial, deep dermal, and full thickness.

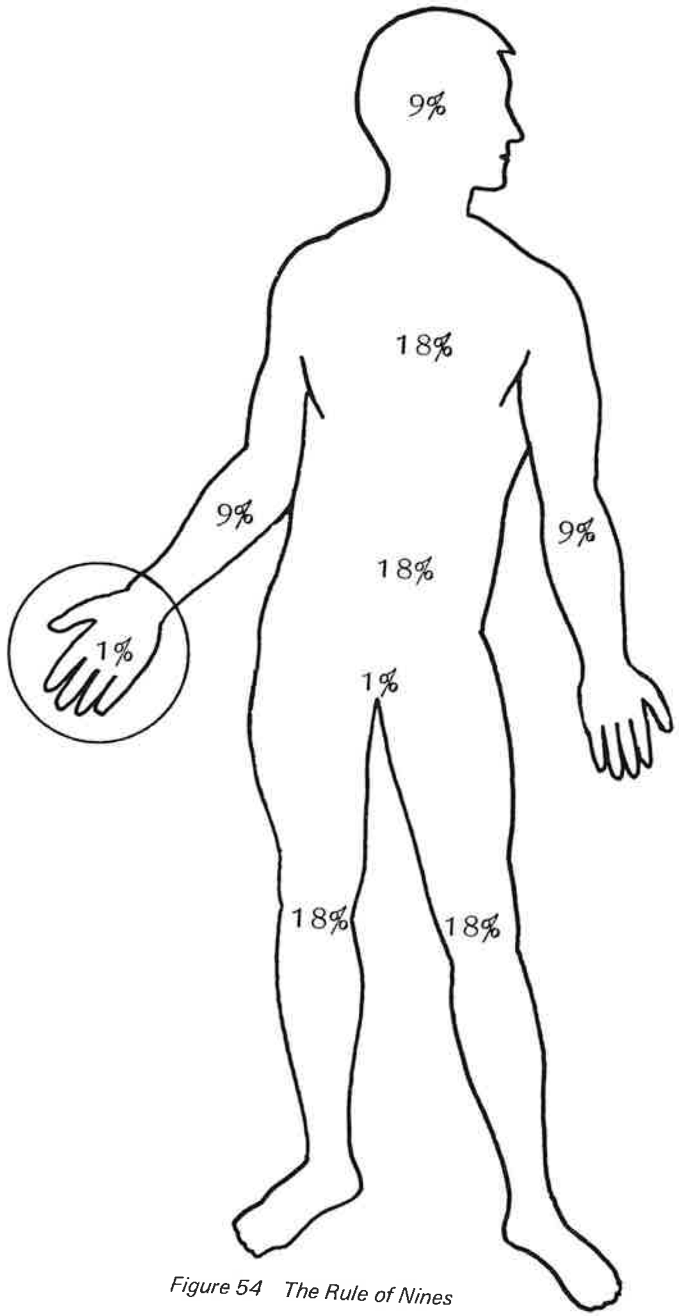


Figure 54 The Rule of Nines

Superficial burns involve only the outer layers of the skin. They are often caused by hot liquids or flash injuries. They are frequently red and blistered, but will heal quickly. Severe sunburn, with its blistering, is an example of this type.

Deep dermal burns extend almost right through the skin. In places they may be full thickness. They may only have patchy areas of sensitivity. Such burns can heal spontaneously, but will take some weeks to do so.

In full thickness burns the injury extends throughout the entire depth of the skin. They appear white or brown and are leathery to touch and are insensitive. These generally require some form of skin grafting.

AGE OF PATIENT

Children and the elderly do not tolerate burns as well as other age groups.

EVALUATION

MORTALITY

There is a relationship between area of body surface burnt, age, and mortality.

SEVERITY

Any burn having an area greater than 1% of the body surface area, any full thickness burn, and any burn involving the face, hands, feet, or perineum, should be considered with concern. Electrical burns are frequently full thickness and more serious than first thought, and all such burns should be seen by a Medical Officer.

NEED FOR INTRAVENOUS THERAPY

Any child in whom the burn is greater than 10% of the body surface area, or any adult in whom the burn is greater than 15% of the body surface area will require intravenous therapy.

ACTION

It is apparent that to decrease the severity of a burn it will be necessary to either decrease the temperature of the burning agent or to decrease the time for which the skin is exposed to that agent.

IMMEDIATE

In the case of flame burns, to douse the patient with cold water, if it is immediately available, will serve to extinguish any flames. If water is not immediately available, flaming clothing should be extinguished by forcing the patient to the ground and smothering the flames. Smouldering clothing should then be removed as quickly as possible. Removal of burnt clothing that is adherent to the burn is not necessary as it acts as an efficient sterile dressing.

Similarly, with scalds, the immediate application of copious amounts of cold water, if this is available, is of great value. In any case, clothing saturated with hot fluid should be removed as quickly as possible.

In the case of electricity burns, all those precautions associated with electrocution need to be observed. The problems of any associated cardiorespiratory arrest will take priority over the burn wounds themselves. It should be remembered that there are usually burns at both the site where the electric current entered the body, and where it escaped from the body.

Any caustic chemical in contact with the skin should be removed as quickly as possible. Impregnated clothing should be removed, and the underlying skin washed with copious amounts of water. People providing such first-aid should ensure that they themselves are not being exposed to the same danger.

ROLE OF WATER COOLING

Water, when immediately available, has a great application in the immediate care of burns. The continued application of cold water decreases the amount of pain and swelling associated with the burn, and some claim that the severity of a burn is thereby lessened. Limbs or digits are most suited to immersion in cold water. It is recommended that the limb be immediately immersed in water at 15–25°C for 10 minutes, and then for 30 minutes at 25–30°C. Cold compresses may be applied to the face or trunk, and these will need frequent replacement. Such treatment for more than 30 minutes after the burn is of doubtful value. It should not be used during transportation.

The use of ice, ice-cold water, or immersion of larger areas for more than a few minutes is dangerous. Digits may be badly affected by the cold and hypothermia may result when large areas of the body are cooled. This applies particularly to infants and children.

CARE OF BURN SURFACE

Any loose material, charred clothing, etc., which can be easily removed, should be removed. Blisters should be left untouched. The entire burnt area should then be wrapped in a sterile burn dressing.

It is best to avoid any form of local application or dressing material which may have loose fibres. In the absence of sterile burn dressings, a clean linen sheet is an acceptable alternative.

Burns of the face are best left exposed. A bulky dressing covering the nose or mouth may be a threat to life if vomiting occurs.

TRANSPORT

In the majority of situations it will not be necessary to transport the patient any great distance. However, on occasions, long distances will need to be covered and transport may be either by road or air. Preferably transportation should take place within the first four hours after the burn injury. Often transport to a local hospital for intravenous insertion, nasogastric tube, etc., by a Medical Officer is only the first step in getting the patient to a Burns Unit in a major hospital.

FLUID REQUIREMENTS

It has already been indicated that burns of large surface areas will require intravenous therapy. If it can be predicted that the transport time to hospital will be greater than one hour, an intravenous infusion should be set up before the trip is commenced. Bladder catheterisation may also be necessary. Fluids given orally may be tolerated, and will also help to replace fluids which will be lost from the burnt area.

POSTURE

Swelling is a natural consequence of a burn, and burnt limbs must be elevated. Any potential constricting agent, e.g., rings, watchbands, bracelets, etc., should be removed. If the burns involve the head and neck, the patient should be transported in the sitting position.

PAIN RELIEF

The amount of pain experienced in association with burns is variable. Superficial burns may be very painful, and yet deeper burns, where nerve ends are destroyed, may be surprisingly pain-free. In the context of ambulance transport, Entonox can give good pain relief. In severe burns there is an increased demand for oxygen, and this should be administered if pain relief is not required. Remember that Entonox contains 50% oxygen, a higher concentration than can be administered by face mask or nasal cannula.

WARMTH

Body fluid exuding from the burn onto the skin surface, if exposed to draughts will evaporate with a marked cooling effect. This will be prevented by an adequate dressing. The surroundings, if possible, should be pleasantly warm and, if airconditioning is not available to achieve this, a space blanket may be of some use.

AERIAL TRANSPORT

In addition to those factors concerned with road transport, changes in altitude will affect oxygen pressure and may result in expansion of air within the body, e.g., in the stomach. A nasogastric tube will overcome this latter problem.

LIAISON

A radio consultation with the hospital should be made. The hospital to which the patient is being transported should be advised of the nature and surface area of the burn, the age of the patient, and the expected time of arrival.

Chapter 14

Eye Injuries

The eye is a delicate organ and is protected by the eyelids and the bony orbit (Figure 55). Eye injuries may be classified as follows:

1. Mechanical
2. Burns
   - Thermal
   - Chemical
   - Radiation

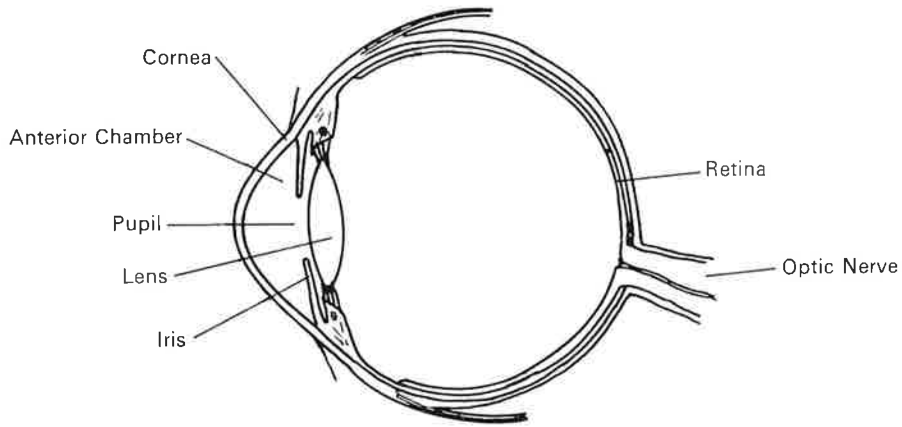


Figure 55 Anatomy of the Eye

MECHANICAL

EYELIDS

The intact eyelids are essential for the proper function of the eye. They are sensitive and close quickly when injury is threatening. Extensive haemorrhage into the loose tissue as the result of contusion or laceration may close the lids ("black eye"), making examination difficult and possibly masking full-thickness penetration or other serious injury to the eye.

Figure 56 Eye Pads in Place

Treatment consists of gentle and careful inspection, followed by the application of 2 sterile eye pads kept in place by strapping, as in Figure 56.

CONJUNCTIVA

The delicate membrane covering the inside of the lids and the outside of the white of the eye (sclera) can be abraded, lacerated or contused. It may swell considerably, concealing foreign material or lacerations. When chemical injury or foreign material is suspected, irrigation by sterile saline is the treatment of choice, and where possible, all particles should be removed as quickly and as gently as possible. Any particles adherent to the cornea should be left strictly alone.

CORNEA

Abrasions to the cornea or "clear window" of the eye are extremely painful and are best treated by applying pads to both eyes (Figure 57). This keeps both eyes motionless and comfortable, but such double padding may disorientate the patient so that reassurance and extra care is essential.

Full-thickness lacerations, or penetration by particles of steel or other foreign material may allow fluid from the eye to escape, and result in the collapse of the eye or even allow protrusion of the contents. Serious injuries such as these should also be treated by padding both eyes carefully, using sterile eye pads, before admission to hospital.

IRIS

The iris, which gives the distinctive colour to a person's eye, is a light-sensitive diaphragm which is very well supplied with blood vessels. Injuries to the iris bleed

Figure 57 Double Eye Pads in Place

easily and blood may appear in the anterior chamber (hyphaema). Treatment requires hospitalisation, but keeping the patient quiet and rested in double eye pads may prevent further haemorrhage. Double eye pads to both eyes are necessary to restrict eye movement and prevent constriction of the pupils.

Local injury to the iris may cause the pupil to enlarge and become sluggish or non-reactive to light. Some hours after an injury to the eye the pupil may be constricted. These facts are worth remembering when a head injury co-exists with an eye injury. When recording pupil size, mention of local injury to an eye, if it exists, will prevent misleading conclusions of intra-cranial complications.

LENS

Any injury to the lens results in this delicate structure becoming opaque and white. This is called a traumatic cataract.

POSTERIOR CHAMBER

Injuries to structures behind the lens are unlikely to be apparent to the Ambulance Officer, but if the patient complains of blurred vision, shadows, flashing lights, black spots, or smoky vision, damage to the retina should be suspected, and the patient kept lying down and at rest until transferred to medical care.

BONY ORBIT

A blunt injury to the eye from a fist, tennis or cricket ball, or some similar sized object may create high pressure within the bony socket or orbit, sufficient to fracture the thin walls or floor. In such an injury, delicate supporting tissue or even eye muscle may become trapped in the fracture, causing limitation of eye movement. The patient will complain of double vision, and serious injury to the eye itself may also be present. Once again, treatment consists of careful dressing with double eye pads and careful transport to hospital.

BURNS

These may be caused by chemicals, heat, or radiation, and primarily affect the lids, conjunctiva and cornea.

The treatment of chemical burns, whether acid, alkali, or other, is to use copious running water as soon after injury as possible, to wash out all the particles, then cover the eye and transport the patient to medical care.

Figure 58 Eye Irrigation

SMOKE-AFFECTED EYES

Smoke causes irritation to the eyes and frequently small carbon particles and dust need to be removed by irrigation, preferably using sterile normal saline supplied in packs by Ambulance Stores (Figure 58). Large numbers of patients may need treatment, for example, at the scene of a bushfire, and this is done conveniently and quickly if the patients are asked to lie down, side by side.

RADIATION BURNS

Arc-welding flash burns are a common occurrence in which ultra violet radiation destroys superficial cells of the cornea. The patient typically feels no effect for some hours after exposure, but pain is extreme and examination is made difficult by the patient's inability to open his eyes.

Treatment consists of the application of double eye pads and transport to medical care.

Patients with eye injuries require a great deal of reassurance, gentle handling, sterile eye pads and transportation to medical care, lying flat as stretcher patients, preferably using one soft pillow for the head. Never allow a patient to lie on the side of an injured eye unless he is in a life-threatening state. It must be stressed that the eye must be covered with extreme care.

Chapter 15

Shock

An appreciation of shock requires an understanding of the anatomy and physiology of the cardiovascular system, which is described in Chapter 17.

The peripheral vascular system is a system of blood vessels that delivers oxygenated blood from the heart to the tissues, and returns deoxygenated blood from the tissues to the heart. Cardiac output, the amount of blood ejected from the heart each minute (about 5 litres at rest), depends on the amount ejected each beat (stroke volume) and the heart rate. The stroke volume in turn depends, among other things, on the amount of blood in the heart at the time it contracts. Two main factors determine this; the amount of blood in the blood vessels, and the size of the blood vessels. For practical purposes, tissue blood flow depends on a functioning heart, an adequate blood volume, and the ability of the peripheral blood vessels to alter their size in response to changes in activity of the sympathetic (autonomic) nervous system. A major defect in any of these three factors may cause inadequate tissue blood flow, or shock (Figure 59).

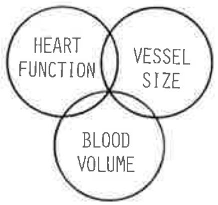


Figure 59 The Three Cornerstones of the Circulation

DEFINITION OF SHOCK

Shock is a term with many meanings, but in the strict medical sense, shock is a condition characterised by an acute reduction in the blood supply to vital tissues. There is a decrease in cardiac output and a fall in blood pressure. As a result, tissues do not receive adequate supplies of oxygen and nutrients. Waste products of cellular metabolism may not be effectively removed and this in turn can cause complex and irreversible changes in body physiology.

To counteract the fall in blood pressure, medium and small blood vessels constrict. This vaso-constriction produces a further fall in tissue oxygen levels and a rise in acid waste products. This leads to tissue acidosis and further cell damage.

TYPES OF SHOCK

1. HYPOVOLAEMIC

This is a common form of shock in which there is insufficient blood to fill the blood vessels, i.e., the heart has not got enough blood to pump. It occurs in association with –

(a) Severe external or internal haemorrhage. The patient with severe multiple injuries – chest, abdomen, pelvis, legs – is always shocked.
(b) Loss of plasma at the site of burns or crush injuries.
(c) Loss of fluid from the gastrointestinal tract, as in diarrhoea and vomiting.

2. CARDIOGENIC

This term refers to shock caused by inadequate functioning of the heart. Circulation of the blood throughout the vascular system requires the repeated action of normal heart muscle. When muscular impairment occurs, as in myocardial infarction, the heart no longer functions well and may be unable to impart sufficient force to drive blood through the system. In this type of shock the heart is overloaded with blood, but cannot pump.

3. NEUROGENIC

Paralysis of nerves after spinal cord injuries may cause neurogenic shock. Normally, blood vessels are controlled by the sympathetic nervous system, and if this is damaged, blood cannot then fill the enlarged vessels, circulation fails and shock ensues. As in hypovolaemic shock, the heart has not got enough blood to pump.

4. SEPTIC

Severe infections may cause myocardial damage, vessel dilatation and loss of fluid from blood vessels. In this type of shock, there may be an element of inadequate filling of the heart with blood, and an element of cardiac failure. In addition, the tissues cannot utilise oxygen effectively.

5. ANAPHYLACTIC

This type of shock is different from those discussed above and occurs when an individual who is sensitive to a substance comes into contact with it and reacts violently to it. Anaphylactic shock is the most severe form of allergic reaction. There is widespread vessel dilatation and loss of fluid from vessels. Skin may be flushed. Associated features may be swelling of the face, wheezing.

Examples of substances which may cause allergic reactions can be grouped as follows:

Injections
- tetanus anti-toxin, penicillin and other drugs.
- bee stings.

Ingestion
- berries, shellfish, some medicines.

Inhalation
- pollen or dusts to which the patient may be sensitive.

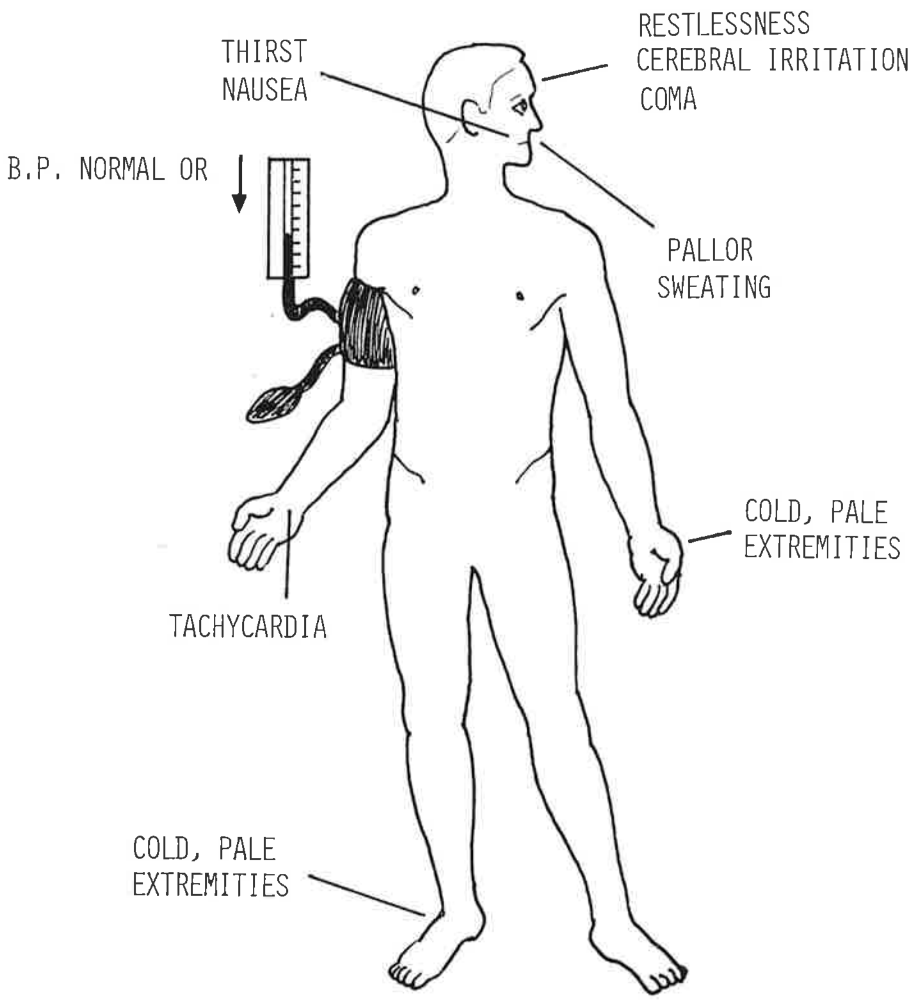


Figure 60 The Shocked Patient

RECOGNITION OF SHOCK (Figure 60)

1. Pale, cold, clammy skin (but may be flushed in anaphylactic shock).
2. Sweating.
3. Faintness or giddiness.

4. Impaired level of consciousness.
5. Nausea or vomiting.
6. Thirst.
7. Rapid feeble pulse.
8. Lowered blood pressure.
9. Rapid respiratory rate.

Note that all these may not be present at once. A young person who has multiple fractures with extensive blood loss may be pale, cold, clammy and confused, but his cardiovascular system may have responded well enough to stop his blood pressure falling. However, he is still in a state of shock, and requires urgent treatment.

MANAGEMENT OF SHOCK

1. Lie the patient down and reassure him.
2. Establish an adequate airway.
3. Ensure effective ventilation.
4. Control severe bleeding.
5. Administer oxygen.
6. Re-check airway and respiration.
7. Splint fractures.
8. Relieve pain, using Entonox, which contains 50% oxygen.
9. Carefully load onto stretcher.
10. Prevent loss of body heat.
11. Elevate the lower limbs from the hips (except in Cardiogenic Shock).
12. Recheck airway and respiration.
13. Transport.
14. If there will be delay in transport, establish radio communication with hospital.

FURTHER MANAGEMENT IN HOSPITAL

In **hypovolaemic** shock, urgent intravenous fluid administration is required. This is commenced at the scene if shock is obvious, or transport will be delayed. If transport time will be short, intravenous fluids may be left until they can be given in hospital. In a patient with multiple injuries, the whole blood volume may need to be replaced, requiring several intravenous infusions.

In **cardiogenic** shock, intravenous fluids are not given because they will produce cardiac failure. The legs are not elevated, because the heart cannot cope with the increase in venous return.

In **neurogenic**, **septic** and **anaphylactic** shock, intravenous fluids are given. In addition, drugs such as adrenaline are given to cause the blood vessels to constrict.

CONSEQUENCES OF UNTREATED SHOCK

Untreated shock may cause death from tissue hypoxia. It may also result in damage to the lungs and kidneys, which take weeks to recover. That is why shock should be suspected, detected, and treated early.

PART D – MEDICAL DISORDERS

Chapter 16

Respiratory Failure

The main function of the respiratory system is to get oxygen from the atmosphere into the blood and to remove carbon dioxide from the blood to the atmosphere. To achieve this, a person requires an intact respiratory centre, cervical spinal cord, nerve supply to respiratory muscles, functioning muscles, intact thoracic cage, intact pleural spaces, open airways and normal lung tissue. If any part of this complex sequence fails, the cells throughout the body suffer oxygen lack within minutes, and the more sensitive cells (as in the brain) begin to die.

Inspiration begins when an electrical signal from the respiratory centre in the brainstem passes down the spinal cord and out in the nerves to the respiratory muscles. This signal is transmitted to the intercostal muscles, which contract, increasing the diameter of the chest from front to back, and from side to side. Contraction of the diaphragm causes the chest cavity to increase its size vertically. Because the layer of pleura lining the lungs is closely applied to the layer of pleura lining the inside of the chest wall, the lungs expand as the chest wall expands. The pressure inside the lungs falls below atmospheric, and air flows through mouth and nose, down the trachea and bronchi to the alveoli. When the signal from the respiratory centre stops, the muscles of respiration relax, and the lungs and chest wall recoil to their resting position. This increases the pressure inside the lungs above atmospheric, and air flows from the alveoli up the bronchi and trachea, and out the mouth and nose. While the air is in the alveoli, oxygen passes across into the blood to be transported to the tissues, and carbon dioxide reaching the lungs from the tissues passes into the alveoli, to be breathed out. The volume breathed each breath is the "tidal" volume, about 500 ml in an adult.

RESPIRATORY FAILURE

Whatever the cause of the respiratory problem, a conscious person is said to be in respiratory failure when he cannot supply oxygen and remove carbon dioxide from the tissues at an adequate rate. A person may complain of difficulty in breathing (dyspnoea), or he may look as if he has difficulty breathing, with increased respiratory rate (tachypnoea) or altered pattern or respiration, even though he may not complain. An unconscious person, on the other hand, cannot complain, and his breathing may look normal even though he is hypoxic. Unconscious patients should be assumed to have a respiratory problem until proved otherwise.

CAUSES OF RESPIRATORY FAILURE

Some of the many causes of respiratory failure are listed below:

1. Decreased oxygen in the atmosphere
   altitude
   gas, vapour or smoke inhalation.
2. Diseases of the nervous system
   meningitis, encephalitis
   spinal cord transection
   snake or blue-ringed octopus bite
   drug overdose
3. Diseases of the chest wall
   flail chest
4. Diseases of the pleura
   pneumothorax
5. Diseases of the upper airways
   inhaled foreign body
   croup
6. Diseases of the lower airways
   asthma
7. Diseases of the lung tissue
   pneumonia
   pulmonary oedema
   chronic obstructive lung disease
8. Decreased amount of available haemoglobin
   anaemia
   carbon monoxide poisoning
9. Decreased blood flow
   myocardial infarction
   blood loss
   anaphylaxis
10. Excessive oxygen consumption
   heat stroke

RECOGNITION OF RESPIRATORY FAILURE

Symptoms and signs of respiratory failure vary with the condition causing it, and with the level of consciousness. Sometimes the patient appears to be in severe respiratory distress but is not (as in hysterical hyperventilation). Sometimes severe hypoxia may exist but the symptoms and signs are deceptive and the patient appears well.

A respiratory problem should be suspected if any of the following are abnormal (Figure 61):

1. RESPIRATORY RATE, DEPTH AND RHYTHM

Breathing may be rapid and shallow, as with fractured ribs, or it may be slow and deep, as in narcotic overdosage. It may be deep and rapid, as in diabetic coma, or quite irregular in rate and depth, as in severe head injury.

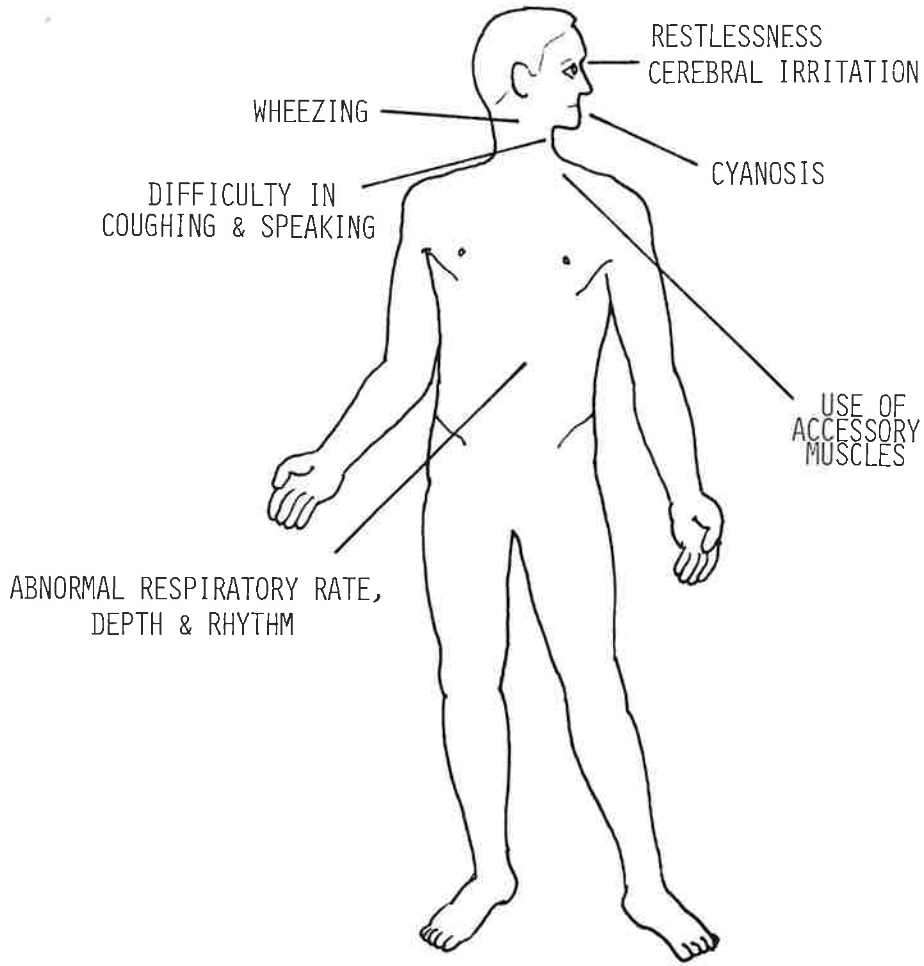


Figure 61 Features of Respiratory Distress

2. AIRWAY NOISE

Upper airway obstruction causes stridor, a noise usually distinguishable from lower airway noise, or wheezing. In patients with sputum retention, the coarse bubbling rattles are distinctive. Airway noise is exaggerated by asking the patient to cough. A completely obstructed airway is silent.

3. COUGHING, SPEAKING, SWALLOWING

A person who cannot cough vigorously, speak a sentence, or swallow, may have a major respiratory problem.

4. MOVEMENT OF CHEST AND ABDOMEN

Chest and abdomen normally move together with respiration. Patients with severe chest wall disease breathe mainly with their diaphragm, hence abdominal movement is more marked.

In upper airway obstruction, the extreme pressure changes created in an attempt to move air past the obstruction result in indrawing of parts of the chest wall, especially the intercostal, supraclavicular, and suprasternal spaces. In flail chest, the free floating segment moves in during inspiration and out during expiration. In complete upper airway obstruction, attempts to breathe result in the abdomen moving out with inspiration, but the chest wall appearing to move in. There may also be downward movement of the larynx on inspiration ("tracheal tug").

5. USE OF ACCESSORY MUSCLES OF RESPIRATION

Abdominal, chest wall, and neck muscles are usually used in exercise. At rest, use of these muscles indicates a major respiratory problem.

6. SYMPTOMS AND SIGNS OF HYPOXIA AND HYPERCARBIA

Hypoxia causes anxiety, agitation, confusion, irritability, drowsiness, coma, cardiac arrhythmias, and cyanosis. Hypercarbia (carbon dioxide retention) causes tachycardia, hypertension, peripheral vasodilatation, sweating, drowsiness and coma.

MANAGEMENT OF RESPIRATORY FAILURE

There are several general principles of management of a patient in respiratory failure:

1. POSITIONING

Posture the patient in the most comfortable position for him, which will usually be sitting or semi-recumbent.

2. OXYGEN THERAPY

8 litres/minute via universal face mask, or 2-4 litres/minute via a nasal cannula. In patients with chronic obstructive lung disease, 2 litres/minute via a nasal cannula.

3. PAIN RELIEF

Pain relief with Entonox if pain is contributing to the respiratory distress. Remember that Entonox contains 50% oxygen.

4. RELIEF OF UPPER AIRWAY OBSTRUCTION

In upper airway obstruction, if the patient is breathing, give oxygen and transport to medical aid. If not breathing, the two manoeuvres which may be of value are:

(a) up to 4 sharp blows with the heel of the hand between the shoulder blades (only of value if obstruction is due to a foreign body);
(b) artificial ventilation.

Note that chest thrust (sudden sharp compression of the chest with the operator's arms around the victim's lower chest) is not recommended.

If upper airway obstruction is thought to be due to anything other than a foreign body (croup, oedema, etc.) and the patient is breathing, no attempt should be made to look in the throat or use suction, as this may precipitate complete respiratory arrest.

5. AIRWAY MAINTENANCE

Airway maintenance in the unconscious patient will require head tilt, jaw support, and sometimes use of an oropharyngeal airway.

6. ARTIFICIAL VENTILATION (refer Chapter 7).

SPECIFIC RESPIRATORY CONDITIONS

THORACIC INJURY

Injury to the chest can be either blunt or penetrating and may result in injuries that range from simple chest wall contusion to damage to major blood vessels and bronchi. Such injuries may include simple rib fracture, pneumothorax, lung laceration and cardiac injury. Injury to the chest cavity may result in profuse bleeding with shock, made worse by decreased ventilation due to lung collapse. Major thoracic injury is a life-threat requiring immediate medical care. Patients with chest injury should be promptly assessed to determine effectiveness of respiratory and circulatory function:

Listen to the patient's breathing.
Watch the movements of the chest.
Check the radial pulse.

If the air exchange is good but the pulse is rapid and weak, bleeding in the chest should be considered. If the air exchange is poor despite vigorous respiratory effort, look for:

Airway obstruction,
Pneumothorax,
Flail chest.

If, on inspection, the expired air is minimal, the chest wall does not move well and one side of the chest is prominent, a large pneumothorax may be present. The neck also should be examined for the position of the trachea, the presence of surgical emphysema, distended neck veins and evidence of trauma.

PNEUMOTHORAX

Traumatic pneumothorax may follow blunt or penetrating injuries and may be associated with bleeding into the chest. Pneumothorax is air in the pleural space. The chest wall pleura and lung pleura are normally in contact with each other. If air can enter through a wound in the chest wall or escape from the alveoli the layers of the pleura separate. Once air enters the pleural space the lung tends to collapse. The degree of collapse depends on the amount of air which can enter the pleural space and whether or not the air is under pressure (tension pneumothorax) (Figure 62).

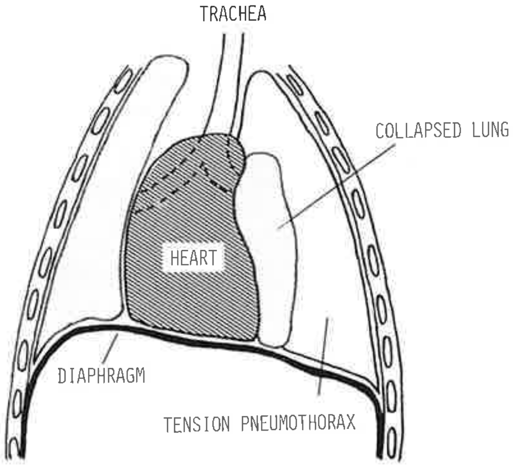


Figure 62 Tension Pneumothorax

OPEN PNEUMOTHORAX

A most serious form of pneumothorax is the open pneumothorax. The seriousness depends on the size of the wound in the chest wall. A sucking wound of the chest is one in which the air is sucked in and out of the wound with respiratory movements. This air movement is accompanied by a characteristic sound. The disturbance to cardiopulmonary function may be severe. If the wound opening is larger than the larynx, air will enter the chest cavity through the wound rather than through the trachea, posing an immediate life threat.

RECOGNITION

1. Variable degree of respiratory distress.
2. Sucking noise as air is drawn through the wound with respiratory effort.

3. Frothy bubbles of blood in the wound.
4. Possible surgical emphysema.

As well as lung collapse reducing greatly the oxygenation of the pulmonary blood, pneumothorax causes the mediastinum to move from side to side, preventing full expansion of the uninjured lung. It also kinks the great veins returning blood to the heart, in turn reducing cardiac output.

MANAGEMENT

1. Immediately reduce the size of the sucking wound by any means. As a temporary immediate measure the Ambulance Officer's open hand should be placed over the wound. Closure of the wound with an aluminium foil dressing taped down to the skin on the top edge and both sides with broad strips of adhesive tape will prevent sucking, but allow blood and air to escape. If the foil dressing is not available a universal dressing may be used to reduce the size of the wound. Roller or triangular bandages, tensioned during expiration will be most effective in maintaining the dressings in place. Under no circumstances should the wound be sealed airtight, or a tension pneumothorax may develop.
2. The patient should be supported in the semi-recumbent (half-sitting) position, lying towards the injured side to immobilize the damaged chest.
3. Give oxygen by universal mask routinely and make sure that respiratory movements are adequate. If pain is a problem give Entonox, which contains 50% oxygen.
4. If respiratory movements weaken or fail, ventilate the patient with a bag and mask with oxygen supplement.

TENSION PNEUMOTHORAX

In tension pneumothorax air enters the pleural space but is prevented from escaping, resulting in an accumulation of air under pressure. As the pressure continues to rise the lung is completely collapsed and the pressure forces the mediastinum across to the uninjured side further inhibiting the ventilating capacity and cardiac output (Figure 62). This is an extreme medical emergency because of rapidly increasing hypoxia and shock. Untreated tension pneumothorax can swiftly lead to death.

RECOGNITION

1. Extreme dyspnoea.
2. Severe cyanosis.
3. Distended neck veins.
4. Profound shock.
5. Progressive deterioration.

MANAGEMENT

In the closed chest injury with tension pneumothorax, oxygen by universal mask and immediate transport to medical aid is mandatory. Check that any chest wound has not been sealed. Establish radio communication with hospital.

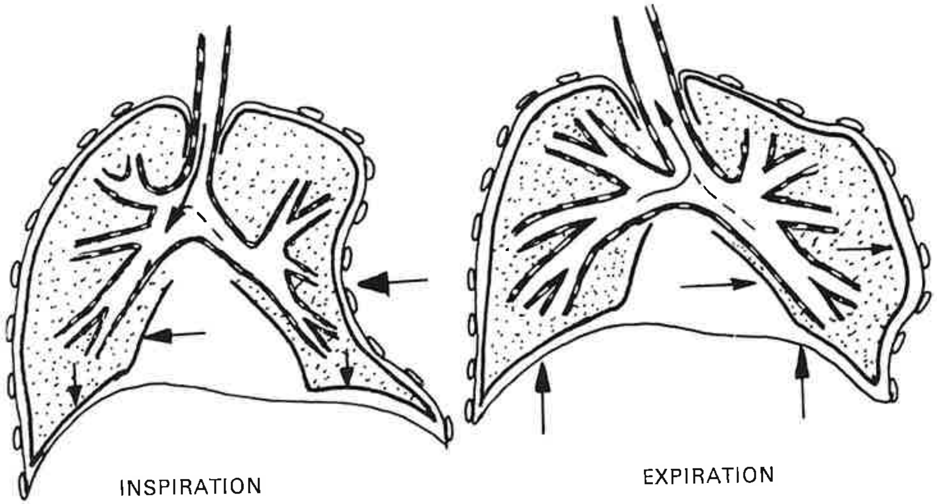


Figure 63 Flail Chest

FLAIL CHEST

Violent impact can cause multiple rib fractures. As a consequence a large portion of the rib cage loses continuity of support. During inspiration the thorax expands, except for the damaged portion which sinks inwards. On expiration the reverse occurs, for as the rest of the chest wall moves inwards the isolated segments move outward (Figure 63). These paradoxical movements prevent the normal movement of air into and out of the lungs. In severe cases the abnormal pressures described will cause the mediastinum to move from side to side, further reducing ventilatory efficiency.

MANAGEMENT

1. Make sure the airway is clear.
2. Apply initial pressure with the flat of the hand with just sufficient force to stop the abnormal movement. Breathing may be visibly improved at this point.
3. A firm pad from a universal dressing or folded hand towel is placed to completely cover the unstable segment. Secure firmly with wide bandages.
4. Patients with marked respiratory distress must receive assisted respiration. Positive pressure lung ventilation is maintained in time with the patient's own efforts.
5. Oxygen by universal mask. Entonox if pain is a feature. This also provides 50% oxygen.
6. Posture the patient so that he is comfortable.

SPONTANEOUS PNEUMOTHORAX

Under certain circumstances a weakened area of lung tissue may rupture spontaneously, causing a pneumothorax. This may occur in a patient with lung disease such as asthma or chronic lung disease, or it may appear in a well young person.

The clinical features are onset of sudden chest pain, associated with respiratory distress.

MANAGEMENT

Management is as for traumatic pneumothorax. If there is chest pain, this should also be treated, since it may not be possible to distinguish the pain from that of myocardial infarction.

ASTHMA

Asthma is a condition characterised by recurrent episodes of respiratory distress associated with wheezing. The condition is due to narrowing of small airways from bronchial muscle spasm, mucosal inflammation, and thick sticky secretions. The bronchial narrowing causes increased resistance to air flow, and "trapping" of air in the alveoli, resulting in over-expansion of the chest.

Asthma is due in some patients to allergy to pollens, dust, certain foods and some drugs. In others, the cause may be smoke, cold air, infection, exercise, or stress.

CLINICAL FEATURES:

Sudden onset of respiratory distress, with short gasping inspirations and prolonged expirations. The patient sits or stands, uses accessory muscles of respiration, and wheezes. The attack may last a few hours, or may persist for days, when it is known as status asthmaticus.

Danger signs in asthma are:

1. Inability to talk or cough (indicates severe hypoxia)
2. Cyanosis (indicates severe hypoxia)
3. Impaired level of consciousness (indicates severe hypoxia)
4. Severe distress with no wheezing (indicates almost complete airway obstruction).

MANAGEMENT:

Management should include posturing the patient comfortably, usually sitting, and administering oxygen by universal mask. Be prepared for respiratory arrest. The patient may have already used their own medications, such as Ventolin aerosol inhalation, which should accompany the patient to hospital. The inhaler should not be used during transport, except following a radio communication, since an overdose of the drug is likely.

PNEUMONIA

Pneumonia means inflammation of the lung. There are many different types of pneumonia, the most common being due to infection of the lungs by bacteria or viruses, which may involve part or all of one lung, or both lungs.

CLINICAL FEATURES:

In the early stages, the patient may have a dry cough, progressing later to a moist cough due to the presence of sputum. Fever is usual, sometimes with rigors. There may be headache, vomiting, aches and pains, and sometimes severe localised pain due to inflammation of the pleura (pleurisy). Respiration and pulse are rapid. In some patients, pneumonia may be associated with unconsciousness or septic shock.

MANAGEMENT:

Management of pneumonia consists of making the patient comfortable and giving oxygen by universal mask. In hospital, bacterial pneumonia usually responds rapidly to antibiotics.

CHRONIC OBSTRUCTIVE LUNG DISEASE

Chronic obstructive lung disease refers to a disease which has 2 components – chronic inflammation of the bronchi (bronchitis), and progressive destruction of lung tissue (emphysema). Tobacco smoking, dust, fumes and infection contribute to the disease.

CLINICAL FEATURES:

The patient usually has a chronic cough with sputum production, respiratory distress and cyanosis. The lungs are chronically inflated, resulting in a "barrel chest". Wheezing is a common feature. Unlike asthma, in which there are periods of respiratory distress and periods of health, chronic obstructive lung disease is progressive and may eventually lead to death from respiratory failure.

MANAGEMENT:

Management consists of posturing the patient comfortably, usually sitting, encouraging him to cough up his sputum, and giving oxygen. Because of the destruction of lung tissue, these patients eventually have a low oxygen content in their blood, and a high carbon dioxide content. They depend on a degree of hypoxia to keep them breathing, and administration of too much oxygen may stop them breathing. Oxygen is given via nasal cannulae at 2 litres/minute. Be prepared for respiratory arrest. Some of these patients use a Ventimask at home. In this case, the mask should be used instead of a nasal cannula.

UPPER AIRWAY OBSTRUCTION

Obstruction of the larynx or trachea may be due to an inhaled foreign body, a tumour, inflammation of the epiglottis (epiglottitis), inflammation below the vocal cords (croup), or swelling of the mouth and neck due to allergy.

When obstruction becomes severe enough, there will be respiratory distress, stridor, use of accessory muscles of respiration, and indrawing of the intercostal, supraclavicular and suprasternal spaces (Figure 64).

Swallowing may be difficult and the patient may sit forward and dribble saliva.

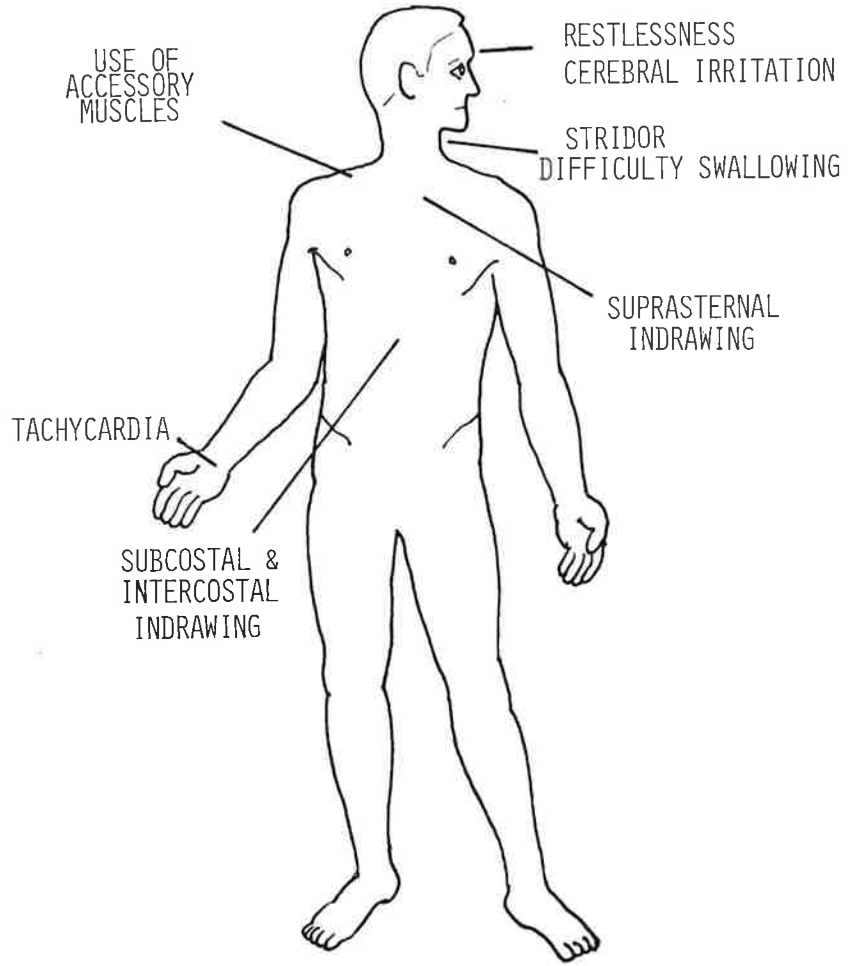


Figure 64 Features of Upper Airway Obstruction

MANAGEMENT

Any patient with respiratory distress and stridor, especially if they are unable to swallow, must be transported rapidly to hospital. Allow the patient to posture themselves. **Radio communication is essential.**

In hospital, the patient may require endotracheal intubation, bronchoscopy or tracheostomy in Theatre or Intensive Care Unit.

HYPERVENTILATION SYNDROME

The hyperventilation syndrome occurs when patients, as a result of emotional distress, breathe rapidly and deeply to the point where they lower the amount of carbon dioxide in their blood excessively. This affects the calcium content of the blood, and results in tetany, or spasm of some muscles, especially in the hand. In addition, brain blood flow is decreased and they may become confused and irrational.

The condition is self-limiting, but is best controlled by reassuring the patient.

If the patient does not settle, allowing him to rebreathe his own carbon dioxide from a paper bag held over nose and mouth will allow the carbon dioxide in the blood to rise, when the symptoms will improve.

UNDER NO CIRCUMSTANCES should rebreathing be considered if there is doubt as to the nature of the problem. If hyperventilation is due to excessive amounts of acid in the blood, as in diabetic coma, or renal failure, rebreathing may kill the patient because the carbon dioxide accumulates and makes the already acid blood too acid to be compatible with heart function.

Chapter 17

Cardiovascular Diseases

The cardiovascular system exists primarily to transport oxygen and other nutrients to the body's cells, and to remove carbon dioxide and other wastes. The pump effect is provided by the heart, and the blood is distributed to the tissues by the arterial system of blood vessels and returned to the heart by the venous system.

ANATOMY AND PHYSIOLOGY

The heart is a hollow muscular organ about the size of a clenched fist, and roughly cone-shaped, which lies behind the sternum and slightly to the left of the midline. It is limited anteriorly by the sternum, and posteriorly by the trachea and spine. It has 3 layers – pericardium, myocardium, endocardium (Figure 65).

1. PERICARDIUM

The pericardium is a double layered membrane which surrounds the heart and protects it from rubbing against other organs.

2. MYOCARDIUM

The myocardium is the thickest layer of the heart, and contains all the muscle which does the actual pumping. Normally the right ventricle is about 0.5 cm thick and the left is about 2 cm thick. Because the heart muscle is continually functioning and does a great deal of work, it requires a good supply of blood. This is provided through the coronary arteries.

3. ENDOCARDIUM

The endocardium is the internal lining of the heart which is very smooth, and this prevents blood clots from building up inside the heart. The endocardium covers all the muscle of the atria and ventricles, as well as the valves.

INTERIOR OF THE HEART

The heart is divided into right and left halves by a partition of muscular tissue known as the intra-ventricular septum. The right and left sides are divided in turn by partitions known as valves into the atria and ventricles. The smaller, thinner

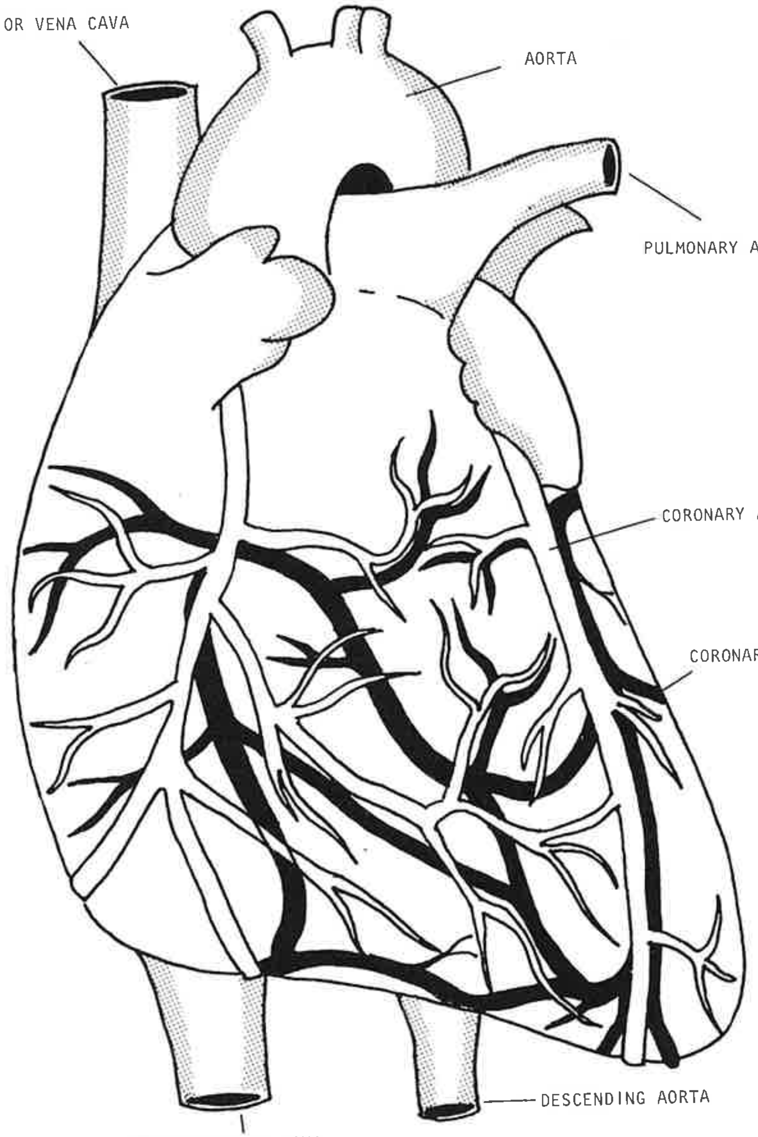


Figure 65 The Heart

walled chambers, the atria, pump blood at low pressure into the larger chambers, or ventricles. The ventricles in turn pump blood into the pulmonary arteries and aorta. The pressure developed in the left ventricle is higher than the right, hence the greater muscle thickness on the left side.

CORONARY ARTERIES

The heart is continuously in action and must perform a great work load. To allow the heart to function adequately it must have a sufficient supply of oxygen and sugar to allow the production of energy for contractions. These nutrients are supplied by the coronary arteries, which are quite large blood vessels arising from the aorta and passing over the external surface of the heart to supply most of their content to the heart muscle.

Since the left ventricle functions at higher pressure than the right, it has a greater workload, is thicker, and needs more blood. The left coronary artery is therefore larger than the right. It is this left vessel which is more likely to narrow or block off, producing angina or myocardial infarction.

HEART FUNCTION

An initial electric impulse arises from the sinoatrial (SA) node in the atria and the impulse spreads across the atria, causing them to contract and pump blood into the ventricles through the mitral (left) and tricuspid (right) valves. The heart then pauses briefly whilst electrical impulses cross the atrio-ventricular (AV) node near the intraventricular septum.

The electrical activity then passes from the AV node to the conducting tissue in the intra-ventricular septum, and on to the muscle of the left and right ventricles, causing them to contract and pump blood into the pulmonary artery and aorta, respectively. Thus blood is received by the atria from the pulmonary veins or vena cavae, is pumped through the mitral and tricuspid valves to the ventricles, where contraction pumps blood into the great vessels through the aortic and pulmonary valves. Clearly, input and output from the right and left sides of the heart must be equal.

ECG

The ECG is a tracing of the electrical activity in the heart. It is used to diagnose arrhythmias and myocardial infarction. A brief introduction is set out here to illustrate the principles and uses for the interest of Ambulance Officers (Figure 66).

The normal ECG contains a P-wave which represents the electrical activity associated with atrial contraction, a pause (the PR-interval) whilst activity passes to the AV node and the QRS complex, which represents contraction of the ventricles.

The T-wave represents the electrical resetting of the heart in its return to a normal electrical state, so that after the T-wave the heart is ready for another impulse to recommence the cycle.

A great deal of information can be obtained from the ECG. The matters which concern the Ambulance Officer are **rate** and **rhythm**. The rate can be counted from the ECG paper or oscilloscope.

Similarly, abnormal rhythm patterns can be recognised, the most important of which is ventricular fibrillation (Figure 67) in which the electrical stimuli are coming from all over the ventricle rather than the regular route, arising from the AV node. Consequently, the regular appearance of the ECG is lost and the appearance is irregular as shown.

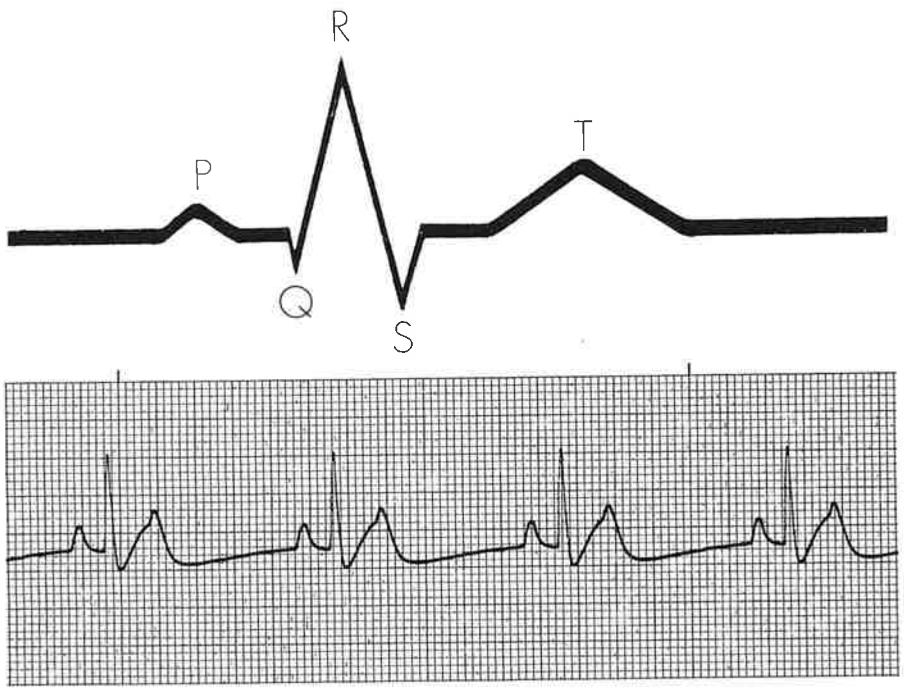


Figure 66 Normal ECG Trace

Ventricular fibrillation is one of the sequelae which may follow myocardial infarction, and is what happens in cardiac arrest. The final abnormality of rhythm is asystole – absence of activity.

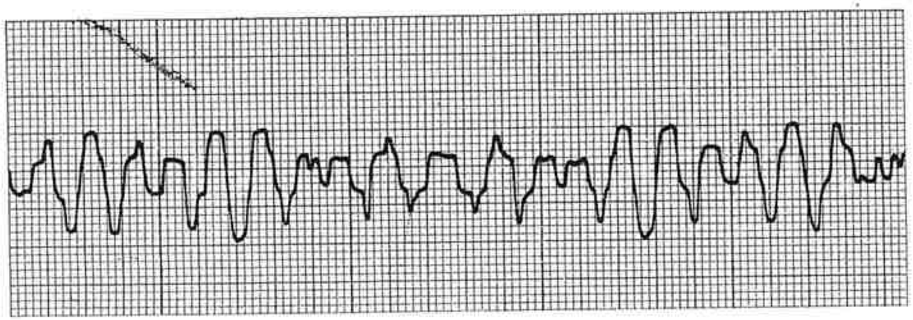


Figure 67 Ventricular Fibrillation

DISEASES OF THE HEART AND BLOOD VESSELS

ATHEROSCLEROSIS

Atherosclerosis is a disorder in which fatty material is deposited in the walls of large blood vessels, causing roughening, so that blood clots may build up on the roughened area.

This process occurs in all people and seems to begin soon after birth. The disorder progresses throughout life, but is much faster in some people than others, and inheritance appears to play a part in it, but so do factors such as obesity, cigarette smoking, high blood pressure, and lack of exercise.

The disorder is symptomless until the deposit and the subsequent blood clot either significantly narrow an artery so that not enough blood passes through to supply sufficient blood to the relevant organs, or until a blood clot completely blocks an artery so that there is death of all or part of that organ. Conditions which are related to atherosclerosis are myocardial ischaemia, myocardial infarction, cerebrovascular accident, and some cases of gangrene of the legs.

MYOCARDIAL ISCHAEMIA

In this disorder the coronary arteries supplying blood to the heart muscle become narrowed by the atherosclerotic process described above.

As a result of this narrowing, insufficient blood passes to the heart muscle so that not enough oxygen can be delivered, and toxic substances are produced which the blood cannot remove. These toxic substances accumulate in the ischaemic area and are responsible for the chest pain called "angina pectoris".

Normally the patient has little or no pain at rest, but develops the pain on exercise as the heart increases its work in response to the increased demand for blood. As a result, more oxygen is required to produce energy for the increased cardiac work, but little extra blood can get through. Thus the pain tends to develop on mild-to-moderate exertion, depending on the degree of coronary artery narrowing.

The pain typically is described by the patient as a pressure or tightness or crushing type pain located in the centre of the chest behind the lower end of the sternum, and often spreading to the jaw, the left shoulder, arm or hand, and occasionally to the right arm. The pain comes on after exertion and lasts only a few seconds or minutes.

There may also be associated shortness of breath (dyspnoea) and anxiety or apprehension. Since exercise brings on the pain, the patient will be conscious of this and will usually stop and sit down, or lean against a post until the pain passes off – usually in a short time. The patient may then be able to continue his previous activity.

Treatment

The patient who is known to have angina can be put comfortably at rest and, if necessary, allowed to lie down in a position of maximum comfort. The patient should be given his Trinitrin or Anginine tablets under the tongue, since in this way the drug is very rapidly absorbed and will relieve the pain in a few minutes. A side effect of the tablets may be light-headedness or a headache, and a rapid pulse rate may be noted. If the pain does not pass off with Trinitrin or Anginine, the patient should be treated as for myocardial infarction.

Complications

Usually there are no complications and the pain acts as a warning to stop and rest. Some patients who develop angina may eventually have a myocardial infarction, but this is by no means always the case, and reassurance may well help the patient.

MYOCARDIAL INFARCTION

This condition can lead to death in minutes. It is caused by a block in a coronary artery leading to death of the myocardium beyond the blocked portion. A common cause of coronary artery occlusion is a blood clot.

The area of the myocardium which dies depends on the site of the occlusion within the coronary circulation and as a result the clinical outcome is variable. Infarction is marked by chest pain, often not unlike angina. It is described as vice-like and may spread from the chest up the neck, into the lower jaw, into the left shoulder, and down the left arm and into the right arm. Unlike angina, it persists even after rest and Trinitrin or Anginine, and its onset need not follow exertion. It may last for hours. Myocardial infarction can usually be distinguished from angina by the increased severity in infarction, by the absence of relief on rest, and by the lasting of the pain for more than 30 minutes. If in doubt, treat as infarction.

The patient commonly feels nauseated, giddy and must usually lie down in a semi-recumbent position. He may become pale, sweaty, cold and may vomit. His pulse may be weak and rapid. The patient may then appear to improve for a time, but his chest pain may persist. He may become unconscious and show all the signs of shock. The pulse may become weaker and noticeably irregular. Shortness of breath (dyspnoea) is a common associated symptom.

Cardiac arrest is a common sequel to myocardial infarction and is often heralded by the pulse rate becoming very irregular prior to its stopping.

Signs and symptoms of acute myocardial infarction

1. Central crushing chest pain possibly with radiation to upper abdomen, lower jaw and arms.
2. Nausea, vomiting, sweating.
3. Dyspnoea, but rarely severe enough to stop the patient from lying flat.
4. Weak, rapid, often irregular pulse.
5. Shock without haemorrhage – due to heart failure.
6. Fear of impending death.
7. May result in cardiac arrest.

Management

1. Do not move the patient more than absolutely necessary. Make the patient comfortable. Any movements must be performed slowly and smoothly.
2. Regularly check the pulse and breathing and watch skin colour. Be alert for a cardiac arrest.
3. If cardiac arrest occurs, or respiration fails, take immediate action. Resuscitate.

4. Administer oxygen by nasal cannula or universal face mask, whichever the patient tolerates more readily.
5. Administer Entonox if pain is a problem – pain relief will reduce fear and shock. Remember that Entonox contains 50% oxygen.
6. If signs of shock are increasing, lie the patient flat, unless he is short of breath, when he should be placed in the semirecumbent position.
7. Transport to hospital as Priority GREEN. Avoid rapid changes in speed and direction. Use Priority RED only when cardiac arrest or severe cardiogenic shock is present.
8. Ascertain if the patient has been seen by a Medical Officer and whether or not any medication has been administered. An injection of morphine is commonly given, but other substances such as pethidine, pentazocine (Fortral), or lignocaine (Xylocaine or Xylocard) may have been given by injection. This information must be passed on to the Medical Officer at the hospital. In severe cases, establish radio communication with hospital.

Complications

There are three major complications of myocardial infarction – arrhythmias, cardiogenic shock, and cardiac failure.

1. Cardiac Arrhythmias

A cardiac arrhythmia is any disorder of the normal heart rhythm. In its least disturbing form no more than an occasional pause in the regular pulse may be noted. In its most severe form there is ventricular fibrillation leading to circulatory arrest.

The arrhythmias may cause symptoms that the patient describes as "palpitations" in the chest; that is, an awareness of the rapid beating of the heart. This can be quite disturbing at the time. There may also be cardiac failure, precipitated by the rapidly beating heart becoming poorly oxygenated. The coronary circulation is less efficient at very fast heart rates.

In patients who have infarcted heart muscle, the dead tissue may cause an irritable focus, usually in the left ventricle. The result is that instead of the regular electrical events described under the ECG, abnormal beats arise in the irritable area and may lead to the sudden development of the rhythm known as ventricular fibrillation or cardiac arrest. As a result of the lack of co-ordinated electrical activity, the ventricle does not contract regularly or evenly, and so does not pump blood out of the left ventricle.

The onset is sudden and the symptoms are dramatic with sudden lapse of consciousness and dilated pupils (due to poor blood flow to the brain) and absent pulses. The treatment consists of cardiopulmonary resuscitation (CPR). Clearly a Priority RED transport at this point is mandatory.

Unfortunately, the majority of cardiac arrests occur in the first few minutes or hours after the myocardial infarction, hence the Ambulance Officer has quite a high chance of having to deal with this emergency situation.

When a person with ventricular fibrillation arrives at hospital, CPR is continued until electric defibrillation can be given at the earliest possible moment. In persons who have a rapid transport to hospital and high quality CPR, there is a reasonable chance of a successful outcome. If CPR is given inadequately the result, unfortunately, is less satisfactory, and brain damage may result.

2. Cardiogenic Shock

Cardiogenic shock develops when the heart is so damaged it cannot pump enough blood to provide the tissues with oxygen. Treatment consists of lying the patient flat, and giving oxygen.

3. Cardiac Failure

Cardiac failure is said to occur when the amount of blood being pumped out from the ventricles is less than the amount coming into the atria from the vena cavae or pulmonary veins. As a result the blood tends to back up in the lungs (left ventricular failure) and/or in the veins of the legs (right ventricular failure).

The conditions which may predispose to cardiac failure are:
- Myocardial Ischaemia
- Myocardial Infarction
- Valvular Heart Disease
- Cardiac Arrhythmias
- Drugs
- Hypertension
- Anaemia

(a) Left Ventricular Failure (pulmonary oedema)

The predominant feature of this type of failure is dyspnoea so severe that the patient is compelled to sit up and gasp for breath. Other activity is superseded by this struggle for breath. This situation is explained by the fact that, as the heart fails, blood banks up in the pulmonary circulation. Fluid escapes into the alveoli and, in effect, they become waterlogged. Oxygen exchange is then reduced, and the patient becomes hypoxic.

Signs and Symptoms of Left Ventricular Failure

Dyspnoea and wheezing respiration – especially at night.
Profuse sweating.
Cyanosis.
Cough, often producing blood-stained sputum.
Agitation.
Confusion.
Nausea and vomiting.
Weak, rapid pulse, which may be irregular.
Sudden collapse.

Management

1. Always transport as a stretcher patient. Carry the patient to the ambulance even though he must sit up. Make the patient comfortable in a sitting position and move him as little as possible.
2. Administer oxygen by universal face mask or nasal cannula.
3. Reassure the patient by being confident and efficient in making him comfortable on the stretcher.
4. Transport to hospital (Priority Green).

5. Constantly check the pulse and respiration and be alert for cardiopulmonary arrest.
6. If the patient has obvious fluid in his airway, gently remove it with the suction apparatus.
7. Note if he has been seen by a Medical Officer and ask what, if any, medication has been given. Morphine by injection is a drug commonly given and a fluid-removing drug, Frusemide (Lasix) may also have been administered. This information, along with your observation of pulse and general condition of the patient, must be passed on to the Medical Officer at the hospital.

In the case of a cardiac emergency where the patient becomes unconscious, place him in the coma position, insert an oropharyngeal airway, remove secretions by regular suction of the upper airway, and carefully watch for cardiac arrest.

(b) Right Heart Failure or Congestive Cardiac Failure (C.C.F.)

This type of myocardial failure is due to failure of the right ventricle causing blood to dam up in the veins of the peripheral circulation.

An increase in venous pressure occurs in the veins of the leg, and fluid is extruded out of the blood vessels and into the tissues, causing a swelling of the legs or oedema. A similar process affects the kidneys which are unable to excrete waste salt and water as effectively as usual, with the result that salt and water are retained by the body and increase the problems of oedema and shortness of breath.

A further complication of this process is that fluid tends to accumulate in the legs during the day, but when the patient lies down to sleep the fluid is reabsorbed and settles in the lungs. Therefore, it is during sleep that a patient develops the sudden onset of shortness of breath due to cardiac failure. Clearly the fluid retention described aggravates this problem.

Signs and Symptoms of CCF

Ankle oedema.
Abdominal pain, due to engorged liver.
Distended neck veins.

Management

As for left ventricular failure. In hospital the Medical Officer will examine the patient to determine the underlying cause of the CCF, and will commence hospital management.

Drugs will be given called diuretics, which increase the salt and water loss through the kidneys and relieve the fluid overload, and digoxin will usually be given to increase the strength of the heart beat.

The outlook, therefore, is for very rapid improvement and after a few days in hospital, return to an active healthy life.

Chapter 18

Diabetes

Diabetes is the disorder caused by an inadequate supply of the substance insulin, a "hormone" which is produced by the pancreas, a small organ situated in the abdomen and lying behind the spleen and between the kidneys.

The result of lack of insulin is that the sugar (glucose) in the blood cannot be effectively utilised by the body, especially the muscles and brain, and the levels of glucose in the blood begin to rise leading to symptoms described below.

THE UTILISATION OF SUGAR

Food taken by mouth consists of carbohydrates (e.g., starch and sugar) as well as protein and fat. The complex chemical compounds of carbohydrate are broken down by enzymes in the bowel to a simple sugar called glucose, and this is the sugar which is then absorbed and transported in the blood. After a meal, glucose is taken up by the liver and stored as glycogen ready for release, as the body needs glucose between meals. Glucose is continuously burnt in the muscles, brain and other tissues to produce carbon dioxide and water (which are excreted through the kidneys and lungs) and in so doing, energy is released (Figure 68).

Both the storage of insulin in the liver and the burning of it by the tissues requires insulin, so that if there is insufficient insulin, the level of glucose in the blood rises to higher and higher levels, and it is this rise in glucose levels which causes the initial symptoms.

As the deficiency of insulin becomes more severe, glucose cannot be burnt completely. Thus energy is not efficiently produced, and substances called ketone bodies accumulate in the body. These substances are toxic and acidic and, in turn, cause further symptoms.

THE SYMPTOMS OF DIABETES

The initial symptoms of diabetes are caused by the rise in blood glucose levels, and consequent loss of water and other substances through the kidney. Normally, water and glucose are presented to the kidney by the body and most of the water and all the sugar are reabsorbed so that no glucose appears in the urine.

The Medical Officer wanting to look for early diabetes therefore tests the urine for glucose, and if he finds it, the patient is usually diabetic. This is then confirmed by further blood testing.

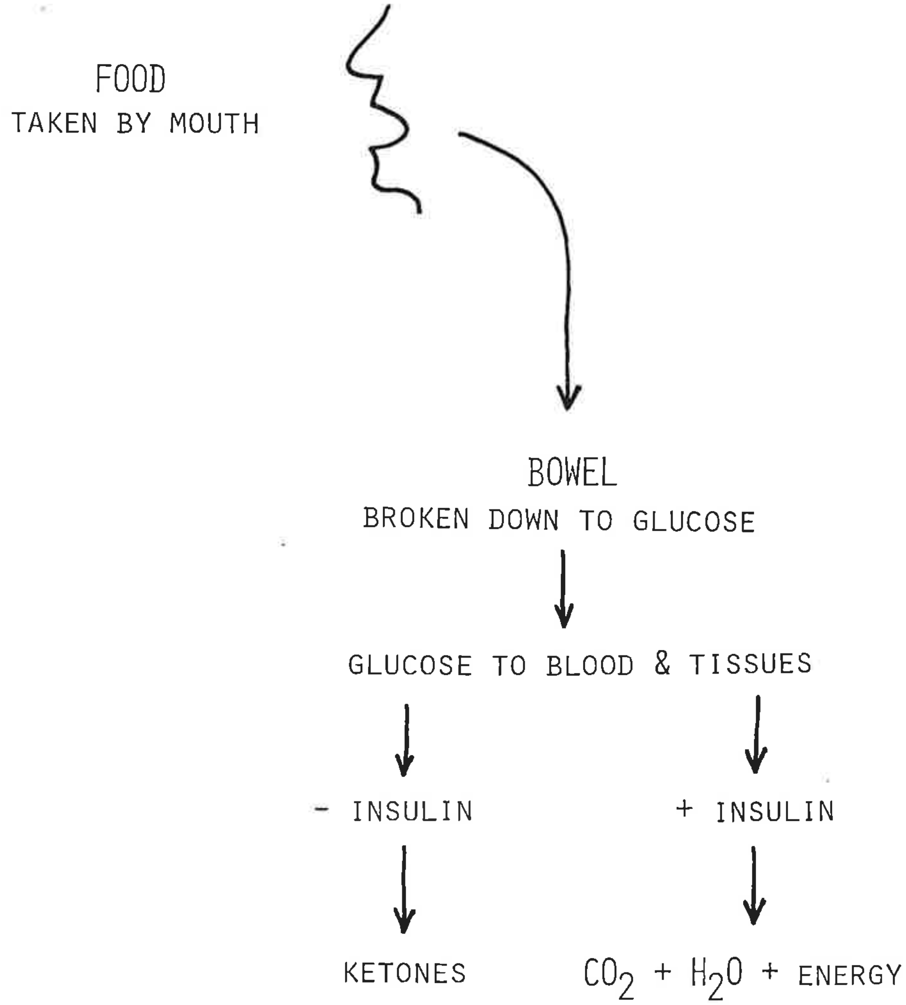


Figure 68 Metabolism in Diabetes

If the blood glucose levels are very high, the kidney will not be able to reabsorb the glucose and large quantities of it "spill" into the urine and, because of a process called osmosis, the kidney cannot reabsorb water either, so the patient begins to lose large amounts of glucose and water through the urine.

Hence, the first symptoms a diabetic may develop are tiredness and weakness, and passing very large quantities of water. With this goes severe thirst. The patient may pass 5 or more litres of urine a day, compared with the normal quantity of about one litre per day.

PRESENTATION OF DIABETES

There are two forms of diabetes usually described, although there are very many variants in between.

1. INSULIN-DEPENDENT DIABETES

This occurs as described above and may often have a rapid onset with a coma occurring within 24 hours of the first symptoms. These patients are usually young and almost always require insulin for the rest of their lives.

2. NON-INSULIN-DEPENDENT DIABETES

This comes on later in life, often in people who are overweight, and, in many cases, the disorder may be asymptomatic, the diabetes being picked up on routine examination by the Medical Officer. Often these people do not require insulin, at least initially. Dieting will frequently remove much of the problem, although the people remain classified as diabetics and may redevelop the symptoms later in life, even if their weight does not increase.

MEDICAL TREATMENT OF DIABETES

The treatment of the juvenile diabetic is insulin, given by injection once or twice daily, together with a rigidly controlled diet, so that the effects of insulin and diet combine to give normal blood glucose levels throughout the day.

The non-insulin-dependent patient may require diet only, or tablets, which stimulate the pancreas to produce more insulin, but in some cases this fails and the patient will also require insulin treatment with all the restrictions of diet, life-style, etc., that this implies.

DIABETIC COMA

As the process described above progresses, and the patient loses more water (i.e., becomes dehydrated), ketones accumulate. Since these substances are toxic, the patient becomes more unwell. The end result is that the patient lapses into coma – so called "diabetic coma". This process can come on over a few hours or days.

On examination, the main features are coma (or delirium), heavy sighing respiration, dehydration (the patient is dry in the mouth and tongue, and also on the skin), and rapid pulse.

TREATMENT

Untreated, the patient will die, but, fortunately, this is an uncommon event these days. The ambulance treatment is to transport the patient efficiently and promptly to hospital, on a priority GREEN. Once in hospital the patient will be given salt and water, together with insulin through an intravenous drip, and his condition will significantly improve within two or four hours, with lessening coma and a return to

normal mental function with reducing urine volume. He may, however, be exhausted for one or more days, and may continue to show glucose and ketones in the urine for some time.

INSULIN COMA (Hypoglycaemic Coma)

When insulin is administered to a patient, the effects last for several hours so that the patient has to be given food regularly to prevent the blood glucose levels falling below normal. Normally a diabetic patient on insulin must eat at least three regular meals, plus morning and afternoon tea and a snack before going to bed. The important thing to know is that if food or insulin intake are not balanced, then the glucose levels will either rise or fall outside normal, both situations which give rise to symptoms. When the glucose levels rise, the processes described above occur, i.e., thirst, coma, etc.

When the glucose levels become low, most of the effects are on the brain, which must have glucose in much the same way that it needs oxygen. The symptoms of low blood glucose or insulin excess (hypoglycaemia) are therefore very much like anoxia.

As the blood glucose levels fall below normal, the patient may exhibit behavioural changes (e.g., such as changes seen in the person as if he were drunk), or he may behave in a variety of odd or abnormal ways. Later, he may become confused and this may be followed by coma or unconsciousness. In many cases, the transition from odd behaviour to coma may be very quick. Physical signs, in addition to the mental and conscious state changes described above, include profuse sweating and pallor, with a moderately increased pulse rate. Occasionally patients with insulin excess may have an epileptic fit, but this fit does not recur, unless the patient has a subsequent episode of insulin excess.

It is reasonable to think of insulin coma as being caused by either too much insulin or not enough food, and treatment will follow upon this. Exercise also can increase the use of glucose and can help precipitate insulin coma. Occasionally the tablets given to non-insulin-dependent diabetics may also cause hypoglycaemia.

TREATMENT

If a diagnosis of diabetes is known (from history or medic alert badge) or suspected, and there is a possibility of insulin excess present, then glucose must be given. If the patient is conscious, then he can be given either glucose sweets (which many insulin-dependent diabetics carry), or sweetened drinks and the patient will often revive dramatically in 5-15 minutes. In this event, a check should be made that the patient has future access to food so that the condition does not recur. If there is doubt about what has happened, the patient should be encouraged to seek medical attention, particularly if this is the first time that a hypoglycaemic attack has occurred. If doubt exists in any diabetic coma situation, glucose should be given to a conscious patient since it will do no harm, if the patient has diabetic coma, and may well relieve the situation if the patient has insulin excess. If the patient is unconscious, he or she should be transported to hospital promptly and efficiently on a Priority RED. At hospital the Medical Officer will administer glucose intravenously and the patient usually recovers immediately.

SUMMARY

The following table sets out the differences in summary form between diabetic coma and insulin excess.

	Diabetic Coma	Insulin Excess
Blood glucose	High	Low
Coma	Yes	Yes
Speed of onset	Hours/Days	Minutes
Dehydration	Yes	No
Sweating	No	Yes
Response to glucose	Nil	Rapid

Chapter 19

Brain Diseases

The brain is a very sensitive organ which is protected by a layer of strong bone – the cranium or skull – which forms a closed cavity about it. This cavity is penetrated only by nerves (the biggest of which is the spinal cord) and blood vessels, which enter the cranium through small holes.

Being the most physiologically active of all the tissues, and not having the ability to store nutrients or oxygen, the cells of the brain depend on a continual and adequate supply of oxygen and glucose at all times. Interference with this causes rapid loss of function (unconsciousness within 1 minute and death within 4 minutes).

Due to the closed nature of the cranial cavity, the brain is also very susceptible to any pressure on it, whether from a haematoma, tumour, haemorrhage or oedema (swelling) of the cerebral tissue. This pressure causes not only interference with the blood supply to the brain, but also anatomical changes in shape and position, which can be fatal, e.g., pushing the brain or part of it through one of the openings in the cranium.

ANATOMY

THE BRAIN

The brain consists of two lobes or hemispheres joined together by connecting fibres. Beneath the hemispheres lies the cerebellum, which is connected to them by the brain stem, which structure is also the connection between the brain and spinal cord. The hemispheres each contain four lobes – frontal, parietal, occipital and temporal (Figure 69).

1. The frontal lobe is concerned with personality and muscle movement.
2. The parietal lobe receives sensations from all over the body and also allows us to perceive our position in space.
3. The occipital lobe is responsible for vision, both black and white and colour.
4. The temporal lobe is where smell, taste and hearing are interpreted, and also where a number of complex functions such as speech are integrated.

The cerebellum is a two-lobed structure, and here, balance is controlled. The cerebellum also exerts fine control over muscle movement, so that the movement of the muscle (initiated by the cerebrum) is smoothed out so that there are no jerky "over-shootings".

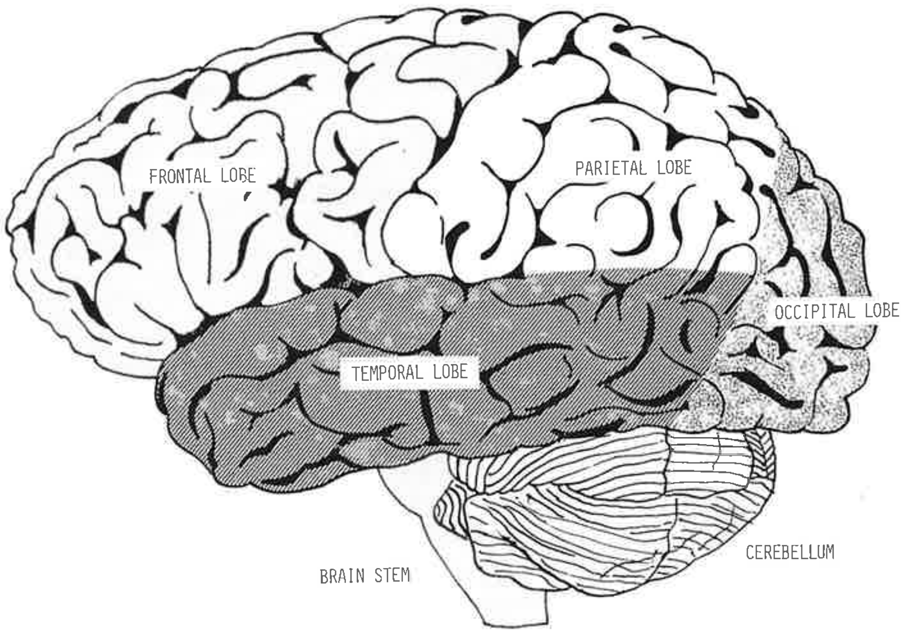


Figure 69 Anatomy of the Brain

The brain stem contains the fibres running between the cerebral hemispheres and the spinal cord, and vice versa. These fibres control muscle movement (motor nerves) and also carry sensation (sensory nerves). The 12 cranial nerves emerge from the side of the brain stem. The cranial nerves are those nerves which control many of the functions of the head, e.g., eye movements or sensation of the face. Further, the brain stem has certain vital functions which are well-known to Ambulance Officers, including the control of respiration and circulation. Damage of the brain stem may lead to immediate coma.

The brain substance is made up of cells (the grey matter) which lie externally on the surfaces, and fibres (the white matter), which connect the cells with other parts of the brain or the brain stem, spinal cord and peripheral nerves.

Blood is supplied to the brain through the two carotid arteries and the two vertebral arteries, with appropriate venous drainage. In addition there are arteries supplying blood to the brain coverings or meninges, and these, if damaged, can cause increased pressure within the skull.

The meninges are thin but strong coverings of the brain, found in three layers. These are called the dura (outer), pia and arachnoid maters. Their function is to protect the brain and to enclose the fluid which surrounds the brain, the cerebrospinal fluid or CSF.

The CSF is a colourless watery fluid which is produced within the brain substance in the ventricles. The fluid passes down through the ventricles and out over the brain stem. It is then found around the brain and spinal cord, and is gradually absorbed along the blood vessels at the top of the brain. The CSF has a function in supplying nutrients to the brain, and also in protecting it against trauma.

CONSEQUENCES OF DAMAGE

The consequences of damage to the brain are many and varied, but a few of the more obvious signs of damage to the nervous system will be described here.

CEREBRAL HEMISPHERES

The consequences of damage to the cerebral hemispheres are very much dependent on where in the hemispheres the damage has occurred, as well as in what way the damage has occurred. Symptoms from the major lobes are described here.

1. Frontal Lobe

If the anterior part of the frontal lobe is damaged, there may be a personality change which could lead to a behaviour disorder, e.g., urinating in the street, whilst the posterior part of the lobe contains the centre for muscle movement so that damage here leads to a loss of muscle movement on the opposite side of the body (hemiplegia).

2. Parietal Lobe

Damage will cause a loss of sensation on the opposite side of the body (hemianaesthesia).

3. Occipital Lobe

Damage to one occipital lobe will cause loss of vision on the opposite side of the body (homonymous hemianopia), and this means a loss of half the vision in each eye.

4. Temporal Lobe

Loss of this lobe will lead to aphasia, and an inability to get the words out, even though the patient knows what he wants to say. This is a particularly disturbing symptom since the patient will often be treated as though he were mentally defective when this may not, in fact, be the case, and care needs to be exercised. If in doubt, try asking questions which require a yes/no answer, and the patient will often respond appropriately to these simple questions. A person with aphasia, when put under pressure, will find increasing inability to speak, even though he knows what he wants to say.

5. Cerebellum

This structure, when damaged, will cause loss of balance (ataxia) and a common example of this type of damage is seen in drunkenness or alcoholic intoxication. The other type of damage which can be seen is muscular inco-ordination of a special type, often seen in multiple sclerosis. Damage to the cerebellum can occur not only in multiple sclerosis, but also with chronic alcohol ingestion with a stroke or a number of other diseases.

6. Brain Stem

Very small lesions in this area will cause loss of specific function of one cranial nerve, such as facial paralysis, but more commonly a diffuse lesion will cause unconsciousness, often with slow pulse and respiration and pin-point size pupils.

7. Spinal Cord

The spinal cord contains fibres going from the brain to the muscles via the peripheral nerves, and initiating muscular contraction; and sensory fibres running from the surface of the body to the brain. Complete section of the cord causes either quadriplegia (loss of the use of and sensation from all four limbs), if it occurs in the cervical region, or paraplegia (loss of power and sensation in the lower limbs) if this occurs further down.

BRAIN DISEASES

CEREBRO VASCULAR ACCIDENT (CVA)

A CVA is the disorder resulting from the death of brain tissue from either cerebral haemorrhage or thrombosis. This is caused usually by atherosclerosis. The development of atherosclerosis has been described under cardiovascular diseases (Chapter 17). As atherosclerosis in the brain progresses with age, the arteries become rough which in turn leads to either clotting within the arteries (cerebral thrombosis) or the arteries become weakened and may burst under the pressure of arterial blood (cerebral haemorrhage). Both these processes may be exacerbated by high blood pressure. With either haemorrhage or thrombosis, some brain tissue dies (and dead brain tissue cannot regenerate), and some tissue is damaged. This latter, however, may recover.

A cerebral haemorrhage gives symptoms which come on over a few minutes in a person who has often been previously perfectly well. The disorder is usually in the cerebral hemisphere so that patient may rapidly develop hemiparesis on the opposite side of the body, or he may develop an aphasia.

Cerebral thrombosis on the other hand is usually of slower onset, coming on over hours and may, for example, produce a hemiparesis in the morning in a patient who was perfectly well the night before. Treatment in hospital consists of rest and rehabilitation, so that any brain tissue which is not dead can be coaxed back into action. There is usually little active drug or operative therapy, but many weeks of rehabilitation can be necessary before as full a recovery as possible can be obtained. Many patients recover completely, but some are left with a permanent deficit.

The Ambulance management consists of management of the unconscious patient, if coma is present, or reassurance and considerate movement to hospital if the patient is conscious. It must be remembered that loss of function of part of the body, especially when coming on suddenly, is very frightening indeed. Anything that can be done to ease the patient's anxiety will greatly assist in the patient's integration into the hospital environment. Care must be taken in the conscious patient who cannot talk. He may perfectly well understand all that you say and will not like being treated as a child.

EPILEPSY

This disorder is a frightening one for patient and onlookers alike. Epilepsy is caused by a sudden disorder of electrical activity in the brain, which may at first be generalised or may begin as a focal fit, i.e., one part of the body may develop abnormal activities such as twitching of the fingers. This may then progress to a generalised disorder, or may remain localised. A classical epileptic fit is described in four phases:

1. Aura Phase

This is a sudden inappropriate sensation peculiar to that person, and usually the same from fit to fit. The aura may last a few seconds or a few minutes. If the aura is short, and the fit is uncontrolled, then a person with epilepsy should be advised against hazardous occupations, e.g., driving a car or working at heights, as he will have little time to get himself into a safe position before the tonic phase begins.

2. Tonic Phase

This is the first part of the fit which is identifiable by outsiders. Here the patient falls to the ground and all muscles, including respiratory muscles, go into active and powerful contraction. **Management** at this stage is to protect the patient from damage, as the phase will end when the patient's oxygen reserve runs short. There is little value in trying to force the jaws open as it is very difficult to do and will probably cause more problems than just waiting until the next phase.

3. Clonic Phase

This stage is the classical fitting one that is so well known. Here the patient has rhythmical muscular contractions which may be quite violent and cause the patient and well-intended bystanders harm. This phase may last a few minutes – or rarely, many hours. **Management** at this stage is to give any restraint as is needed to protect the patient from harm and to insert an airway if this is necessary. If the fit does not stop after a few minutes, removal to hospital will be necessary and should be done with minimum necessary restraint. If this is not possible, a Medical Officer should be called to administer suitable antiepileptic drugs.

4. Post Ictal (Fit) Sleep

This may last a few minutes to a few hours, and is very deep at first, but then gradually lightens. Following this, the patient may waken and have little or no recollection of the preceding events.

Ambulance management has been partially discussed above. In the tonic phase, protect the patient from harm and continue this during the clonic phase, but insert an airway, if necessary. The patient should be removed to hospital –

(a) if the patient has not been previously known to be epileptic,
(b) if the fitting won't stop,
(c) if there is any damage or harm likely.

It is vital to remember that by the time the patient arrives in hospital he is usually either sleepy or awake, but there are no witnesses available. A person having their first fit will be fully investigated and if a diagnosis of epilepsy is made, then certain restrictions may be placed upon him, e.g., no driving of a car for two years. It is therefore vital that a full description be filled out in the Ambulance Officer's report, both from the Ambulance Officer's own description and that of bystanders, as this will greatly assist the subsequent hospital management and may prevent an incorrect diagnosis being made. Once under medical care, the patient will be given drugs which suppress the abnormal electrical activity in the brain so that the fits no longer occur. Fortunately, almost all patients can now be adequately controlled on drugs.

CEREBRAL TUMOUR

People may develop tumours which arise from within the brain (primary tumour) or in other organs, e.g., carcinoma of the lung, which then "seed" to the brain via the bloodstream. These latter types are called secondaries, and the symptoms may be of slow onset such as a slowly progressive hemiparesis over several weeks, or they may develop quickly such as can occur with a bleeding into the tumour. It may then be difficult to distinguish the disorder from a CVA. The symptoms can be varied but there is often a hemiparesis which may be getting slowly worse, or there may be a headache, and a headache from brain tumour can be extremely severe. In most cases there is quite positive treatment which can be offered in hospital. This may consist of an operation, radio therapy or drug therapy.

Should an Ambulance Officer be asked to transport such a patient to hospital, then consideration and reassurance, plus a careful drive to hospital, are mandatory. As for a CVA, the patient's anxiety may well be extreme, and if he has a headache, any movement at all can cause further pain. Fear may make the headache markedly worse.

MULTIPLE SCLEROSIS

This disorder is a fairly common one, and Ambulance Officers may well come in contact with such patients. The cause of the disease is unknown. In an attack, patches of the brain become inflamed, and the nerve fibres are damaged so that even though symptoms eventually subside, some residual damage is inevitable. After one or more attacks the patient develops any one or more of a number of symptom complexes. The patient may have a very labile mood and personality change. He may have a hemiparesis or partial or complete blindness in one or both eyes, or there may be urinary incontinence.

The disease is often a progressive downhill one, with relapses and remissions, and there is little that can be done to prevent it. The Ambulance Officer may be called to remove a patient to hospital in an attack, or when he develops complications such as bladder infection or pneumonia. There is no particular management for such situations, but the question of anxiety must be borne in mind at all times.

Patients with this disease are usually all too aware of the outlook for the disorder, and can be very anxious or depressed. Confident reassurance and considerate removal to hospital greatly assists in the integration of this patient into the hospital scene.

Chapter 20

Crisis Intervention and Psychiatric Disorders

Working as an Ambulance Officer, or, in fact, just being a member of society, necessitates meeting people, reacting to them, having them react to you, and then influencing their attitudes and behaviour, or being influenced by them. Usually, this occurs on very limited contact, so your first perception of the other person and their perception of you is very important.

At this time, then, external cues become very important; for example, the way the patient is dressed, his tone of voice and manner, and the situation the patient is in. From this you usually gain an impression of the patient and relate to him on this impression. It is important to remember that your own experiences and feelings play a large part in this. For example, if you have had a child who has been hurt, and are then called to a similar situation, your reaction will be different.

In any relationship there are two people involved. This is so in a doctor/patient relationship, a first-aider/patient relationship, or any other situation. It is important that both negative and positive feelings are considered when you interact with a patient. It is sometimes difficult to accept negative feelings and then use them to assist the patient and your relationship, rather than allowing them to become a hindrance.

Therefore, what does contribute to a therapeutic relationship? Firstly, information-sharing. Introducing yourself to the patient, explaining who you are, and asking the patient's name so that this can be used in further contact with the patient, allows the patient to gain some confidence and understanding of what is happening to him. While eliciting this information it is important to remain calm and reassuring, but at the same time to maintain empathy.

This second task may at times be difficult to achieve. It is hard to imagine yourself in the place of the drunk alcoholic in the gutter or the distress of a paranoid patient. However, transferring to the patient that you are trying to understand his predicament and reaction is reassuring. It is important that this is not done in a condescending way, as this may only increase the patient's feeling of helplessness and insecurity.

Careful explanation of what you are doing and your plans allows the patient to feel that he is a part of the relationship. Don't forget that his relationship to you is also altered by his social and cultural background, as well as his past experience, and may, therefore, appear to you to be a little inappropriate and difficult to understand at times.

The third important aspect to a relationship is effective communication, and this requires listening to the patient and responding appropriately. It is difficult to reassure a patient if you are not clear what he is frightened of or upset about. This

is an easy trap to fall into – to assume what the patient is anxious or worried about. Once again, these assumptions can be based on your experience and not related to the patient at all. A lot of your relationships as an Ambulance Officer occur in crisis situations.

Crises may be precipitated by stressful events of special significance to the person or persons affected, or may be readily perceived by others as a crisis situation; for example, a motor vehicle accident. This means that perhaps the crisis to you may seem insignificant, and can leave you feeling let down or even angry. Nevertheless, every individual reacts differently and intervention needs to occur when the person in crisis faces a problem that he cannot readily solve by using the coping devices that have worked before.

This means that the patient is looking for someone to help him take control and help him solve the problems in a different manner. This necessitates a calm but active role to assess the situation and act accordingly.

It is important to remember that a person in crisis is highly suggestible, which can be used to his benefit. However, any indecision or anxiety on behalf of the Ambulance Officer will also be transmitted to the patient and thus may cause the situation to escalate.

Another important aspect of crisis intervention is to allow the patient to feel that he has contributed to the solutions discussed, and thus maintain some responsibility for his behaviour and future.

EMOTIONALLY DISTURBED AND PSYCHIATRIC PATIENTS

Patients suffering from psychiatric illnesses are people whose feelings are basically the same as ours, but their feelings are of greater intensity and cannot be controlled or contained in the normal way. Psychiatric patients can, in general, be divided into two main groups; those suffering from neurotic conditions and those suffering from psychotic conditions.

Patients suffering from a **neurosis** may be extremely distressed by the way they are feeling, but are able to maintain contact with reality. This usually means that they can be reassured and comforted to some extent, which allows for trouble-free transportation to medical care. Patients with this disorder may present with a wide range of symptoms. Common presentations which may confront the Ambulance Officer are:

1. ACUTE ANXIETY STATES

The patients may be extremely anxious and agitated, and may complain of many bodily complaints; for example, headache, palpitations, gastric discomfort, chest pains and sweating. Reassurance in an understanding way is necessary. These patients can become so distressed that they begin to over-breathe or hyperventilate. It this is allowed to continue, these patients will then develop further signs and symptoms, including cramps in the small muscles of their hands and feet, and a painful pins and needles sensation. In this situation they require a great deal of firm reassurance.

2. DEPRESSIVE ILLNESS

These patients develop feelings of hopelessness and uselessness, usually in response to some stress in their social environment; for example, loss of a loved one, loss of job, or multiple social difficulties. They may be tearful and depressed, but usually show some response to a caring person who is willing to try and understand their plight. These patients can, however, feel quite suicidal, and this needs to be considered when dealing with them.

3. PHOBIC STATES

These patients usually have an unreasonable fear of something; for example, leaving their house, getting into a motor vehicle, or fear of heights. This needs to be understood by people dealing with them, and they often need considerable reassurance.

Patients with **psychotic** illnesses are more seriously ill, and often are not in touch with reality. This means that it is sometimes difficult to understand the way they behave or the way they think. They may suffer from conditions varying from extreme excitation and elation to severe depression with determined attempts at suicide. There may be hallucinations, that is, when the patient sees or hears something which is not there – or delusions, that is, when he has false or mistaken beliefs which he holds in spite of all evidence to the contrary. Patients in this group may present with:

1. MANIA

These patients suffer from extreme excitation and elation. There is much disorder of thinking and hallucinations and delusions are common. Physical activity is often extreme and quite reckless, with no fear of injury or other consequences. The mood of these patients can change quite rapidly from being extremely elated to becoming quite aggressive. They often do not have any insight into their illness, and do not feel that they are unwell and in need of hospitalisation. If this is the case, the patient may require sedation from a Medical Officer before he can be transported to hospital, and may in some circumstances need to be certified by the Medical Officer before being transported to medical care.

2. DEPRESSION

Once again, there is a change in the patient's mood and outlook. It can be so severe that the patient has false beliefs about his work and situation. He may believe also that he deserves to feel this way.

These patients may be uncommunicative and in a totally withdrawn state. They can be actively suicidal, and thus constant vigilance is necessary. A particular type of depressive illness can occur within a few weeks of child-birth, and these women may not only be suicidal but may have the delusion that they must kill their infant. Special care is needed to prevent this.

3. SCHIZOPHRENIA AND PARANOID STATES

These patients also suffer from hallucinations and delusions. They often hear voices, perhaps directing their behaviour or discussing them. These patients can feel that they are being controlled by an outside influence, and often feel that their thoughts can be read by others. In paranoid states the patient feels he is being persecuted, and thus he is very suspicious of others and can become antagonistic and aggressive. These patients may not have any insight into the fact that they are ill, and thus object to being taken to hospital. It is necessary for the Ambulance Officer to remain calm and encourage the patient to accompany him. This can sometimes be done by indicating to the patient that you understand how frightened he must be feeling in his present state, and would like to help him. The patient should not be directly confronted with his false beliefs, as these patients have little, if any, insight. If this approach does not work, or if the patient is markedly paranoid, sedation may be necessary prior to transport being contemplated.

ORGANIC BRAIN SYNDROMES

These are the disorders of the brain with an organic basis. In an acute brain syndrome or delirium, the patient is confused, disorientated, actively hallucinating, especially having visual hallucinations – for example, small animals running around the room – and may also have delusions. Common causes are infection, drugs, alcohol, or diseases of the brain. The patient is often very frightened and needs constant supervision, as he may try to run away. Management and transport to hospital should be instituted as with schizophrenic patients. Patients suffering from chronic brain syndromes, as with senile dementia, may also be confused and vague about what is happening. They need constant reassurance and understanding, and need to be constantly reminded of their situation and what is real.

GENERAL REMARKS

In dealing with patients with any form of nervous or mental illness it is essential that the initial approach should be made in a natural, calm way. The old tendency to regard those suffering from these illnesses as a class apart is fortunately disappearing. Many of these patients are aware that they are ill, but they are very frightened by their illness and afraid that they will be treated differently from other patients. Thus, response by the Ambulance Officer in a calm way will often mean that the patients can be taken to medical care without any difficulty. If the patients are extremely aggressive, one must consider the safety of the Ambulance Officer as well, and thus, either sedation by a Medical Officer prior to care, or consideration of transport by the police should be considered.

Patients requiring transport to hospital against their will, because of mental illness, require certification in the form of an "Order for Immediate Admission and Detention" (Form 4). This must be signed by a Medical Officer (Figure 70).

Form No. IV (Section 14 (1))

South Australia—Mental Health Act, 1976-1979

ORDER FOR IMMEDIATE ADMISSION AND DETENTION

The Superintendent,

............................Hospital.

I have this day personally examined...(name)
(Block Letters)

of...(address)

As a result of my examination I am satisfied:—

(*a*) that that person is suffering from a mental illness that requires immediate treatment;

(*b*) that such treatment can be obtained by admission to and detention in an approved hospital; and

(*c*) that that person should be admitted as a patient in an approved hospital in the interests of his/her own health and safety or for the protection of other persons;

and I hereby make an order for his/her immediate admission and detention under section 14 (1) of the Mental Health Act, 1976-1979.

The following are the grounds on which this order is made:

....

....

....

....

....

Name...

Address......................................

....

Date.................................... Signature.....................................
(Qualified Medical Practitioner)

Section 14 (3):—

Having personally examined...
(Block Letters)

.... (name), I *agree/do not agree that that person requires to be detained, and I therefore *confirm/discharge the order.

Name...

Address......................................

....

Date.................................... Signature.....................................
(Psychiatrist)

*Cross out whichever is not applicable.

(See over)

Figure 70 Admission Form 4

If the patient cannot be persuaded to enter the vehicle voluntarily, and a Form 4 has been completed, the Police must be called. Patients who do not have a Form 4 filled out cannot be removed against their will.

Chapter 21

Poisons and Venomous Bites

Poisoning is a common occurrence which may be either accidental or intentional.

Children between the ages of six months and four years make up the major proportion of the accidental poisoning group, in many instances swallowing substances such as detergents which an adult would find revolting to taste. Poisoning in children is often the result of careless actions by adults, whereby dangerous tablets and medicines are left within a child's reach. Ambulance Officers can play a significant role in preventive medicine by tactfully pointing out this danger when in homes where toxic substances are stored without regard to child safety.

Poisoning in adults may be a form of suicide attempt, and sleeping tablets, antidepressants and tranquillizers are often taken in excess. Patients who have attempted suicide in this manner, and who are still conscious, must be observed closely in case they undertake other actions of a self-destructive nature. The management of patients with mental illness, including those with suicidal tendencies, is discussed in Chapter 20.

When in doubt as to the correct management of a particular poisoned patient, the Ambulance Officer should always seek advice via radio from a hospital or Poisons Information Centre.

Poisons may enter the body in four ways:

1. By mouth;
2. By way of the lungs;
3. Through the skin;
4. By injection.

POISONING BY MOUTH

Swallowed poisons can be considered in two groups. Poisons may be:

(a) **Corrosive** – that is those which are capable of causing chemical burns. In this group are strong acids and alkalis, including some household cleaning agents;

(b) **Non-corrosive** – that is those that do not cause burning. Tablets and medicines taken in overdose are examples of non-corrosive poisons, as are most household products, such as detergents, shampoo, etc.

MANAGEMENT

In either case it is important for the Ambulance Officer to ascertain the history of the poisoning as accurately as possible. The patient may be unconscious, and for this or other reasons, unable to give details. There may be witnesses available to give relevant information such as the exact time of the poisoning, and observations on the patient's recent mental state and behaviour. The Ambulance Officer should specifically look for any remaining drugs or poison, and for any container which may have held the poison. These items should also be taken to the hospital for analysis, an investigation which may have a vital bearing on the treatment subsequently given to the patient.

Vomiting should not be induced in the unconscious patient (inhalation of vomitus may occur); or in corrosive and petroleum product ingestion (cause more damage if vomited).

Be prepared for vomiting, especially in children who have been given syrup of Ipecacuanha. This drug usually causes vomiting some 20 minutes after administration.

POISONING BY INHALATION

Gassing, for example by car exhaust emission, domestic gas supply or industrial fumes is not common, but is always dramatic and requires quick decisive action on the part of the Ambulance Officer.

Car exhaust emission and building fire fumes contain carbon monoxide. Natural gas does not. Carbon monoxide is a gas which combines with haemoglobin in the body's red blood cells and prevents those cells from carrying oxygen. Although affected casualties do not become cyanosed, they nevertheless suffer from severe oxygen lack.

Industrial gases include carbon tetrachloride, chlorine, cyanide fumes, hydrogen sulphide and trichloroethylene. All of these cause drowsiness, and loss of consciousness. Cyanide fumes in particular can be rapidly fatal.

MANAGEMENT

A major consideration is to ensure that the Ambulance Officer is not the next victim.

Rescue from a gas-filled environment must be done with extreme caution and where industrial gases are involved the rescue should be performed by especially trained teams using life-lines and suitable respirators.

Move the patient to fresh air.

Give oxygen as a routine.

If the casualty has inhaled one of the industrial gases and subsequently requires artificial respiration DO NOT use the mouth to mouth method.

POISONING THROUGH THE SKIN

Poisons absorbed directly through the skin surface are often substances used in agriculture, for example insecticides. Special mention is made of organophosphate compounds of which Parathion and Malathion are examples. They are related to the nerve gases of chemical warfare and are found in market gardens and orchards. In these settings they are sometimes applied by aerial spraying. Of greater significance today is their widespread availability for use in household gardens.

Organo-phosphates can gain entry to the body by ingestion, inhalation or absorption through the skin or conjunctiva. Initial symptoms are headache, bradycardia, vomiting, diarrhoea and breathlessness. These may be followed by respiratory paralysis, unconsciousness and death.

MANAGEMENT

If the poison is entering the body by absorption through the skin then remove contaminated clothing and irrigate the affected skin thoroughly with water. The Ambulance Officer must wash his own hands if he touches the contaminated clothing.

Keep a careful watch on the patient's breathing.

Assisted ventilation USING A BAG AND MASK is often needed together with frequent suction to the airway. Remember that mouth to mouth resuscitation is FORBIDDEN in this situation.

POISONING BY INJECTION

It is unfortunately increasingly common for an Ambulance Officer to be called to a drug addict who has collapsed while taking drugs such as heroin, morphine or pethidine. These drugs may markedly depress respiration and artificial respiration may be necessary.

When examining such patients take particular note of pulse and respiratory rates and of pupil size and reaction to light. Look for injection sites.

Remember to collect any containers, drug ampoules or hypodermic syringes found at the scene and take them, with the patient, to hospital.

The Ambulance Officer's responsibility is to the patient and it is not his role to do other than give patient care and transportation to medical aid. Referral to police or other government departments is a step best left to the staff of the hospital receiving the patient.

A feature of narcotics is that they depress respiration, and elevation of carbon dioxide in the blood causes coma. An unconscious narcotic overdose patient may wake up and become aggressive once adequate ventilation has been established. Hospital care is still required, however, because if he is left alone he will become unconscious again.

SNAKE BITE

In Australia, bites from snakes and other venomous creatures are another cause of poisoning by injection. Always assume that the snake which attacked the patient was a venomous one. Remember that there may be very little evidence of injury or reaction at the site of the bite. Signs and symptoms, which usually occur within a few hours of the bite may include:

- Nausea and vomiting;
- Drowsiness;
- Double vision;
- Sweating;
- Faintness;
- Muscle weakness;
- Bruising or bleeding.

Muscles used in respiration may become weak or paralysed, leading to respiratory difficulties. Be alert for this and assist respiration if it is failing.

If the bite was on a limb, immediately apply a firm roller bandage over the site and bandage beyond the site to the fingers or toes and then back along the limb to include the joint above. The pressure of the bandage compresses the lymphatic vessels and stops flow of venom into the circulation. The roller bandage should be applied as for a sprain or strain, and the extremities should be checked to ensure that the bandage does not impair the circulation. Do not wipe or wash the venom off the skin because it may be used to identify the snake. The time at which the bandage is applied should be noted. Immobilise the limb, but do not elevate. Establish radio communication to hospital.

Arterial tourniquets and constrictive bandages are no longer used.

Transport to hospital where an antivenom may be administered. If practicable, bring the snake for identification. A patient with symptoms from snakebite is usually given antivenom in hospital.

SPIDER BITE

Bites from red-back and funnel web spiders have been known to kill humans. Red-back spiders may be found throughout Australia but funnel-web spiders are mainly confined to the eastern coast. Treatment of funnel web spider bite is the same as for snake bite. Cold water application to the site will ease the pain from red-back spider bite. There is no need to bandage. There is an antivenom available for use in treating red-back spider bite, and one has recently become available for funnel-web spider venom.

BLUE-RINGED OCTOPUS BITE

The blue-ringed octopus can be found in shallow waters around the coast of Australia, including South Australia. Envenomation by this creature is serious as the venom may cause paralysis of muscles and failure of respiration and death in a few minutes.

Treatment is the same as for snake bite. Keep a close watch on airway and breathing and assist respiration if it is failing.

Establish radio communication with hospital.

TRANSPORT TO HOSPITAL

Only in relatively rare instances is it necessary to rush a poisoned patient to hospital with siren wailing and red light flashing. Such measures may be warranted in instances of poisoning by organo-phosphates, arsenic, cyanide and strychnine.

Occasionally a Medical Officer may specify emergency transportation when other poisons are involved.

All poisoned patients should be transported without undue delay, but a few minutes of careful treatment before transportation will be more beneficial than a high-speed dash with inadequate treatment.

A good detailed history of events is invaluable to the Medical Officer.

COMMON POISONINGS BY MOUTH, AND RECOMMENDED TREATMENT

1. *ACIDS*

Do not induce vomiting. Give milk or water.

2. *ALKALIS*

Include ammonia, caustics, drain cleaner, oven cleaner, floor stripper, lime. Do not induce vomiting. Give water, lemon juice, orange juice, or dilute vinegar, then milk.

3. *DRUGS*

Sleeping tablets, tranquillisers and antidepressants may cause unconsciousness, respiratory depression, hypotension, tachycardia, cardiac arrhythmias, and convulsions.

Provided care of the airway and ventilation is meticulous, most patients can be safely transported to hospital.

4. *PETROLEUM PRODUCTS*

Include dry cleaning fluids, kerosene, turpentine, petrol, wood stains and oils. Do not induce vomiting. Give milk.

5. *PLANTS*

The most serious poisonings have resulted from ingestion of:

Angel's Trumpet	Lantana
Castor Oil Beans	Oleander
Deadly Nightshade	Death Cap Mushroom
Foxglove	

Establish radio communication to hospital.

Chapter 22

Assistance with Medical Procedures

Ambulance personnel may be required to assist a local Medical Officer or a retrieval team Medical Officer at the scene. There are some procedures normally only carried out by a medical officer in which the ambulance officer can be of great assistance. He may also then be responsible for monitoring the function of the equipment used during transport. One such procedure is intravenous therapy (Chapter 10). The others of importance are intubation of the trachea and underwater seal chest drainage.

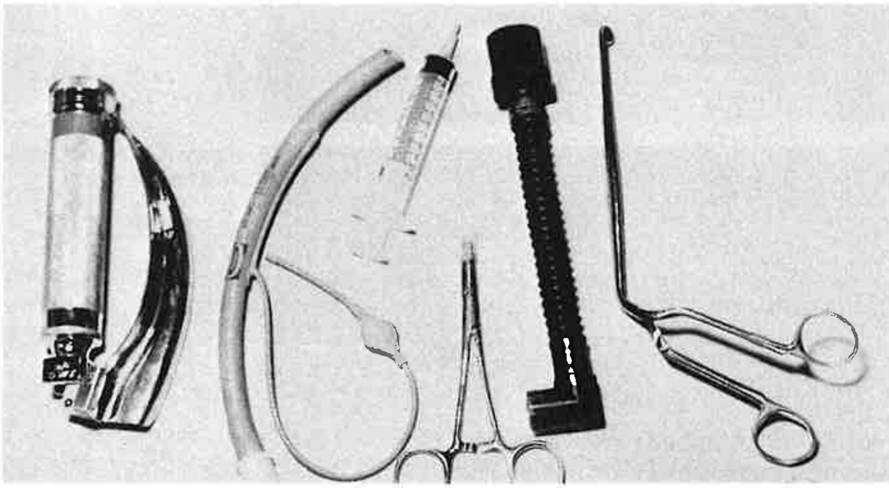
INTUBATION OF THE TRACHEA

An endotracheal tube may be passed into the trachea via the mouth or nose for several reasons:

1. To allow artificial ventilation for long periods.
2. To protect the airway from inhalation of foreign material.
3. To overcome upper airway obstruction.

The essential equipment is shown in Figure 71: endotracheal tube, syringe, clamp, laryngoscope, tube mount, tape. A bag and mask, suction, oxygen and

Figure 71 Equipment for Intubation of Trachea



anaesthetic drugs are also required, as well as a pair of intubating (Magill) forceps, and a malleable introducer.

PROCEDURE

1. All equipment is checked to ensure it is working efficiently.
2. The patient breathes or is ventilated with 100% oxygen for 3 minutes.
3. Drugs are given by the Medical Officer.
4. Cricoid pressure is applied by the assistant to prevent regurgitation of gastric contents. The cricoid cartilage, immediately below the larynx, is gripped between index finger and thumb, and pressed backwards (Figure 72). If the patient vomits, the Medical Officer will order immediate release of cricoid pressure to avoid damage to the oesophagus.
5. Medical Officer intubates.
6. After intubation, the cuff is inflated with the syringe, as directed, and the tube clamped.
7. The patient is ventilated with 100% oxygen.
8. Suction down the tube is performed with a Y suction catheter.
9. The tube is secured to the patient's neck (Figure 73).
10. Ventilation is continued.

Figure 72 Application of Cricoid Pressure

Figure 73 Endotracheal Tube in Place

UNDERWATER SEAL CHEST DRAINS

These drains are inserted through the chest wall into the pleural cavity to drain air (pneumothorax) or blood (haemothorax) in patients with chest injury. The water seal acts as a valve to stop air being sucked back into the chest. Its place may be taken by a rubber flap (Heimlich) valve.

The essential equipment consists of:

Chest drain catheter.
Bottle.
Connecting tubing.
Surgical instruments.
Antiseptic solution and swabs.
Local anaesthetic, syringe and needle.
Needle and suture.
Adhesive tape.

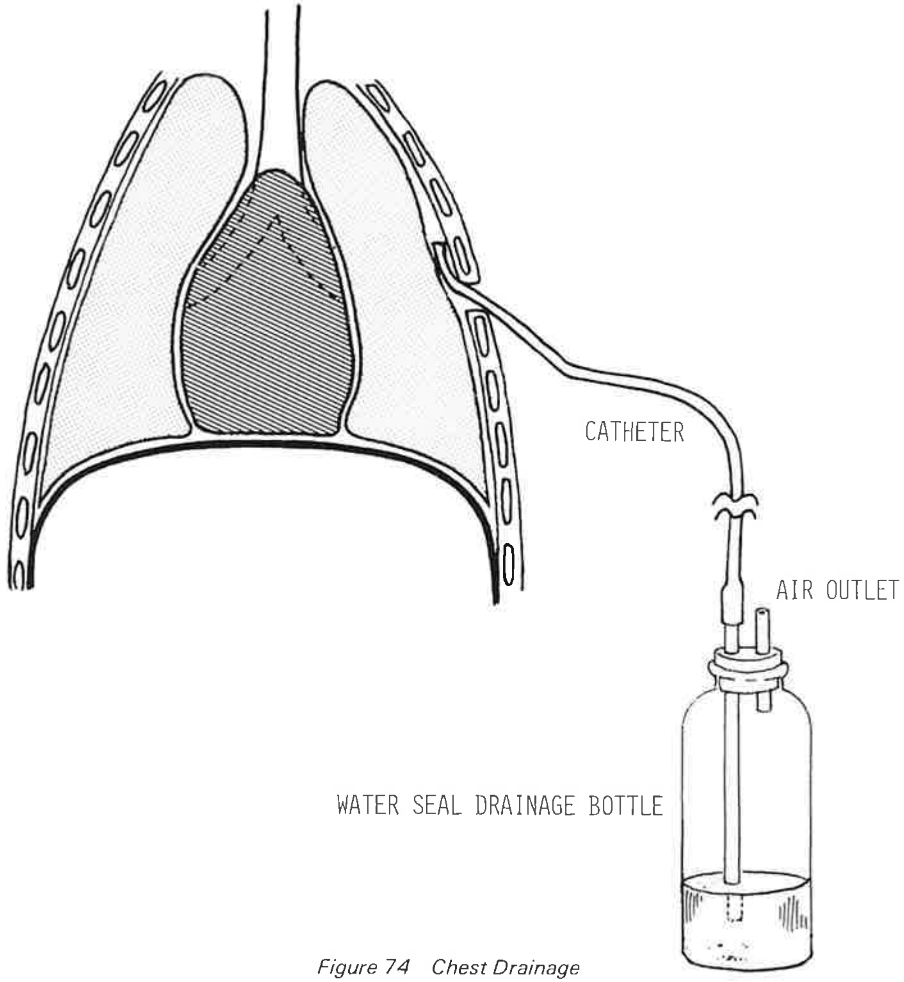


Figure 74 Chest Drainage

PROCEDURE

1. 500 ml normal saline is poured into the bottle.
2. The bottle and tubing are assembled so that the long rod is below the level of fluid in the bottom of the bottle.
3. The Medical Officer prepares the site, cleans the skin, infiltrates local anaesthetic, and inserts the catheter.
4. The catheter is secured to the patient and connected to the bottle (Figure 74).
5. Observe that air bubbles under water, or that blood drains into the bottle, or that the fluid level in the tube in the bottle swings up and down with respiration.

DANGERS

1. The drainage bottle must never be elevated above the floor, or fluid will flow from bottle into pleural cavity.
2. If the bottle breaks or a disconnection occurs, the patient has an open pneumothorax. Clamp the tubing with forceps until the problem is corrected, then unclamp.

BOTTLE CHANGING

If the bottle fills up, clamp the tube, remove the top, empty out all but 500 ml of fluid in the bottle, and record the volume. Replace the top, unclamp the tube.

In a transport situation, a rubber flap (Heimlich) valve may be connected to the chest catheter. An ordinary vented drainage bag is connected to the other end of the valve.

PART E – CHILDBIRTH

Chapter 23

Emergency Childbirth

Childbirth is a natural physiological event. A basic knowledge of the process of childbirth will help the Ambulance Officer to deal with a delivery which may occur before or during transportation. The Ambulance Officer must remain calm and give the mother confidence and emotional support, as well as assist during the delivery.

NORMAL PREGNANCY

Pregnancy lasts a total of forty weeks. The foetus (developing baby) lies within the uterus and is linked by the umbilical cord to the placenta. The placenta is an organ which allows the exchange of oxygen and nutrients from maternal blood to foetal blood and carbon dioxide and waste products to pass from the foetal blood to the maternal blood. Surrounding the foetus and cord, and covering the inner surface of the placenta, are two thin layers of membrane (amniotic membrane). Contained within this sac, and surrounding the foetus, is approximately 1,000 ml of amniotic fluid.

The foetal position is usually head-down, with the foetal back facing towards the mother's front (Figure 75).

LABOUR

Labour is the work the uterus does to allow the baby to be born and the placenta to be expelled. During this time the muscles in the upper part of the uterus contract and shorten while the muscles in the lower part of the uterus and around the cervix stretch and become thinner until the baby is able to pass through. As a result of this action, the upper part of the uterus pushes the baby through the dilated cervix and birth canal. Between the contraction period of the muscles there is a resting period.

Initially the contractions may only occur at ten minute intervals and last for 30 seconds, but as labour progresses the contractions will occur at 2-3 minute intervals and last up to 60 seconds.

After the baby is delivered, the uterus will continue to contract. This will cause the placenta to separate from the wall of the uterus and be expelled through the birth canal. Once the placenta and membranes are expelled, the uterus will usually contract firmly to prevent excessive bleeding.

Figure 75 The Pregnant Uterus

SIGNS AND SYMPTOMS OF LABOUR

1. Presence of uterine contractions. These occur with rhythmic regularity, eventually occurring every 2-3 minutes and lasting 45-60 seconds.
2. Rupture of the amniotic membrane with the escape of the amniotic fluid.
3. A vaginal discharge of blood and mucous called the "show".
4. A low backache.

STAGES OF LABOUR

There are three stages of labour:

FIRST STAGE –

begins with the onset of regular uterine contractions and lasts until the cervix is fully dilated.

SECOND STAGE –

lasts from full dilatation of the cervix until the birth of the baby.

THIRD STAGE –

lasts from delivery of the baby until expulsion of the placenta and membranes.

INITIAL EXAMINATION OF THE PREGNANT WOMAN

An initial examination of a woman in labour should be performed to determine the most appropriate course of action. Observe the woman's colour, pulse rate, respiration rate and, if possible, blood pressure. Feel for uterine contractions by placing a hand flat on the abdominal wall. The contractions will be felt as tightening of the uterine muscle, which may last up to 60 seconds, and then relaxation of the muscle as the contraction passes off. Observe if there is any vaginal loss of fluid or blood. Note the colour of the fluid. It should be a clear yellow colour. Check whether the vulva and perineum are bulging due to the foetal head pushing down. If the head is visible at the vulva, delivery is imminent.

The woman who is in severe pain, or has dark green/brown fluid draining, or is bleeding freely, requires priority GREEN transport to medical aid. If the woman's observations are satisfactory and the foetal head is visible at the vulva, the Ambulance Officer must make preparation for the delivery to occur in the home or vehicle. Once the head is visible, the woman usually has an uncontrollable urge to "bear down" and push with the contractions.

FIRST STAGE MANAGEMENT

Keep calm at all times.
Reassure the mother and family.
Place a sterile pad between the woman's legs.

Observations

Colour
Respirations
Pulse
Blood pressure (if possible)
Uterine action
Woman's reaction to contractions
Loss from vagina
Appearance of the foetal head.

Position the woman on her side, or in the position in which she is most comfortable, but not flat on her back.

Pain may be relieved by the correct administration of Entonox.

The Ambulance Officer should wash his hands thoroughly if possible, then cover his hands in obstetric (Hibitane) cream and wipe off excess with a clean towel, in preparation for the delivery. Place a protective covering on the bed and open the maternity kit. (For contents see Figure 76).

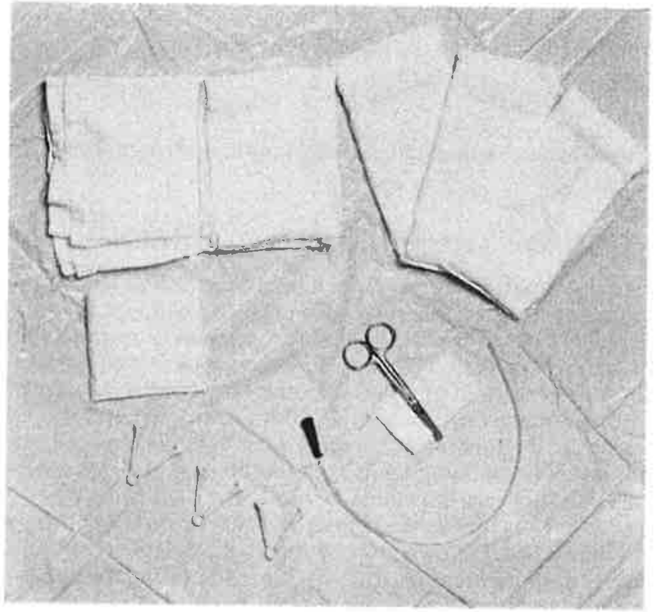


Figure 76 Maternity Kit

SECOND STAGE MANAGEMENT

The baby's head will be visible at the vulva.

Ensure privacy and warmth.

Position the woman on her back with her head and shoulders elevated on two pillows. The Ambulance Officer must again wash his hands and nails thoroughly, if possible, then use Hibitane cream. Place sterile burns sheets between the woman's legs. Cover the anus with a sterile pad to keep the delivery field clean. Any faeces that are involuntarily passed must be wiped backwards away from the vulval area.

DELIVERING THE BABY

Allow the head to deliver slowly by encouraging the mother to pant instead of pushing. Once the head is delivered, gently support it and wipe the face with a sterile pad. If there is a membrane over the baby's face it must be torn. If the cord is around the baby's neck, ease it up carefully over the baby's head, or down over the shoulders. If the cord is tightly around the neck, place 2 clamps on the cord 5 cm (2") apart, and snap them shut. Using sterile scissors, cut between the two clamps and free the cord. DO NOT USE FORCE.

As the body emerges, slide your hand down the baby's back, cradling the buttocks in one hand and the neck and head in the other (Figure 77). Remember, newborn babies are slippery.

Hold the head lower than the trunk to facilitate drainage of any secretions. DO NOT STRETCH THE CORD.

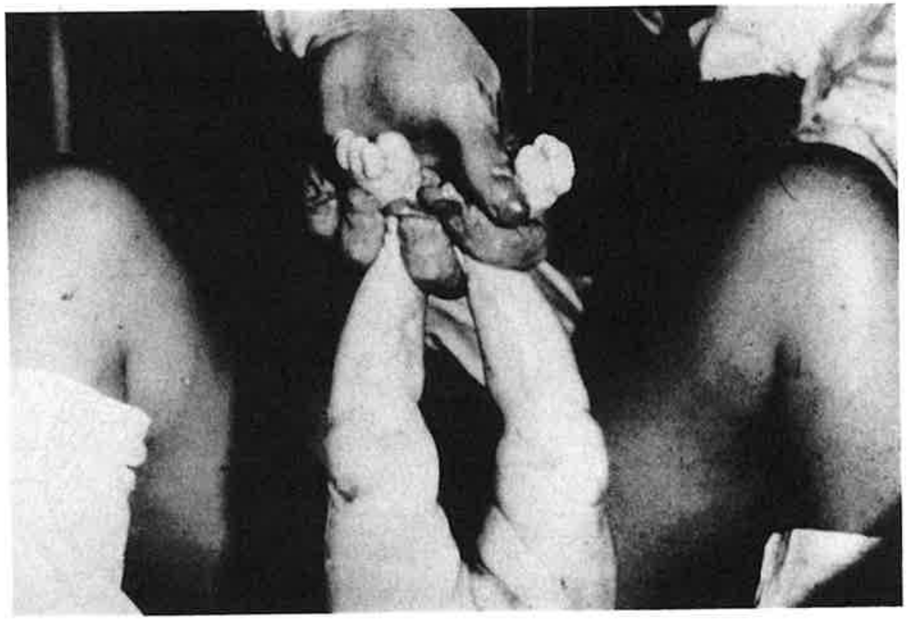


Figure 77 Holding the Baby

CARING FOR THE BABY AND THE CORD

Place the baby on his side on the bed between the mother's legs. If necessary, gently clear the baby's mouth using a small suction catheter and the neonatal aspirator. If the baby does not breathe initially, a gentle tap on the soles of the baby's feet is usually all that is necessary.

Quickly, but gently, dry the baby with a sterile napkin. Place 2 clamps on the cord close together, approximately 30 cm (12") from the baby, and place the third clamp 8 cm (3") beyond this (Figure 78). Using sterile scissors, cut the cord between the two outer clamps, leaving two clamps on the baby's side.

KEEP THE BABY WARM

Once the cord has been clamped and cut, the baby must be wrapped in two clean bath towels or baby blankets. Don't forget to cover the baby's head (leaving the face exposed), otherwise a large amount of body heat will be lost from the baby. Once the baby is breathing well and warmly wrapped, give him to the mother to hold.

DELIVERING THE PLACENTA

This may take up to 15 minutes. DO NOT ATTEMPT TO DELIVER THE PLACENTA OR PULL ON THE CORD. Adopt a wait-and-see attitude. Encourage the mother to put the baby to the breast. Even if the baby nuzzles and licks but

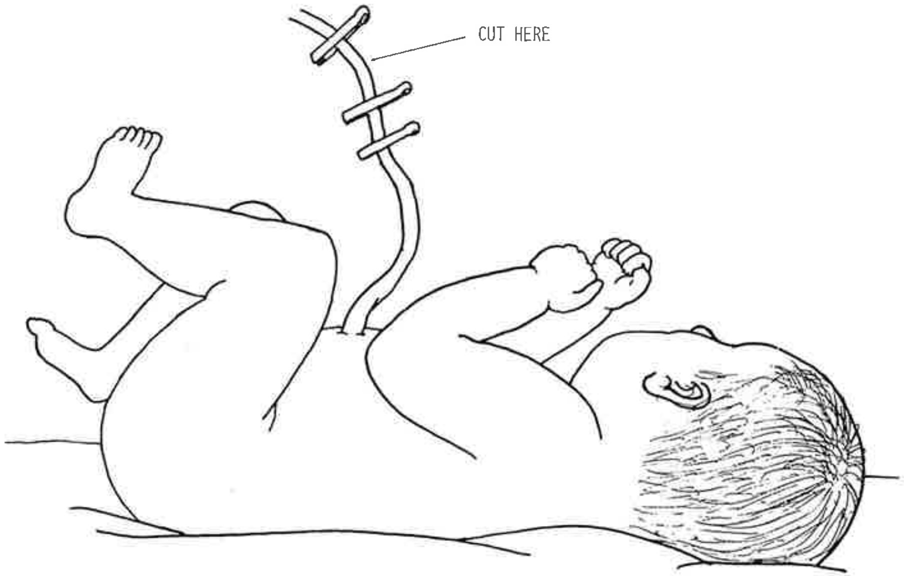


Figure 78 Clamping the Cord

does not actually suck, this will encourage the uterus to contract strongly, thus separating the placenta. The mother may then push the placenta out through the birth canal. Place the placenta in a plastic bag or container, and take to hospital with the mother and baby. If the placenta has not delivered in 15 minutes, transport the mother and baby to hospital.

CARE AFTER DELIVERY

Place a sterile pad over the vulva and remove wet and soiled sheets and replace with dry ones. Cover the mother with blankets.

Every 2 minutes check –

1. the baby to ensure normal respirations and colour;
2. the baby's cord, to ensure no bleeding;
3. woman's pulse and vaginal loss.

The mother and baby should be transported to hospital as soon as possible.

SUMMARY OF EMERGENCY CHILDBIRTH

SECOND STAGE MANAGEMENT

1. Remain calm.
2. Reassure the woman and family.
3. Relieve pain with Entonox.

4. Maintain a high standard of hygiene.
5. Prepare for delivery.
6. Do not interfere – but gently support the baby.
7. Clear baby's mouth.
8. Ensure respirations established – resuscitate.
9. Clamp and cut the cord.
10. Keep the baby warm.
11. Do not attempt to pull the placenta out.

CONDITIONS REQUIRING URGENT TRANSPORTATION

1. Severe bleeding from any cause.
2. Abnormal delivery.
3. Prolapsed cord.
4. Maternal convulsions.

In the metropolitan area these conditions require transportation to a major obstetric hospital where immediate medical care is available.

COMPLICATIONS OF PREGNANCY AND LABOUR

EXCESSIVE MATERNAL BLEEDING

Excessive maternal bleeding is a life-threatening situation. It may occur before, during or after delivery.

Before Delivery

If before delivery and concealed, the only indication may be a patient in shock. Immediate transport to hospital is essential.

After Delivery

Feel the uterus by feeling the mother's abdomen at the level of the navel. If the uterus does not feel like a cricket ball, gently rub it to stimulate it to contract. Check the birth canal. If the haemorrhage is from lacerations, apply direct pressure using a sterile pad.

If the mother is bleeding excessively, emergency transportation to hospital is essential. Treat for shock, as necessary.

ABNORMAL DELIVERY

If it is known that an abnormal delivery such as a breech presentation is likely to occur, the woman must be transported to hospital immediately.

If the baby delivers at home or during transportation, "hands off" is the rule until the baby is born. Then resuscitate the baby, as necessary, and wrap warmly.

CORD PROLAPSE

This may occur when the membranes rupture and a length of cord prolapses in front of the foetus. It may lead to impairment of the foetal oxygen supply, and death of the foetus. It is not a common condition, but if it does occur, the patient must be immediately transported to hospital on a Priority RED.

Management during Transportation

Place the woman on her side and in the head-down position by elevating her buttocks on 3 pillows, or elevating the foot of the stretcher. Where possible, the woman should be placed in the knee-chest position, with the head down. A Hibitane cleansed hand should be placed on the foetal head during transport to stop it progressing through the birth canal. Do not handle the cord as it may go into spasm, further reducing the oxygen supply to the foetus. Cover the cord with a large sterile dressing placed between the woman's legs. Administer oxygen to the woman, as this, in turn, may provide better oxygenation to the foetus.

ECLAMPTIC FITS

This is a very severe condition and is an exacerbation of the condition called pre-eclampsia (toxaemia of pregnancy). In this condition the woman has an elevated blood pressure, excessive oedema and protein in her urine. The condition is characterised by convulsions and coma.

Warning signs of impending eclampsia are –

severe headache
visual disturbances
vomiting
drowsiness
epigastric pain

Management (of impending eclampsia or eclamptic fit)

This is a life-threatening situation for mother and baby, and immediate transport to a maternity unit is essential. Lie the patient on her side and resuscitate with suction and oxygen, as necessary. Transport to hospital on Priority RED.

MISCARRIAGE OR ABORTION

For the purpose of this text the terms "miscarriage" and "abortion" are synonymous.

Miscarriages commonly occur between 8 and 12 weeks gestation. The earlier they occur the less likely it is that complications such as severe haemorrhage will follow. If any of the products of conception are expelled, save them for the doctor's inspection. Place 2 or 3 large dressings between the woman's legs. Reassure her. Unless the bleeding is severe, this condition is not an emergency and the mother should be transported quietly to hospital.

ECTOPIC PREGNANCY

This is a cause of severe abdominal pain. Here the pregnancy develops in one of the uterine (fallopian) tubes instead of the uterine cavity. As the foetus enlarges, the tube stretches and then ruptures, causing severe abdominal pain and shock due to intra-abdominal bleeding.

Treatment is analgesia for pain and treatment for shock.

ADMINISTRATION OF ENTONOX TO A PATIENT IN LABOUR

1. The key to successful Entonox analgesia in labour is to begin the inhalation before the pain is felt.
2. If the analgesic mixture is inhaled for at least 20 seconds before the onset of pain, then analgesia will be effective.
3. It is quite wrong to wait until a contraction is painful before starting the inhalation because the analgesic action will not become apparent for another 20 seconds, and will not be maximal for some 60 seconds.
4. There is a delay between the commencement of a uterine contraction and the appreciation of pain by the patient. This time lag must be used to build up an analgesic level of nitrous oxide in the woman's blood.

METHOD OF ADMINISTRATION

1. The Ambulance Officer must feel the woman's abdomen to detect commencement of the contraction.
2. When a uterine contraction is detected, instruct the patient to breathe slowly and deeply into the face mask. Breathe out normally.
3. Entonox must only be used during a uterine contraction.

Chapter 24

The Humid Crib

The normal full-term infant can lead a separate existence immediately after birth, but needs support to maintain temperature and to obtain nourishment. The premature baby, and the neonate at risk because of developmental abnormalities or maternal problems, need special care to survive. In line with modern developments and neonatal care, a retrieval service has been established in South Australia and is based in Adelaide. The service provides expert medical and nursing care, together with advanced equipment required to treat sick new-born infants (Figure 79).

The transport incubator and monitoring equipment are mounted on a special stretcher frame capable of fitting in all ambulances and also in the St. John aeroplanes. (All ambulances are fitted with the appropriate 12 volt sockets). Both the personnel and the equipment are transported to the baby, and specialised treatment is then given prior to and during the carriage of the baby to an Intensive Care Unit. This is the optimum way and, in fact, the only way that sick new-born infants should be transported. However, there may be situations where this service, for various reasons, is not immediately available, and as new-born infants need the support of optimal environmental conditions of temperature and oxygen, the humid crib is valuable in providing these conditions (Figure 80).

THE CRIB

The humid crib is a special neonatal carrier for nursing and transporting the neonate at risk. The unit provides a means of maintaining constant temperature and humidity, by an electrical heating circuit and water bath. The water bath contains sponges saturated in water. Heating is achieved by thermostatically controlled incandescent lamps or by resistance strips.

The neonate crib is a simple moulded tray which is fitted into the base of the carrier and requires only simple bedding for the baby to lie on. To provide a closed environment, a transparent polymer lid is fitted over the base, hinged at one end to allow access to the crib for cleaning and placing the baby inside. A device is fitted to enable the lid to be maintained in the open position.

The lid is fitted with two iris ports which allow the operator to attend the baby with the lid closed, and this in turn allows the maintenance of a constant environment. The lid has several small holes for crib ventilation to prevent carbon dioxide accumulation. To allow for the addition of oxygen, there is a tapered inlet in the

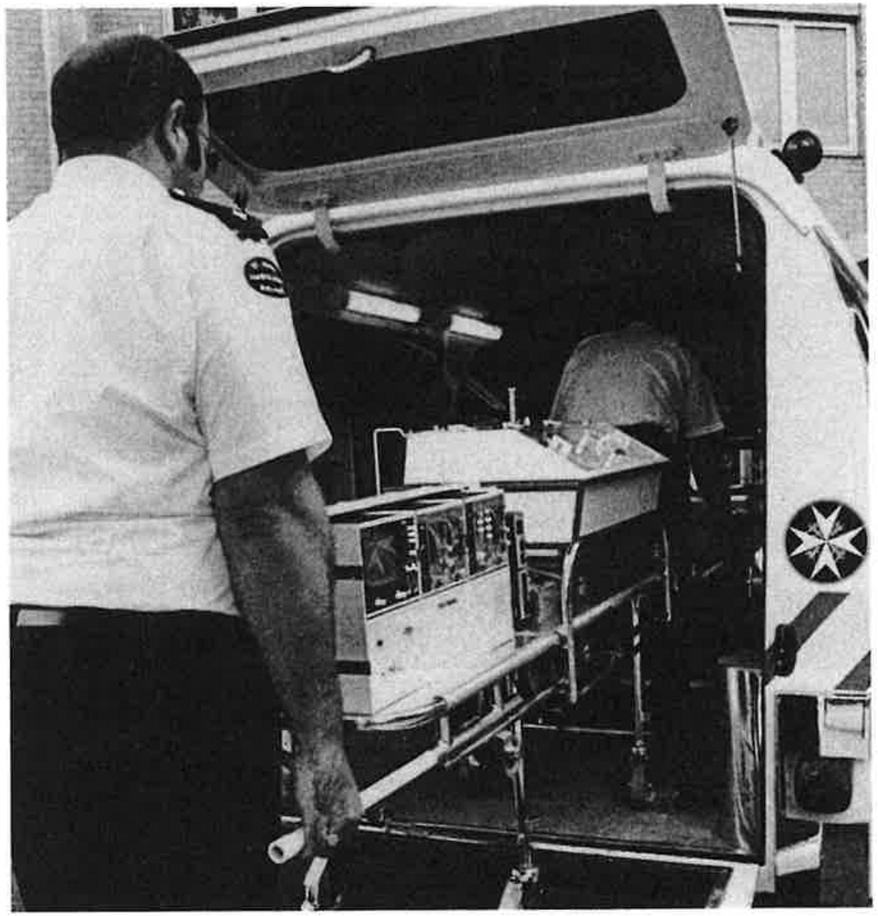


Figure 79 Retrieval Equipment

base which can be connected by normal tubing to an oxygen source. A flow rate of 4-6 litres per minute should be used for safe operating.

Optimum ventilation and satisfactory oxygenation are important in neonatal care, but excessive oxygen can be harmful as it may cause blindness. Oxygen therapy in the emergency situation should be delivered with the aim of maintaining a warm pink infant. Flow rates should be adjusted accordingly.

The units in general use can be electrically operated from normal mains power (240 volts) or with accessory leads from the 12 volt outlet in the ambulance. When connected to the vehicle power, the temperature regulator on the base is not operable. To help with maintenance of the crib temperature and humidity on the journey to collect the baby, the crib should be kept covered with the soft polythene cover provided. The unit should be sited in the centre of the ambulance, and

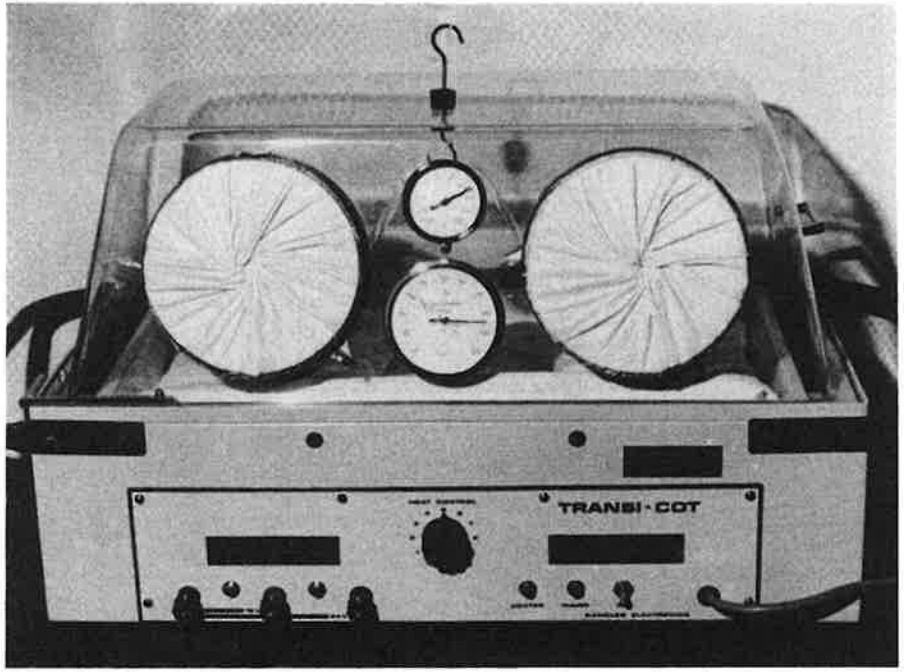


Figure 80 The Humid Crib

the vehicle heater operated when the weather is cooler. Remember, the 12 volt system has marginal reserve and can only maintain the environment in the crib. The lid cannot be opened without compromising the environment inside the crib.

While operating from mains power, the temperature and humidity can be easily maintained and controlled. It is necessary to have the crib operating in a standby mode at the ambulance centre so that correct operating conditions can be subsequently maintained on vehicle battery power. The crib should be moved to and from the vehicle with minimal delay, and only opened to place or remove the infant. When arriving at a pick-up point, the crib should be operated from mains power until optimum operating conditions are reached and stable, before removing to the vehicle for transportation to the destination.

The baby should be clothed and wrapped in blankets and placed on his side and positioned so that constant observation can be made of the airway, chest and umbilical stump. Any manipulation of the baby must be accomplished through the iris ports, ensuring that they are closed snugly around the operator's forearms.

Good lighting is essential to provide optimum observation of the baby through the lid of the crib. Do not leave the soft plastic cover on the lid while the baby is in the crib.

The humid crib should be used in all cases where transport of a new-born baby can be reasonably expected, e.g., a maternity case. The crib must be fixed securely on the floor of the vehicle to prevent it moving and damaging the baby.

OPERATING CHARACTERISTICS

To be effective, the temperature in the crib should be maintained at 30-34°C (86-94°F) during transportation of the baby. This means that the crib should be held at ambulance centres with its internal temperature at 36°C, as there may be some heat loss when the crib is in use. It is easy to cool the crib, if necessary, but difficult to raise its temperature when working from ambulance battery power.

The humidity should be set at 80-90%.

MAINTENANCE OF THE HUMID CRIB

The humid crib will only give useful service if it is operating correctly. Regular, frequent maintenance is required to ensure efficient function. Vehicle supply cables must be regularly inspected and maintained. Cable terminals must be tight and clean. Vehicle power outlets must also be regularly inspected and cleaned for proper contact.

In the stand-by phase, the crib should be cleaned and disinfected at least weekly. This will mean dismantling the infant compartment to reach areas where dust may collect. Simply washing with detergent solution and then wiping down with a recommended antiseptic solution will provide satisfactory cleaning. Infant bedding is best kept in a sealed polythene pack to remain clean for instant use. After every use the crib should be chemically cleaned, exposed to direct sunlight for a time, and then fitted out with fresh linen.

The sponges, which are saturated with water to provide humidification, require regular cleaning. To minimise the accumulation of sludge, use filtered or distilled water. In emergency operation the sponges may be saturated with warm water to produce optimum temperature and humidification.

NEONATAL PROBLEMS

The humid crib is used for transporting premature, ill, or at risk neonates. It is not always needed for normal full-term babies, but as a fallen temperature can be harmful to new-born babies it is advisable to transport all new-born babies in the crib.

The most common problems requiring crib transfer are:

- Prematurity
- Respiratory Distress Syndrome
- Aspiration pneumonia
- Neonatal jaundice
- Congenital Heart Disease
- Infection, e.g., meningitis
- Multiple congenital defects.

These infants require constant observation, oxygen therapy at levels to maintain a pink colour; that is 4-6 litres per minute as a minimum starting rate. Specialist advice may always be obtained by ringing the Neonatal Intensive Care Units at either the Queen Victoria Hospital or Flinders Medical Centre. In case of doubt, a Medical Officer's opinion should be sought at the scene.

The babies may, in some instances, require gentle ventilation with a bag and mask. In an emergency situation be prepared to discard equipment and use mouth-to-face resuscitation if any difficulty arises with resuscitation equipment.

PART F – ST. JOHN PROCEDURES

Chapter 25

Ambulance Driving in an Emergency

This chapter is written to assist Ambulance Officers in deciding how they should drive in an emergency, when to adopt emergency procedures, and what the implications of those emergency measures are.

To ensure that a patient has the best treatment, Ambulance Officers should do things quickly and methodically. They should, however, remember that doing things quickly is not always measured in kilometres per hour, but in the manner most suitable in the circumstances.

Few, if any, emergencies require the use of excessive speed. In addition, poor driving practices such as swerving, fast turns, and sudden changes, often increase the extent of injuries or illness and create adverse effects on the patient, the most important of which is excessive anxiety which may aggravate any disorder that the patient already has. In addition, bad driving practices will also increase the chance of the vehicle being involved in an accident with detriment to crew, patients and other road users.

The decision to use warning devices and to proceed faster than other traffic is a serious one. In taking it, an Ambulance Officer must realise that he is exercising a right granted to him (Section 40 of the Road Traffic Act), which gives certain exemptions to "*Any ambulance which is being driven in answer to an urgent call or is conveying an injured or sick person to any place for treatment urgently required.* **THERE IS NO EXEMPTION FROM DRIVING WITH 'DUE CARE AND ATTENTION'** ".

CLASSIFICATIONS FOR INITIAL RESPONSE

PRIORITY ONE

This indicates an emergency situation to which the ambulance proceeds with all due care, using both visual and audible warning devices, as appropriate.

1. Vehicular and industrial accidents, where the degree of urgency is unknown.
2. Acute chest pain (unrelieved in 5 minutes).
3. Severe chest injuries.
4. Severe shock from any cause.
5. Uncontrolled haemorrhage.
6. Respiratory or cardiac arrest.
7. Unrelieved respiratory distress.
8. Unconsciousness where life threat exists.

9. Hypoglycaemia.
10. Anaphylaxis.
11. Heat stroke.
12. Obstetric emergencies.
13. Drug overdose or poisoning with respiratory depression.
14. Any patient who is having a fit.
15. Any condition where a life-threat situation may reasonably be expected to exist.
16. As directed by the leader of a Medical Retrieval team.
17. Such other condition as may be determined by the Controller.

PRIORITY TWO

This indicates the case is non-urgent. In this case the Ambulance should proceed to the location to arrive as soon as practical. The visual and audible warning devices must not be used.

1. Cerebrovascular accident (CVA).
2. Conscious drug overdose or poisoning without respiratory or circulatory depression.
3. Vaginal bleeding.
4. Road or industrial trauma where a true emergency is known not to exist.
5. As directed by a Medical Officer.

PRIORITY THREE

All other cases presently denoted by a time.

CLASSIFICATIONS FOR PATIENT TRANSPORT

After patient assessment, the decision to transport as Priority "RED or GREEN" lies with the Ambulance Officer. In all cases, Ambulance Control must be advised of the priority when mobile.

Under Red classification the Emergency Provisions of the Road Traffic Act are invoked and a Medical Transmission is essential.

COUNTRY AMBULANCE PROCEDURES

Country Ambulance crews transporting patients to Adelaide on Priority RED will notify the Ambulance Control by radio as soon as possible, giving all relevant information.

Whenever communication installations in country areas permit dialogue, e.g., Ambulance crews to base and/or hospital, the same priority Red procedure should be followed to ensure that a standard state-wide code is adopted.

EMERGENCY AMBULANCE DRIVING PROGRAMME

TRAFFIC SIGNALS OR STOP SIGNS

The emergency ambulance must approach a red traffic signal or stop sign with both visual and audible warning devices operating.

The Ambulance must stop at the stop line with the warning devices still operating. Ensure that the intersection or junction is clear and that ALL other drivers are "giving way". Only when the Ambulance driver is SURE it is safe to proceed, he may do so with due care. If there is any doubt whatsoever, the DRIVER MUST NOT PROCEED.

RAILWAY AND/OR TRAMWAY CROSSINGS

Drivers MUST NOT proceed over a railway/tramway crossing when the warning signals are operating, or when directed not to by a Railway or Transport Authority employee.

SPEED LIMITS

Drivers of ambulances driven in emergencies are permitted to exceed normal speed limits by 20 kph. For example, such ambulances may travel at 80 kph in a 60 kph zone, or 100 kph in an 80 kph zone. However, it is the driver's responsibility to drive with due care at all times.

SCHOOL CROSSINGS

An emergency Ambulance MUST NOT exceed 25 kph at an operating school crossing or disregard the monitor's "STOP" sign.

USE OF WARNING DEVICES

The driver of an Ambulance must not depend solely upon the flashing light or siren to guarantee safe passage, but should drive at all times with DUE CARE AND ATTENTION, showing consideration towards other road users.

The flashing light should be used to provide an additional form of protection at the scene of an accident or other emergency. The Ambulance should be positioned to afford the maximum protection at the scene, and should have the engine running to avoid excess drain of the battery.

AMBULANCE VEHICLE ACCIDENTS

In the event of a St. John vehicle being involved in an accident, the driver must report the incident as soon as possible to –

(a) Metropolitan crews – the Communications Centre;
(b) Country crews – their own Centre, if locally, or, if en route to or from Adelaide, either the Adelaide base or the nearest contactable St. John Centre;

with the following information:

1. Location of the incident.
2. Whether any person has been injured.
3. Whether any other vehicle is involved.
4. Whether Ambulance transport is required.
5. Request for a senior officer, or his nominee, to attend for assistance.
6. Whether the vehicle is driveable or extensively damaged.

Country personnel will also request that their Centre is notified of the situation.

Before leaving the scene, the following information must be obtained:

1. Names and addresses of –
   (a) person(s) injured, and their injuries,
   (b) the driver(s) of the other vehicle(s),
   (c) any witnesses,
   (d) any other occupants of the other vehicle(s);
2. Make and Registration number of the other vehicle(s);
3. The name and number of any police officer attending.

Unless otherwise advised, the driver may be required to remain at the scene until the arrival of a senior officer.

The Ambulance driver is required to provide the Police at the scene with his/her name, address and the Centre of operation only. No other statement should be made until a senior Ambulance Officer is present.

On return to his/her Centre of operation, the driver will be required to complete an Insurance Accident Claim Form.

Chapter 26

Communications

The St. John communication system relies on the use of telephone and radio and the need to be able to send and receive accurate information is of paramount importance. Communications between ambulances and their control point, hospitals and Medical Officers have become an accepted part of the service. With the expansion of the St. John communication system it has become necessary to have discipline among operators, and a standard procedure.

DEFINITIONS

CALL SIGN

A common radio call sign is allocated by the Department of Communication to identify the St. John Ambulance Services throughout South Australia. This call sign is VL5FT, to which the location of the radio base station is added, e.g.,

VL5FT – ADELAIDE, VL5FT – LAMEROO

The call sign is to be used each half hour to identify its origin.

NET CONTROL STATION (NCS)

This is the one station on a network which serves as the Senior Headquarters. The NCS is responsible for the efficient receipt and despatch of messages and to ensure that standard procedures are adhered to.

SUB-STATION

Any station on a net other than the NCS.

LINK

Two or more stations operating on the same frequency for communication between each other.

NET

Any number of stations operating on the same frequency for communication under the control of the NCS.

PHONETIC ALPHABET

To allow greater clarity of message, and so that no mistake in spelling will result, the following phonetic alphabet and numbers are used when a name must be spelt or a number spoken.

Letter	Word	Pronounced
A	Alfa	AL fah
B	Bravo	BRAH voh
C	Charlie	CHAR lee
D	Delta	DELL tah
E	Echo	ECK oh
F	Foxtrot	FOKS trot
G	Golf	GOLF
H	Hotel	hoh TELL
I	India	IN dee ah
J	Juliett	JEW lee ETT
K	Kilo	KEY loh
L	Lima	LEE mah
M	Mike	MIKE
N	November	no VEM ber
O	Oscar	OSS cah
P	Papa	pah PAH
Q	Quebec	keh BECK
R	Romeo	ROW me oh
S	Sierra	see AIR ah
T	Tango	TANG go
U	Uniform	YOU nee form
V	Victor	VIK tah
W	Whisky	WISS key
X	X-ray	ECKS ray
Y	Yankee	YANG kee
Z	Zulu	ZOO loo

Stress the syllables printed in capital letters. Thus, in kilo, pronounced KEY loh, emphasise the first syllable, and in papa, pronounced pah PAH, the last syllable, e.g., the word "SYDNEY" would be spelt: S-See AIR ah, Y-YANG key, D-DELL tah, N-no VEM ber, E-ECK oh, Y-YANG key.

TRANSMISSION OF NUMERALS

0 ZE-RO
1 WUN
2 TOO
3 THUH-REE or TREE
4 FOW-er
5 FI-YIV
6 SIX
7 SEV-en
8 AIT
9 NIN-er

In numerals, stress the first syllable, e.g., SEV-en. Transmit all numbers by pronouncing each digit separately (except whole thousands). Where a number includes a decimal point, say the number as shown above, pronouncing the "point" as DAY-SEE MAL.

24-HOUR CLOCK

To avoid any ambiguous times, the 24-hour clock is used, and times are always given as shown in the following examples.

1.00 a.m. = 0100 hours (ZE-RO, WUN, ZE-RO, ZE-RO)
2.23 a.m. = 0223 hours (ZE-RO, TOO, TOO, TREE)
10.45 a.m. = 1045 hours (WUN, ZE-RO, FOW-er, FI-YIV)
1.09 p.m. = 1309 hours (WUN, TREE, ZE-RO, NIN-er)
2.18 p.m. = 1418 hours (WUN, FOW-er, WUN, AIT)
7.30 p.m. = 1930 hours (WUN, NIN-er, TREE, ZE-RO)

PRO WORDS

Pro words are pronouncable words or phrases which have been assigned special meanings to aid in the efficient passing of messages and in raising queries on difficult messages.

AFFIRMATIVE	Yes.
ALL AFTER	The portion of the message which I require is all that follows . . .
ALL BEFORE	The portion of the message which I require is all that precedes . . .
ALL STATIONS	I am calling all stations/mobiles on this net.
CORRECTION	An error has been made in this transmission.
DISREGARD	Delete all reference to my last transmission.
ETA	Estimated time of arrival.
ETD	Estimated time of departure.
FIGURES	The following numbers are transmitted.
I SAY AGAIN	I am repeating my transmission.
I SPELL	I shall spell the next word phonetically.
LOCSTAT	What is your present location?
MESSAGE	I require you to write this transmission.
NEGATIVE	No.
OUT	My transmission is ended. No reply required.
OVER	My transmission is ended. I await your reply.
ROGER	Message received and understood.
SAY AGAIN	Repeat all of your last transmission.
SEND	I am ready to receive your transmission.
SITREP	I require a situation report.
WAIT	I must pause for a few seconds.
WAIT OUT	I must pause and I will call when ready.
WRONG	That message is incorrect.

HOLD POSITION

Cars directed to hold position must pull over when practicable, stop, and await further instructions.

MESSAGE PROCEDURES

The receipt and despatch of messages is dependent on four basic factors.

BREVITY

All messages are to be as brief as possible without destroying or altering the context.

ACCURACY

This is of prime importance. An incorrect message may cost a life.

SPEED

All messages should be sent at a speed which allows the receiver to accurately record it.

SIMPLICITY

Forethought must be given to all messages transmitted. A simple concise directive is all that is required.

TRANSMITTING TECHNIQUE

Clear speech is essential to ensure the receiving operator understands your message. The following factors will aid in developing an easily understood style.

VOICE RHYTHM

Any phrase spoken in normal conversation has a natural rhythm, making it intelligible. This rhythm should be preserved when transmitting a message by radio or telephone. Speak all words plainly and avoid the running together of consecutive words. The message should be spoken in a short complete phrase, not word by word.

VOICE SPEED

The operator should maintain constant speed of speech and avoid hurrying through less important words. If a message needs to be written, gauge the speed of transmitting at which you yourself can write.

VOICE VOLUME

The operator should speak at normal conversation level and should not shout. Each word spoken should be at an even level and not fade on the last words of the transmission.

VOICE PITCH

High-pitched voices are more clearly understood. A deliberate effort should be made to speak with a higher pitch than usual.

Apart from developing the correct voice qualities, one should be familiar with using all types of our communication equipment. Because the radio network is shared by other stations there is a need to be more familiar with this equipment.

The following list of do's and don'ts assist to develop a good technique.

DO –

1. . . . listen before transmitting. Other stations may be using the frequency.
2. . . . think what you are going to say before you commence your transmission.
3. . . . remember to press the PTT switch prior to transmitting, and RELEASE it immediately you have finished. Be sure you identify the car clearly.
4. . . . speak clearly with the microphone approximately 2 inches from your mouth.
5. . . . speak slowly, especially when the other station is writing down your message.
6. . . . learn and use the list pro words.
7. . . . always give the called station's call sign first.
8. . . . be professional when "on air".
9. . . . allow the base operator time to answer the radio.

DON'T –

1. . . . use Christian names or platitudes like "please" and "thank you".
2. . . . use slang or bad language.
3. . . . leave the radio unattended or close down without notifying the NCS.
4. . . . use the radio for unimportant messages.
5. . . . use the siren when making a radio transmission.

TELEPHONE

To ensure that the correct service or centre is allocated to the designated case, the following procedure will be adopted.

1. Always answer the phone with –
   - Name of centre or service;
   - Operation code or fleet number of vehicle;
   - Name of person answering phone.
2. Have writing material at hand.
3. When contacting the Communications Centre, always identify yourself as above.

RADIO

The St. John Ambulance Service in South Australia is allocated four (4) very high frequencies (VHF) radio channels, using frequency modulation (FM). All four frequencies are installed at remote sites to serve the metropolitan area and all mobiles. However, country bases use only one. The particular frequencies allocated ensure virtual **line-of-sight communication** with a nominal range of 30-50 kilometres from a base aerial to or from a mobile vehicle. Greater distances are obtained if the base mast is also on a hill or the mobile is on higher ground or in an aeroplane. Whilst each base station in the metropolitan area is allocated specific duties, their use can be interchanged in an emergency.

Channel 1

1. A base station at Crafers is maintained to:
   - control ambulances in areas that cannot be reached by Channel 2;
   - communicate with country base stations with messages relating to the control of ambulances.
2. All base stations in the country operate on Channel 1.

Channel 2

1. A base station at Tea Tree Gully operates on Channel 2 for the control of ambulances in the metropolitan area.
2. Country ambulances, when in or near the metropolitan area, should communicate on this channel.

Channel 3

1. The O'Halloran Hill base station is used for the control of metropolitan clinic cars (walking cases) in normal day-time hours.

Channel 4

1. A base station is located on Sheoak Road, Belair, but which, on request, can be "patched into" Intensive Care Units or Casualty Departments of RAH, QEH, FMC, RGH, ACH, Modbury, and Lyell McEwin Hospitals.

To enable the Base Radio Operator to allocate his fleet, ambulance crews should adopt the following procedure.

1. Accept initial directions to the case per phone when on Centre.
2. Immediately move out to the car and advise the Radio Operator.
3. Advise the Radio Operator –
   - arrival at scene,
   - mobile from scene (priority and type of carry),
   - arrival at destination (advise destination if unknown),
   - clear from case (using call sign).
4. When called "on air" immediately reply, giving location (LOCSTAT).

The use of the radio call sign by ambulance crews should indicate that the vehicle is free to accept another case.

Should the ambulance crew wish to pass a message, they will use the term BASE, together with the pro word MESSAGE.

When the Base Radio Operator needs to pass a message to an ambulance crew, he will call the car as normal, with the pro word MESSAGE. In this case there is no need for the ambulance crew to reply with their location.

In general, calls should be made no more frequently than at 30-60 second intervals. However, in an emergency, two calls should be made, prefixed by the word "emergency", and, if the call is not answered, activate the Base Alarms by pressing the "Call" button.

MEDICAL TRANSMISSION PROCEDURE

Every time an ambulance crew notifies the Control Centre that they will be transporting a patient on Priority Red with an ETA in excess of 4 minutes, or that they require advice from a Medical Officer, the following procedure will apply in relation to hospitals equipped with the Communications System.

The crew will be asked to change to Channel 4 and await Control to call them. The controller will establish which hospital is required and effect the connection of the hospital with the ambulance concerned.

Fleet numbers are to be used when operating on this system. It is important the word "Echo" or other code be added if relevant, as this, on occasions, will have a bearing on instructions given by the doctor for further treatment.

It is essential that all necessary information be obtained PRIOR to communication with the Medical Officer so that the information is ACCURATE (particularly the "vital signs") and transmitted in the ORDER laid down by the Proforma, to standardise procedure when relaying patient information.

Proforma

1. SEX and approximate age of patient.
2. HISTORY of case.
3. VITAL SIGNS:
   - (a) Conscious state.
     Response for – eyes open
     – verbal
     – motor
   - (b) Respiratory rate.
   - (c) Blood pressure, systolic/palpatory.
   - (d) Pulse.
   - (e) Pupils – size (1-8)
     – reaction
   - (f) Skin
   - (g) Temperature
4. TREATMENT initiated.
5. OTHER APPROPRIATE INFORMATION.
6. ETA at hospital.

A special form used by the Medical Officer at the hospital for recording the information, lists headings in the same order as points 1 to 6.

The following explanations and examples, elaborate on these points:

2. History

May involve the type of accident or incident in which the patient has been involved (recent history) or any known medical condition(s) for which the patient has been treated over past weeks, months or years. Also, any medications prescribed.

3. Vital Signs

This should include any known injuries, suspected complaint or disease and/or any relevant signs or symptoms.

4. Treatment Initiated

This means any treatment already given by a Medical Officer at the scene. Oxygen, Entonox, drugs, substances given or actions taken to counteract poisoning, applications of splints or methods used to control any bleeding are just a few examples.

6. ETA at Hospital

It must be pointed out that use of this facility should only be applied when 10 minutes or more from the nearest emergency hospital. Also, if contact is established before transport has commenced, state ETD and approximate time which will be required for travel.

AIM OF THE FACILITY

The system has been installed to provide direct voice communication between hospital, medical, nursing staff and ambulance crews. Through this facility the Ambulance Officer may be guided by the Medical Officer (within the Ambulance Officer's capacity) in further treatment that will, at least, lead to improved initial care. In addition, the Medical Officer has the means to acquire more accurate, and pertinent signs, symptoms, history, etc., which must result in better patient care. Prior knowledge gained in this manner can also benefit hospital staff when making preparation for receiving the patient (i.e., arranging for the most needed equipment, cubical or ward and/or special staff).

NB: For this project to be a success it must be stressed that both ambulance crews and hospital staff should refrain from using the facility for any communications other than THE EXCHANGE OF URGENT OR VITAL INFORMATION RELATED TO PATIENT MANAGEMENT OR CARE.

Chapter 27

St. John Ambulances and Their Equipment

More than 200,000 patients are transported by St. John ambulances or clinic cars in South Australia each year. Clinic cars, more than 40 in number, are used mainly to convey patients to hospital out-patient departments for pre-arranged appointments. The clinic cars are Ford station sedans which can be converted within minutes to stretcher-bearing ambulance vehicles, should the need arise.

More than 160 St. John ambulances are in operation throughout the State, and there are two main types of vehicle currently in use, the transit van ambulance and the Em-Care ambulance.

THE TRANSIT VAN AMBULANCE

This is a recent addition to the St. John ambulance fleet in South Australia. It is a 6-cylinder, high-performance motor, automatic gearbox, with air conditioning to the driver's and patient's cabin. The vehicle carries two stretchers and has easy access to the patient's compartment through a third door on the near-side of the vehicle (Figures 81 and 82).

Figure 82 Transit Van – Internal

EQUIPMENT IN THE TRANSIT VAN AMBULANCE

Life Support Kit:

- Adult Resuscitation Bag
- Adult Resuscitation Mask (1)
- Adult Oxygen Mask (1)
- Child Resuscitation Bag
- Child Resuscitation Masks (3)
- Child Oxygen Mask (1)
- Airways – Size 3 (2)
- – Size 5 (2)
- Resuscitube (1)
- Cannula and Linket (1)
- Suction Catheter, Straight, 16G (1)
- Portable Suction Unit with 16G straight catheter attached

First Aid Kit:

- Triangular Bandages (8)
- Conforming Bandages, 10 cm (6)
- Conforming Bandages, 15 cm (6)
- Universal Dressings (2)
- Combine Dressings –
  - – 10 × 9 cm (4)
  - – 10 × 20 cm (4)
  - – 20 × 20 cm (4)
- Universal Shears (1)
- Forceps (1)
- Constrictive Bandage (1)
- Safety Pins (6)
- Adhesive Tape – 2.5 cm (1)
- – 5.0 cm (1)
- Severed Limb Bag (1)
- Penlight Torch (1)

- Eye-pads (2)
- Alfoil Dressings (2)
- Burns Dressings – 2M × 27 cm (1)
- – 1M × 27 cm (2)
- Airways – Size 00 (1)
- – Size 3 (1)
- – Size 5 (1)

Neonate Resuscitation Kit

- Neonate Resuscitation Bag
- Neonate Resuscitation Masks (3)
- Neonate Suction Catheters (2)
- Airways – Size 00 (2)
- Hand Aspirator (1)
- Maternity Kit (1)
- Universal Dressing (2)
- Obstetric Hand Cream

Airsplint Kit

- Air Splints – Full leg (1)
- – Half leg (1)
- – Full arm (1)
- – Half arm (1)

General Equipment (located in various cupboards/shelves)

- Air conditioner
- Radio/Decoder
- Operational Oxygen – Size D unit
- – Size C unit
- Spare Size C cylinder (1)
- Operational Entonox Unit and Mask
- Spare Entonox Cylinder
- Penthrane Analgizer
- Hare Traction Splint
- Jordon Lifting Frame
- Gliders (1 set – 10)
- Vehicle Suction Unit with 14G Y-suction catheter attached
- Short Spinal Board
- Cervical Collar
- Coma Pillow (2)
- Fracture Pads (2)
- Telescopic Splint
- Receiving Bowl
- Drinking Water Flask
- Bed Pan/Urinal/Toilet Paper
- Haemaccel Twin Pack
- Tissues
- Sheets (20)
- Pillow Cases (10)
- Blankets (5)
- Hand-Towels (5)
- Pillows (2)
- Stretcher/Mattress
- Emergency Stretcher/Mattress
- Universal Dressings (2)
- Map Light
- Clock (mounted)
- Kidney Bowl
- Sphygmomanometer (mounted)
- IV Therapy Pack Holder
- Eye Pads (2)
- Oxygen Spanner
- Restraining Straps (4)
- Plastic Sheets (2)
- Combine Dressings – 10 × 9 cm (2)
- – 20 × 9 cm (2)
- – 20 × 20 cm (2)
- Triangular Bandages (4)
- Conforming Bandages – 10 cm (3)
- – 15 cm (3)
- Gauze Swabs
- Adhesive Tape – 2.5 cm (1)
- – 5.0 cm (1)
- Airways – Size 00 (1)
- – Size 3 (1)
- – Size 5 (1)
- Resuscitation Masks – Size 1 (1)
- – Size 3 (1)
- – Size 5 (1)
- Oxygen Masks – Adult (2)
- – Child (2)
- Cannula and Linket (2)
- Y-suction Catheters – 14G (2)
- Straight Catheter – 16G (2)
- – 10G (2)
- Sphygmo and Stethoscope Unit
- Safety vests (3)
- Hand Spot Light
- Hand Torch
- Jumper Leads
- Jack and Handle
- Wheel Spanner

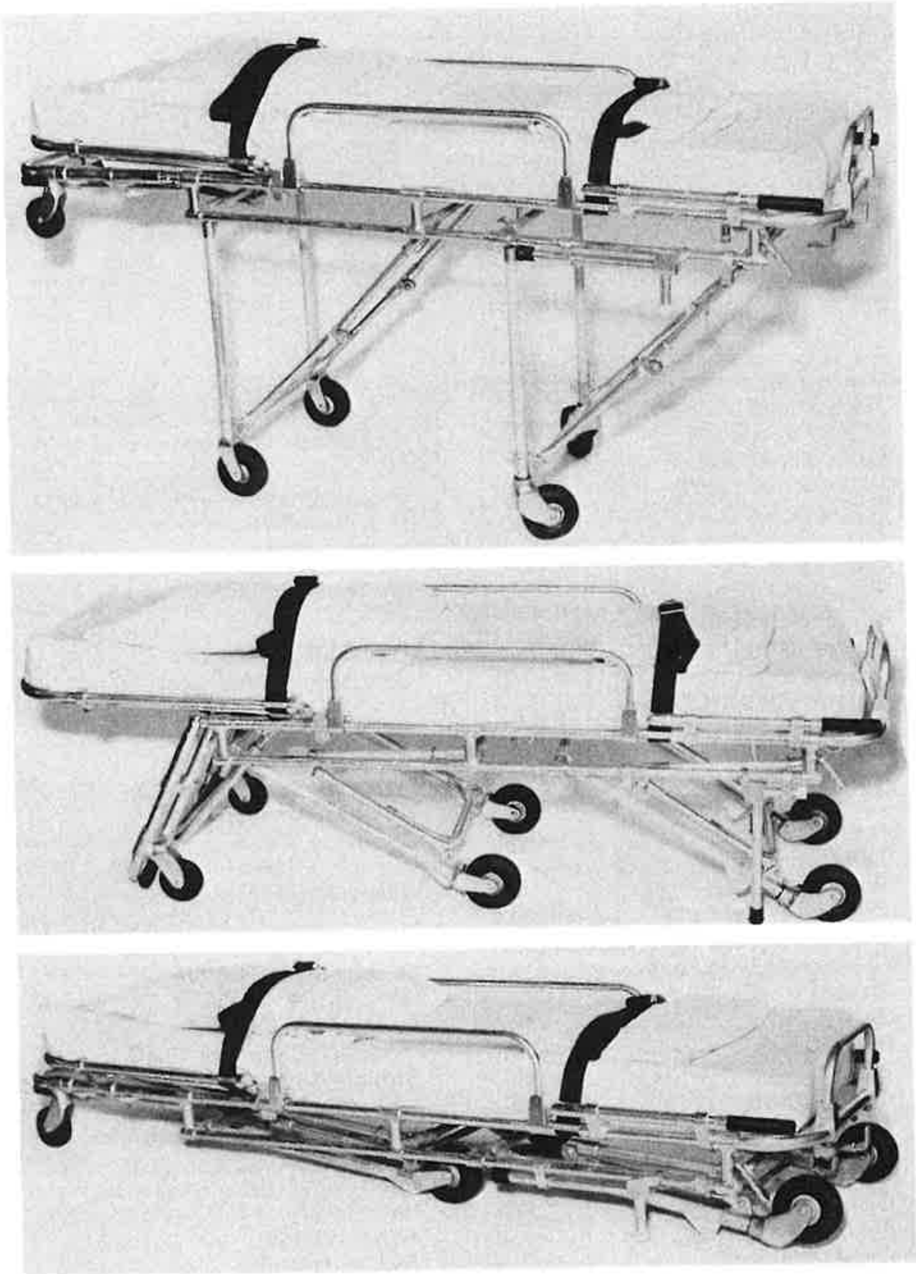


Figure 83 F26 Main Stretcher (a), (b), (c)

Penlight Torch
A/O Report Forms
Case Cards
Hospital List
Bulk Subscriber List
Subscription Brochures
Medic Alert Brochures
Street Directory
Country Road Maps
Fire Extinguisher

Rescue Kit:
12 metre Lashings (2)
Multipurpose Saw
Pinch Bar
Hatchet
Insulated Pliers

STRETCHERS CARRIED IN THE TRANSIT VAN AMBULANCE

- The main stretcher (Figure 83)
- The second stretcher (Figure 84)
- The stretcher chair (Figure 85)

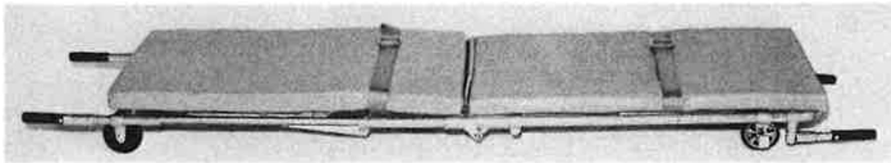


Figure 84
107C Second Stretcher

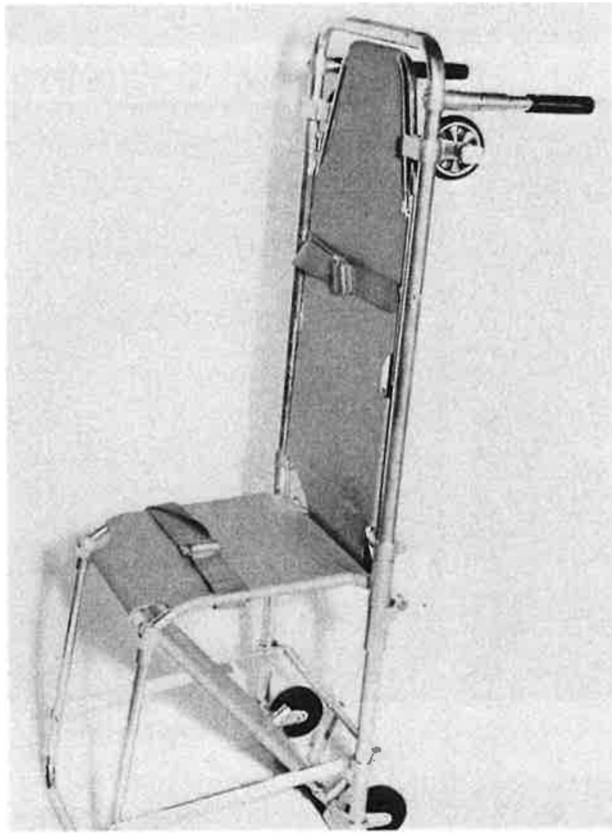


Figure 85
107C Stretcher Chair

Figure 86 Em-Care – External

Figure 87 Em-Care – Internal

EM-CARE AMBULANCE (Figures 86 and 87)

The Em-Care (Emergency Care) ambulance is a unit which was designed and developed by St. John personnel in South Australia. It is constructed on a modified Holden cab-chassis unit, fitted with a V8 308 hp engine. It has the following features:

1. At the rear of the standard drive axles, an additional set of independent rear axles is fitted which allows for extra vehicle length and stability.
2. Total length of the Em-Care is 5.87 metres, of which the patient compartment occupies 2.97 metres.
3. Access to the patient compartment is via the rear door, the bottom portion of which drops down to provide a ramp.
4. A patient is loaded feet first, so that ambulance officers have the maximum possible room to administer treatment.
5. Head room in the work area is 1.78 metres, and permits ambulance officers to stand on either side or at the head of the patient.

EQUIPMENT IN THE EM-CARE AMBULANCE

The equipment in the Em-Care ambulance is identical to that carried in the transit van ambulance. However, since the introduction of the transit van ambulance, various pieces of equipment have been relocated and, in some instances, quantity increased due to the availability of more storage area.

STRETCHERS CARRIED IN THE EM-CARE AMBULANCE

The main stretcher (Figure 88)
The stretcher chair (Figure 85).

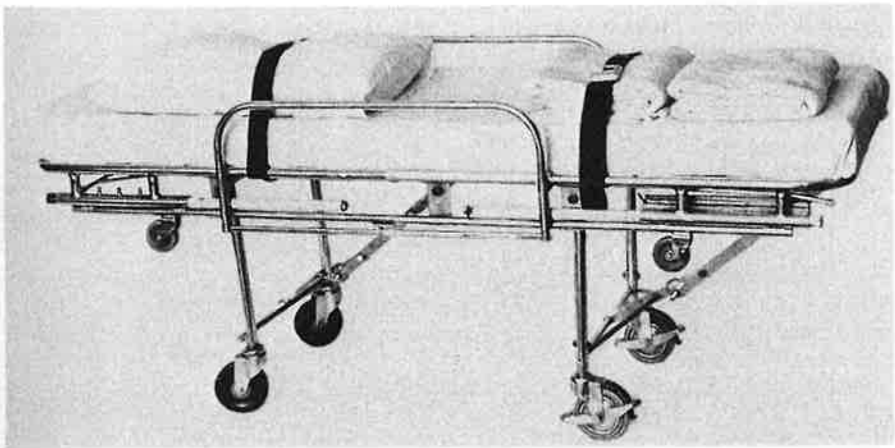


Figure 88 Em-Care Main Stretcher

Chapter 28

Air Ambulance and Helicopter

The Air Ambulance Service flies over 675,000 km per year to transport over 1,200 patients from outlying areas and from interstate, to Adelaide. This is achieved with three aircraft.

The **NAVAJO CHIEFTAIN** (Figure 89) is capable of carrying up to two stretcher patients and four sitting patients. In an emergency, three stretcher patients can be carried. This aircraft is used for multiple patient transfers but its main work is the transport of retrieval teams to the outlying towns of South Australia. The aircraft can cruise at 325 km/hour, and is based at West Beach (Adelaide) Airport.

The **SENECA II** (Figure 90) aircraft is capable of carrying one stretcher and one sitting patient. This aircraft is used for the bulk of routine hospital transfers and interstate transfers. In emergencies, when the Chieftain is not available, these aircraft may be used for retrieval teams, particularly Neonatal Retrieval Teams. The aircraft can cruise at 300 km/hour, and two are based in Whyalla.

OPERATING AREAS

At Adelaide (West Beach) Airport, two operating areas are used by the Air Ambulances (Figure 91). The main area is in front of the refuelling area known as "the waterhole". This area is approached through gates at the extreme northern end of the terminal access road. This area is **always** used to load and unload patients and the neonatal unit.

The Adelaide based aircraft is parked in the light aircraft park, which is on the left, approximately half-way on the airfield approach road. This area is used when delivering retrieval teams to the airport, **unless advised otherwise**.

At Adelaide Airport the Ambulance crew must report to an Airport Security Officer, who will allow access onto the airstrip under his directions. The ambulance must have its flashing light operating at all times when on the airstrip or tarmac area.

The diagram indicates the various locations used.

PATIENT TRANSFER

All aircraft are equipped with ambulance radios and a comprehensive set of equipment to facilitate patient transport. All equipment must be as light as poss-

Figure 89 Navajo Chieftain

Figure 90 Seneca II

ible. The aircraft carry the Ferno Washington 107-C stretcher chair, Hare traction splint, air splints, cervical collar, Jordon frame gliders and a complete set of linen. Stretcher patients should, wherever possible, be presented for transport on a Ferno Washington stretcher which will be replaced with the aircraft stretcher. Similarly, any of the previously mentioned equipment will be replaced from aircraft stock. When patients are delivered by the air ambulance replacement of aircraft stock from the vehicle ambulance stock will be required (including the stretcher).

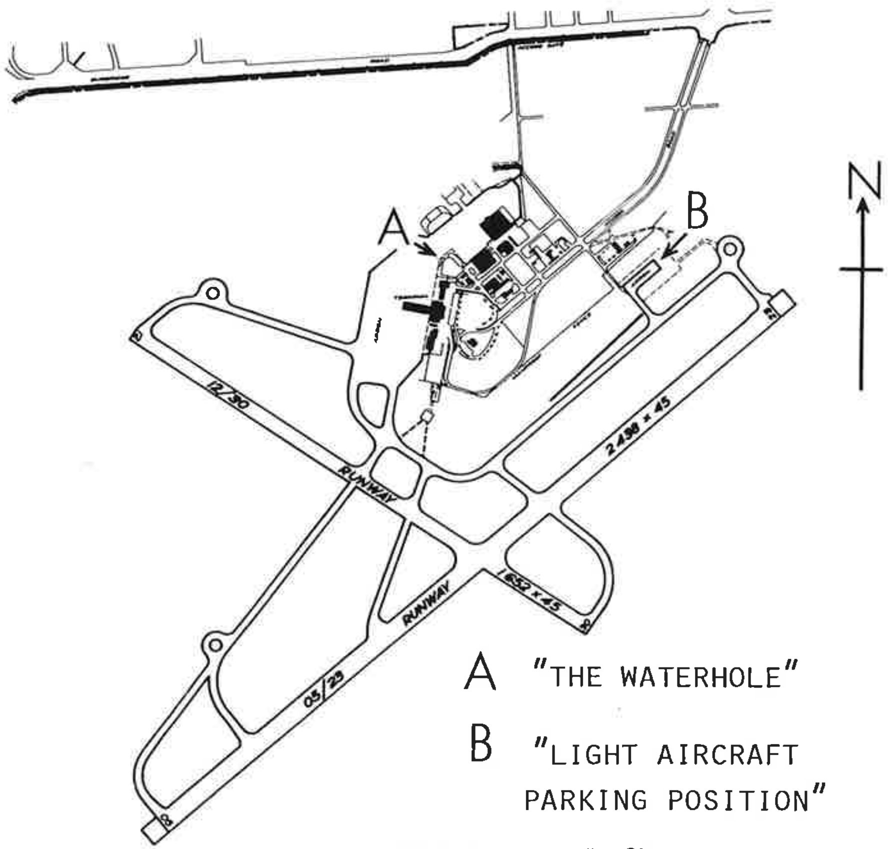


Figure 91 Adelaide Airport Loading Sites

LOADING PROCEDURES

The ambulance should not approach the aircraft until the engines have stopped and all flashing lights have been extinguished. The ambulance may then approach the aircraft but should not proceed closer than 10 metres unless under the direction of the air attendant or pilot. Under no circumstances approach closer than 3 metres, as there are aerials at head height this close to the aircraft (Figure 92). If

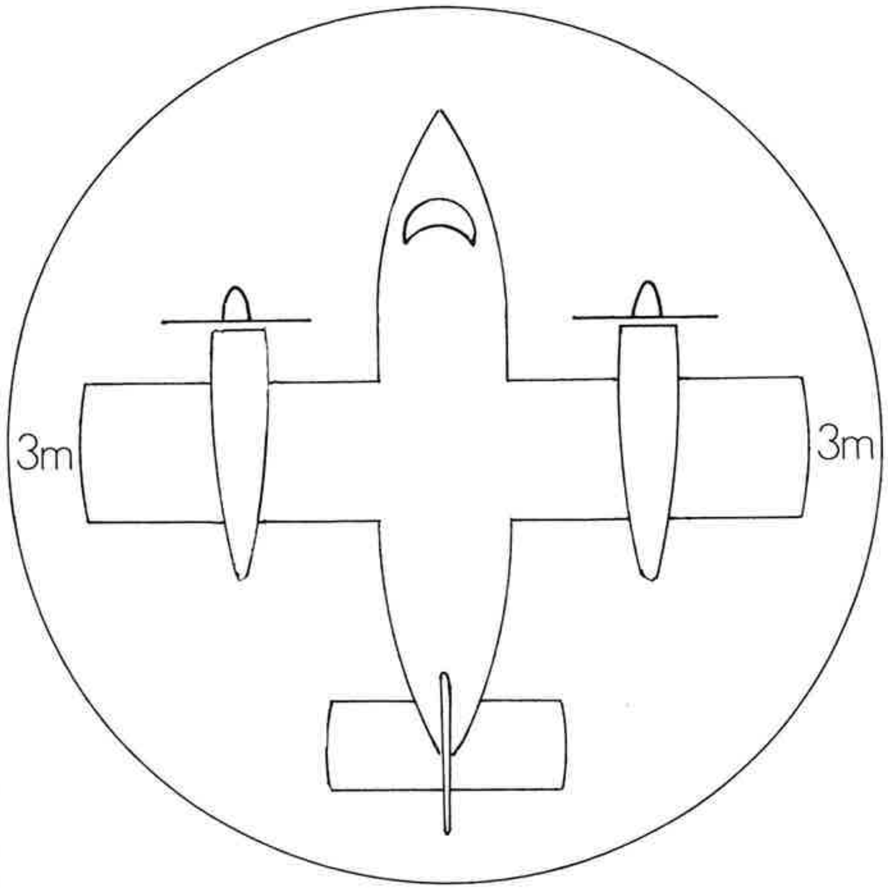


Figure 92 Approach Limits to Aircraft

for some reason the aircraft must be approached while its engines are running, advise the pilot by radio and approach the aircraft only from the front (so the pilot can see you). After attracting the pilot's attention, indicate what you want (e.g., if a letter has been left behind, hold it up in front of you). The pilot will shut down the engines. Only when the propellors have stopped should you approach closer to the aircraft.

The aircraft crew will prepare the aircraft and then indicate when ready to load or unload the patient. The patient should not be removed from the ambulance until the crew indicate readiness to accept the patient. If accepting a patient, the ambulance crew can remove the regular stretcher and change-over equipment whilst the aircraft crew are preparing the aircraft.

The Ferno Washington stretcher can, if not properly handled, fold up during carry, with potentially disastrous consequences for the patient. To prevent such an occurrence, the stretcher should be lifted only at either end or by three people — one at the foot and two on either side of the head end. The latter method is to be employed when passing the stretcher into or out of the aircraft. The two attendants at the head of the stretcher should position themselves as close to the loading door as practicable and feed the stretcher hand-over-hand through the loading door whilst the third attendant supports the foot of the stretcher.

RADIO PROCEDURES

Normally the aircraft will call when approximately 30 minutes from destination and advise estimated time of arrival (ETA) and patient details. The aircraft uses its phonetic call-sign which consists of three letters. The aircraft will often be heard by several stations as their radio range when in flight is considerably greater than that of a car. Transmissions should not be answered or acted upon unless they are directed to your car or station. When talking to the aircraft, keep the tranmissions as brief as possible as the aircraft is generally listening to at least one and sometimes two other radios. Extended transmissions on the ambulance radio can often blot out calls on these other radios. If you call the aircraft and no answer is received immediately, wait a minute or two before calling again as the aircrew may be busy on the other radios.

ASSISTANCE WITH FINDING AIRFIELD

At the more remote or smaller airfields, some assistance may be required to find the airfield, particularly in bad weather. The pilot will request assistance if it is required. By this time the ambulance crew should be able to see or hear the aircraft. Assistance can be provided by directing the pilot (turn left/right, you are heading towards/away from us now) or indicating your position relative to the aircraft using the clock system. (We are in your 3 o'clock position.) If using this latter system, do not advise the aircraft's position in relation to you (you are in our 4 o'clock position) as the pilot has no way of telling in which direction you are facing. (He is, of course, always facing to the front of the aircraft.) Switching on the ambulance warning light is also helpful, although only at night. Similarly, standing on the roof of cars and waving arms is unlikely to be helpful as if the aircraft crew can see people on the ground they will undoubtedly be able to see the airfield.

EMERGENCY LIGHTING

Normally the aircraft only operate at night into airfields with proper lighting facilities (portable or electric). In an emergency, lighting can be provided by vehicle headlights, as shown in the diagram (Figure 93). When using this procedure, a responsible person should be designated to control the vehicles which should not move, except at his direction.

All vehicle movement on the airstrip or area to be used, must be kept under strict control.

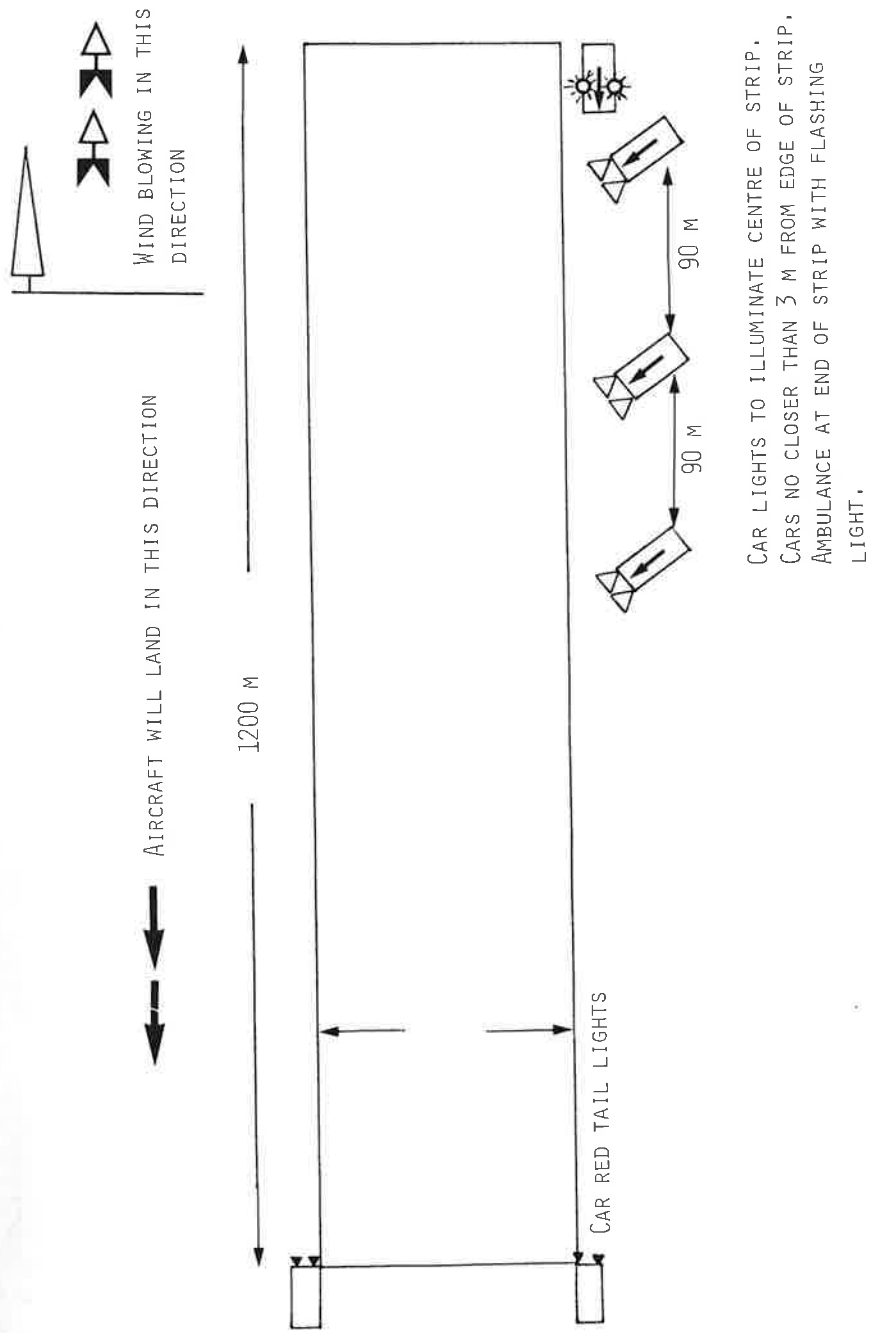


Figure 93 Emergency Strip Lighting

After the aircraft has taken off, vehicles should remain in position for 10-15 minutes in case an emergency landing is required.

STRIP INSPECTIONS

At country airfields which are unsealed strip inspections may be required after rain to ensure the aircraft will not become bogged. This will be requested by the aircraft if required. **Before moving onto the airfield, ALWAYS check BOTH approaches to ensure an aircraft is not about to land.** Continually check the area for approaching aircraft whilst on the strip. The general criteria for suitability is if a laden vehicle such as an ambulance can travel at 80 kph without discomfort to passengers or leaving appreciable marks on the surface, the strip is suitable.

AIRCRAFT DEPARTURE

When patient loading/unloading is complete and equipment is exchanged, move your vehicle away from the aircraft to a safe area. Do not park near the edge of the strip or on the parking area. The pilot will not start engines whilst the ambulance is anywhere behind the aircraft as the propeller blast can cause damage to the vehicle. After the aircraft has taken off, and if circumstances permit, the ambulance should remain at the airfield for 10-15 minutes in case the aircraft returns because of a malfunction.

WALES STATE RESCUE HELICOPTER SERVICE

INTRODUCTION

The Wales State Rescue Helicopter is used jointly by the St. John Ambulance, Police, Country Fire Services, and the Surf Life-saving organisations.

The helicopter, a Bell Long Ranger (Figure 94), is based at the Adelaide Airport, and has a cruising speed of 205 km/hour with sufficient fuel supply for an operating radius of approximately 220 kilometres.

Because of the increasing use of the helicopter for patient evacuation, it is important that **all** Ambulance Officers are fully conversant with the safety procedures necessary.

MAIN ROTOR

A helicopter is referred to as a Rotary Wing Aircraft. Unlike the normal aircraft design where the wings are fixed to the body and the motors are attached to the wings, a helicopter has a fixed motor and a rotating wing (blade) which pivots from a central axis.

The speed of the rotating blade thus provides the necessary downdraft for flight, and the pilot, by varying the blade angle, provides the direction. Under normal

Figure 94 Bell Long Ranger Helicopter

Figure 95 Approach under Rotor

power conditions the blade rotates usually on a level plane and is 3.15 metres (10 feet) from the ground. The blade height may be reduced to 1.25 metres (5'6") from the ground, in circumstances where –

1. the engine is running down (this takes over 2 minutes to occur);
2. the engine is idling and the pilot is away from the controls (this may happen during short stopovers);
3. the aircraft is on uneven ground;
4. the conditions are windy.

Therefore, it is important that anyone approaching or departing from the helicopter **must** do so in a semi-crouched manner (Fig. 95). Only when next to the aircraft body is it **safe to stand upright**.

TAIL ROTOR

The tail rotor is a propellor which acts as a stabiliser. The tail rotor blade is 1.58 metres (5'6") in diameter, but is only 1 metre (3'3") from the ground. The blade operates at a speed of 2,250 revolutions per minute (about 4 times the speed of

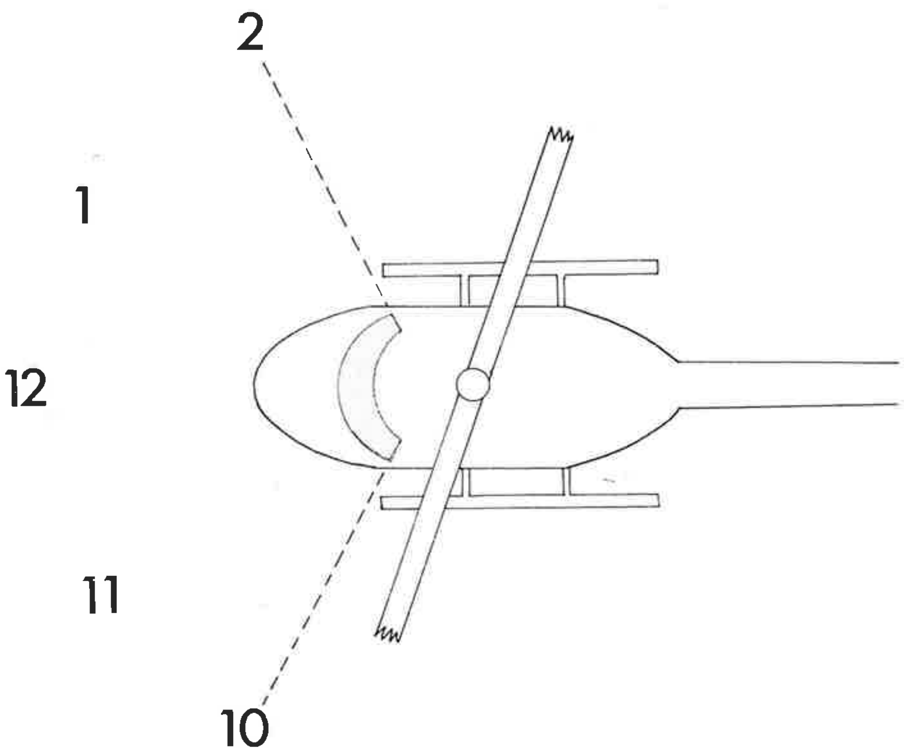


Figure 96 Area of Approach

Figure 97 Approach Indicated

the main rotor) and despite its colourful markings, it becomes virtually invisible to the naked eye.

The tail rotor is unprotected. Therefore, movement aft of the boot section (Fig. 96) by **any** ambulance officer **is strictly forbidden**, whether the motor is operating or not.

APPROACHING OR DEPARTING FROM THE AIRCRAFT

Never approach the helicopter without first having obtained permission from the pilot. (The pilot sits in the right-hand seat of a helicopter.) To obtain permission, stand directly in front of the aircraft (about 12 metres away) and extend one arm at shoulder height with the fist clenched and the thumb pointed upwards (Figure 97). Only when the return thumbs up signal is given by the pilot is it permissible to approach, and then only in a semi-crouched position.

When the aircraft has landed on sloping ground, under no circumstances must an approach or departure be made from the uphill side due to the extreme danger because of the reduced main rotor ground clearance (Figure 98).

When on level ground, **all** approaches **must** be made within the 10-to-2 position from in front of the aircraft, because of the restricted vision of the pilot (Figure 96).

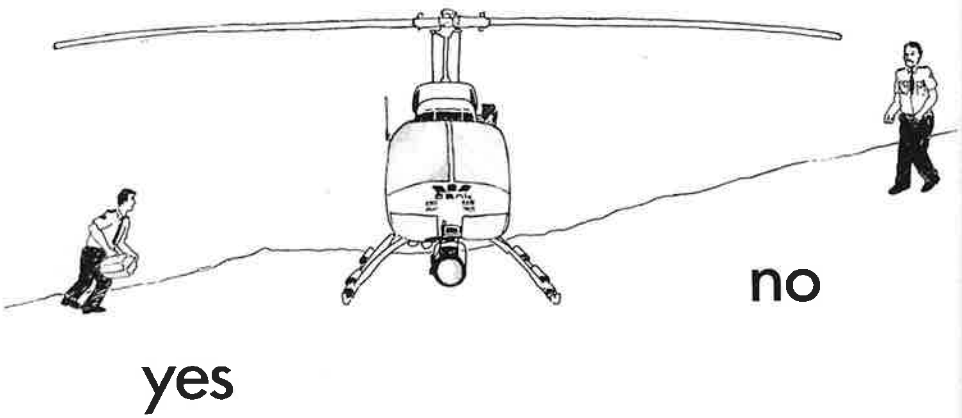


Figure 98 Approach on Hillside

CARRYING OF EQUIPMENT TO OR FROM THE HELICOPTER

Any equipment such as stretchers, IV stands, etc., must be carried in the horizontal position whenever approaching or departing from the aircraft. In particular, if a patient has an infusion line in situ, this **must be turned off** and placed on the stretcher until well clear of the aircraft.

HEAD-WEAR

Under no circumstances must hats, spectacles, sunglasses, or any other loose clothing be worn near the helicopter. Wind drafts may cause these items to be blown off and the natural tendency to retrieve the item could place the person in extreme danger.

Similarly, all stretcher linen or blankets **must** be secured whenever approaching or departing.

LANDING OR DEPARTURE OF HELICOPTER

When the helicopter is about to land or depart, the increased engine speed causes stones, dust, or dry grass to be blown about. To avoid possible eye injury, it is best if your back is turned towards the aircraft during its takeoff or landing.

SUMMARY

1. Never approach the helicopter without the pilot giving his permission by the thumbs up signal.
2. Always ask the pilot for permission to depart from the aircraft.
3. Always approach and depart from the front 10-to-2 area in a crouched manner.
4. All objects to be carried horizontally; IV containers must be turned off and placed on the stretcher.
5. No loose headwear or loose clothing to be worn. Stretcher linen, etc., to be secured.
6. Always turn your back towards the helicopter as it is landing or taking off, to avoid possible eye injuries.

Chapter 29

Disaster Management

It is necessary in any State or region for essential services to have a complete and detailed plan to cope with any major disaster.

In South Australia, overall control of the Disaster Plan is the province of the Police Commissioner, with the Health Services being responsible to him. St. John, in turn, is responsible to the Medical Co-ordinator of the Health Commission for the provision of first-aid and ambulance services.

Any Disaster Plan must be flexible and be able to cope with a whole range of potential disasters. It is essential that whilst the plan is detailed and written down, it must also be simple and the principles must be known to all members in the field who could be called upon at any time to take a major responsibility in an unexpected catastrophe.

Accordingly, the following plan is set out for the guidance of all personnel within the St. John Ambulance Service. It is particularly important that all members should note the responsibility of the first Ambulance Officers at the scene, since their role is critical and they must maintain these positions until relieved by a responsible officer.

CO-ORDINATION OF ESSENTIAL SERVICES

Although the object of disaster response is to provide medical aid to the injured, its success depends upon the co-ordination of all the essential services within the area. A detailed plan co-ordinating the activities of all essential services has been drawn up, but the details set out below in this chapter concern only the role of the Ambulance Officer.

AMBULANCE SERVICE CIVIL DISASTER PLAN

Experience with actual large disasters and realistic mock incidents has shown the best treatment of patients results when all Ambulance Officers use a general plan rather than attempting to treat a segment of the large disaster as they would a small incident. The following plan should be put into operation whenever three or more ambulances are required at the scene of an incident (Figures 99 and 100).

Basically, the plan is intended to cope with between 5 and 70 patients, but can be expanded to handle even greater numbers. In such a case, the activities of St.

John have been designed to blend into any large scale State or National disaster scheme.

PHASE 1 – IMMEDIATE ACTION

ACTION BY THE COMMUNICATIONS SUPERVISOR

1. Despatch ambulances and ambulance crews to the scene, where possible providing one ambulance to every 2 anticipated patients, bearing in mind that a percentage of the total number involved will be walking cases and these may be conveyed by other transport.
2. Notify the Officer-in-Charge of Ambulance Transport who may nominate a Senior Officer to be sent to the scene to assume the role of co-ordinating officer.
3. Check that Police and Hospitals have been informed.
4. In country areas, the Country Superintendent or his nominated Deputy, plus the Duty Transport Officer (Adelaide) must be notified as soon as possible.
5. Withhold information from the press and other news media.
6. If there are insufficient vehicles available to remove all patients in one lift, despatch suitable vehicles and stores to establish a Casualty Clearing Post (CCP). Take such steps as are necessary to send pre-arranged medical aid teams to the scene.
7. Maintain a small reserve to fulfil normal ambulance requirements.
8. Implement the Communications Disaster Plan so as to obtain adequate staff and facilities.

ACTION BY THE FIRST AMBULANCE OFFICERS AT THE SCENE

These people are responsible for early organisation at the scene and for the institution of immediate life-saving treatment where required. They should endeavour to make use of bystanders to assist in stretcher carrying and other relatively unskilled activities.

1. One Ambulance Officer will immediately assume the role of –

   CASUALTY COLLECTING OFFICER (CCO), who should:

   1.1 quickly assess the number of stretcher and sitting patients, and report this information to Headquarters. (Remember, the patients are often scattered over a greater area than is immediately obvious.)

   1.2 Select a suitable site for the Casualty Clearing Post (CCP). There are no firm rules which can be laid down about the siting of the CCP, but factors which obviously must be taken into account include safety, accessibility and proximity to the disaster scene. All walking patients should be gathered at this point.

   1.3 Classify patients into four groups according to medical need. This process is called Triage, and should be done by the most experienced Medical or Ambulance Officer at the scene. The Triage Officer should label each patient with the approved label, as laid out below. These labels are located

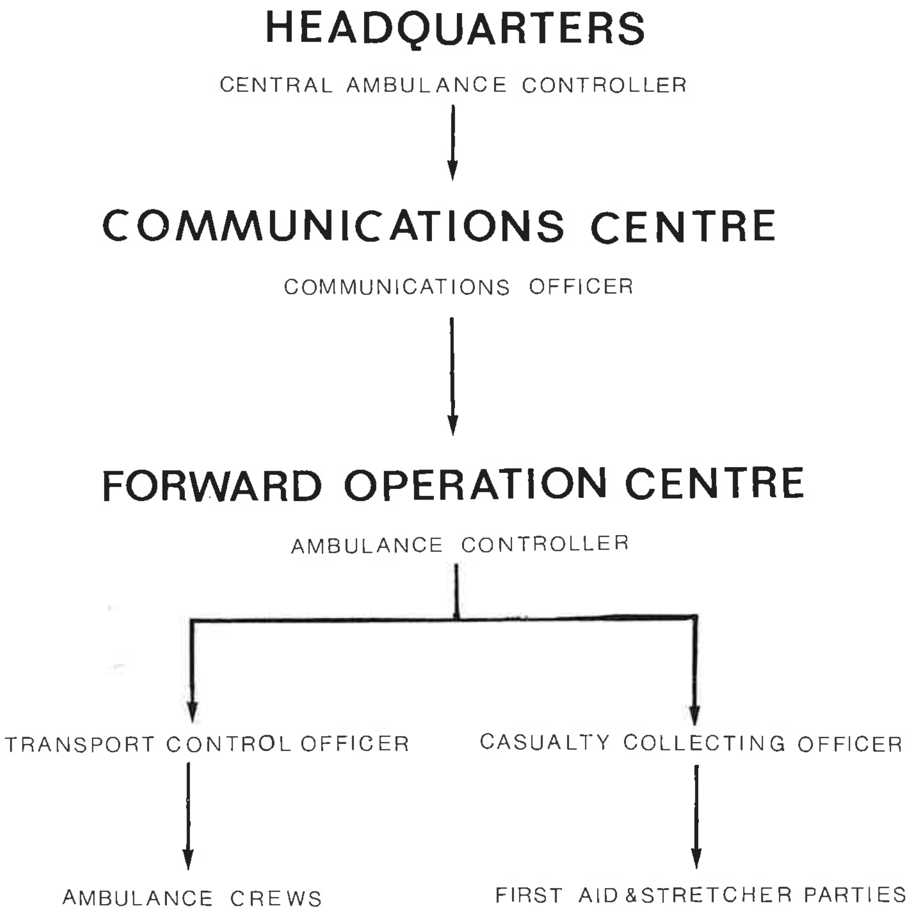


Figure 99 Headquarters Control Structure

at the Communications Room at Headquarters and in the Disaster Kit (at Hindmarsh). The 4 priorities are –

1.3.1 **Red Label – Life Threatening Condition**
For patients with life-threatening conditions requiring priority transport, with or without appropriate resuscitation before transport.

1.3.2 **Green Label – Non-Life-Threatening Condition**
For patients who are alive, and who do not have a life-threatening condition, and who are ready for ambulance transportation according to priority.

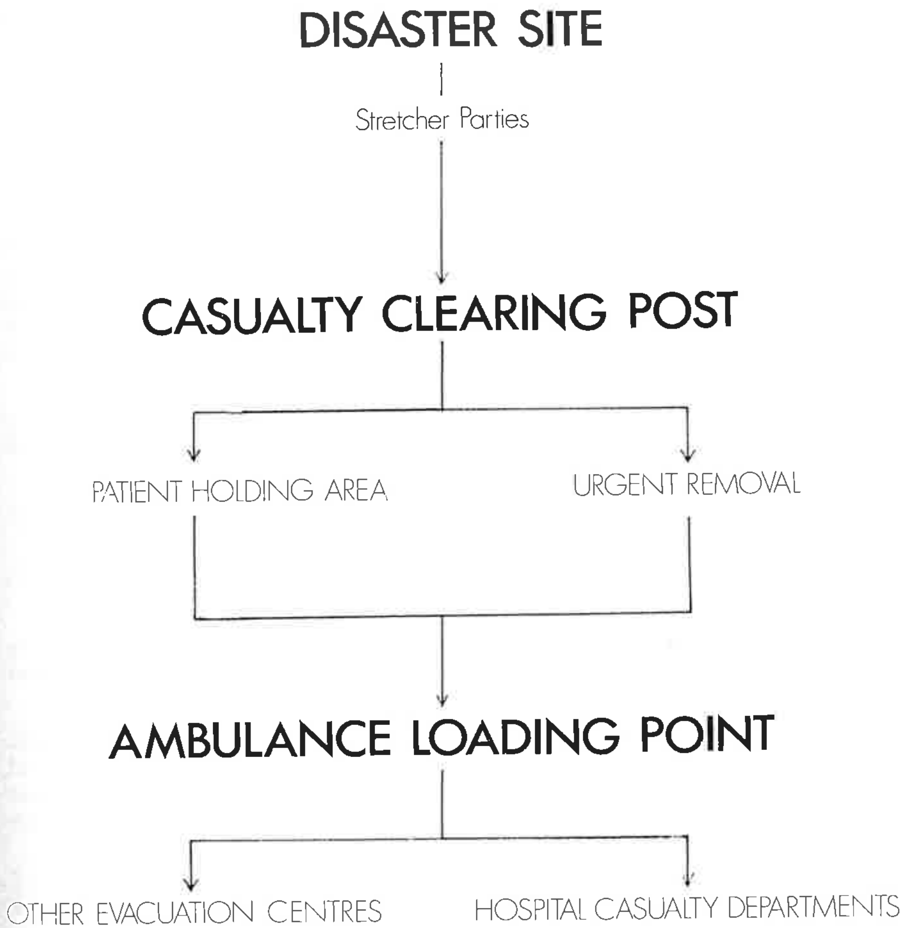


Figure 100 Disaster Site Control Structure

1.3.3 **Yellow Label – Not expected to Live**
For patients not expected to live or whose immediate resuscitation may over-utilise available resources and jeopardise the survival of other patients.

1.3.4 **Black Label – for the Dead**
Walking patients should not require labelling, but should be marshalled in one area at the CCP.

1.4 Direct trained personnel to the most urgent cases – those labelled RED, followed by GREEN, then YELLOW.

1.5 Where practicable, arrange to have the less urgent patients gathered at the CCP under the best medical or nursing care available, using bystanders to assist, if necessary.

1.6 Ensure maintenance of communications by judicious placing of radio receivers, or the use of bystanders.

2. Another of the crew will assume the role of – **TRANSPORT CONTROL OFFICER (TCO)**, and should –

2.1 Select a suitable Ambulance Loading Point (ALP). Once again it is not possible to lay down rules where this point should be, but factors which need to be taken into consideration for the best possible ALP include safety, accessibility from the road, proximity to the scene, ensuring that there is adequate room for as large a number of vehicles as possible to gain access.

2.2 Select access routes and, if necessary, establish an ambulance holding point. Police or bystanders should be asked to help in the maintenance of these routes.

2.3 Ensure that each ambulance is fully and efficiently loaded in turn and that casualty evacuation proceeds at a steady controlled rate.

2.4 Select a suitable person to record the name and brief details of each patient and his destination.

2.5 Ensure that information regarding the number of patients despatched to each hospital and the number of those still awaiting transport, is relayed continuously to the Control Centre.

It must be stressed once again that the role of the CCO and the TCO are vital to the whole disaster plan. The first crew on the scene must take up the positions of CCO and TCO and remain in those positions unless relieved by a Senior Officer designated by the Officer-in-Charge of Ambulance Transport at Headquarters, or until the evacuation of patients is completed.

ACTION BY THE OFFICER-IN-CHARGE OF AMBULANCE TRANSPORT AT HEADQUARTERS (Central Ambulance Controller).

This is the most senior officer available at the time from within the ambulance service primarily involved. When a larger service is called in to assist, a senior officer will be designated and despatched to the scene. This officer is called – **AMBULANCE CONTROLLER**, and he will liaise with the CCO and TCO.

1. After assessing the nature of the disaster he should alert or call out emergency vehicles, volunteers and/or neighbouring ambulance services, as required.
2. Check that the Communications Supervisor has taken the steps listed above. He may nominate an Ambulance Controller, as stated above.
3. Obtain accurate information concerning the available patient accommodation of the appropriate hospitals and their estimated maximum rate of admission.

With the assumption of Headquarters control by the Officer-in-Charge, the operation will enter Phase 2.

PHASE 2 – CONTINUING ACTION

THE AMBULANCE CONTROLLER is in charge of the organisation at the scene. He should –

1. Establish a Forward Operation Centre (F.O.C.).
2. Appoint a Transport Control Officer and a Casualty Collecting Officer. In large disasters these positions may be specially selected, but, as suggested above, a temporary TCO and CCO will have been acting already.
3. Establish a communications system with the Communications Officer and with Headquarters, and relay appropriate information from time to time.
4. Contact senior representatives of other services at the scene.
5. Ensure that an effective operation is in progress and develop the plan to maximum efficiency.

THE CENTRAL AMBULANCE CONTROLLER will –

1. Accept responsibility for the whole operation.
2. Handle press and public information.
3. Call outside help if required.
4. Maintain communications with the hospitals and with the Ambulance Controller, ensuring that the rate of delivery of patients to casualty departments is appropriate. This means that ambulances are sent to hospitals most suitable for the treatment of the patients' injuries. Bear in mind that –
   4.1 at any hospital there is a maximum admission rate which cannot be exceeded. For large hospitals, this is usually about 30 per hour. For hospitals of 50 to 100 beds, it is about 10 to 15 per hour, and for small country hospitals may be as low as 3 or 4 per hour.
   4.2 the surgical facilities of smaller hospitals are adequate for such injuries as simple lacerations and minor fractures, but that head and chest injuries must have priority at hospitals with surgeons who specialise in the treatment of injuries of this nature.
5. Start early to plan for feeding and relieving crews, as necessary.
6. Be available for any other problems that may arise.

THE COMMUNICATIONS OFFICER should –

1. Maintain a link between Headquarters and the scene of the disaster.
2. Co-ordinate and record the movement of all ambulance transport.

MEDICAL AID TEAMS AT THE SCENE

Medical aid may come from Medical Officers sent from major hospitals, and from St. John Medical Officers on call.

It is the duty of the Ambulance Controller and the Casualty Collecting Officer, to point out those patients they consider most likely to benefit from medical attention in the event of the arrival of medical aid.

PHASE 3 – CLEAR UP

When all casualties have been evacuated it is the responsibility of the Ambulance Controller to make a final check of the scene and to advise Headquarters that all is clear. He is also responsible for the return of all stores and equipment. It may be possible to obtain a check list of persons likely to have been injured and to compare this with the list of casualties evacuated.

Glossary

The aim of this glossary is to provide the meanings of a number of the medical words with which some readers may be unfamiliar. The list is not comprehensive, but includes the words used most commonly in the text. It should be used for reference purposes only, as necessary.

Abortion – expulsion of the foetus before the 28th week of pregnancy.
Abscess – a localised collection of pus.
Accessory – additional or extra, e.g., an accessory nipple.
Acidosis – excess acid in the blood.
Acute – a short and relatively severe course.
Alveolus, Alveoli – air cells in the lungs.
Amniotic fluid – the fluid surrounding the foetus in the uterus.
Anaemia – a reduction in the haemoglobin concentration in the blood.
Anaesthesia – loss of feeling or sensation; often induced with drugs.
Analgesia – pain relief; often induced with drugs.
Anaphylaxis – a shock-like state due to a severe allergic reaction.
Aneurysm – an abnormal dilatation of an artery.
Angina – temporary chest pain due to coronary artery disease (myocardial ischaemia).
Anoxia – without oxygen.
Anxiety state – the emotional state characterised by undue worry and apprehension, often associated with depression.
Aorta – the major artery of the body leading from the left ventricle.
Aortic valve – the valve between the left ventricle and the aorta.
Aphasia – Inability to speak.
Arrhythmia (cardiac) – an abnormality in cardiac rhythm.
Asphyxia – suffocation and lack of oxygen.
Aspiration – the removal of fluids from a cavity by suction. Also inhalation of foreign material into the lungs.
Asystole – no detectable ventricular activity.
Ataxia – staggering gait or walk.
Atherosclerosis – a degenerative change in an artery.
Atrium, Atria – the chambers in the heart which receive the blood from the vena cavae or pulmonary veins.
Atrio-ventricular (AV) node – the area in the heart which receives electrical impulses from the atria and passes them to the ventricles.
Autonomic nervous system – part of the nervous system not under voluntary control, which regulates heart, blood vessel, lung, bowel function, etc.

Barbiturate – a drug used as a hypnotic or a sedative.
Blood pressure – the tension or pressure of the blood inside the major arteries.
Brachial artery – the main artery of the upper arm.
Bradycardia – a slow heart rate.

Brain – the part of the central nervous system lying within the skull and consisting of cerebrum, brain stem and cerebellum.
Brain stem – the aggregation of nerves connecting the cerebrum, cerebellum and spinal cord, and lying beneath cerebrum and cerebellum.
Breech presentation – in childbirth, when the foetal buttocks emerge first.
Bronchus, Bronchi – the major air passages of the lungs conducting gas between the trachea and the bronchioles and alveoli.

Cannula – a tube for insertion into a body cavity.
Carbohydrate – a substance containing carbon hydrogen and oxygen. The simplest are known as sugars.
Carbon dioxide ($CO2$) – one of the end products of tissue respiration.
Carbon monoxide – colourless, odourless gas which is highly toxic because it combines with haemoglobin to block its oxygen-carrying capacity.
Cardiac arrest – cessation of heart action either due to ventricular fibrillation, or ventricular asystole.
Cardiac arrhythmia – an abnormality in cardiac rhythm.
Cardiac failure – fluid retention in lungs or limbs, caused by reduced cardiac function.
Cardiogenic shock – shock state caused by severe cardiac damage.
Cardiovascular – pertaining to the heart and blood vessels.
Carotid artery – the major artery in the neck.
Cataract – an opacity in the lens of the eye which may impair vision.
Catheter – a tube for draining fluid, e.g., urinary catheter.
Central Nervous System – the brain and spinal cord.
Cerebellum – the part of the brain lying beneath the cerebrum and concerned with the co-ordination of movement.
Cerebrum, Cerebral – the largest part of the brain.
Cerebral compression – compression of the brain within the skull, e.g., by haemorrhage.
Cerebral contusion – more severe damage to the brain caused by head injury.
Cerebrovascular – pertaining to the blood vessels within the brain.
Cerebrovascular accident (CVA) – a stroke. Either a blockage of, or haemorrhage from a blood vessel within the brain.
Cervix, Cervical – pertaining to the neck; also the neck of the uterus or womb.
Cerebrospinal fluid – the clear fluid which surrounds the brain and spinal cord.
Cheyne-Stokes respiration – breathing characterised by periods of increasingly deep respiration interrupted by periods when the patient does not breath for a time; often found in severe brain damage.
Chronic – persisting over a long period of time.
Clavicle – collar bone.
Coagulation – clotting of blood.
Colon – the large intestine.
Coma – state of unconsciousness; insensibility.
Conjunctiva – the transparent membrane that lines the inner surface of the eyelids and front of the eye.
Conjunctivitis – inflammation of the conjunctiva.
Concussion – sudden temporary interruption of function of the brain, usually due to head injury.
Contusion – a bruise.
Cord prolapse – condition occuring when the membranes rupture and the umbilical cord falls in front of the baby's head.
Cornea – the anterior and transparent part of the external coat of the eye.
Coronary artery – the artery which supplies blood to the muscles of the heart.
Cranium, Cranial – the skull.

Crepitus – a grating sound of two ends of bone rubbing together, usually after a fracture.
Cyanosis – blue discolouration of the skin often due to hypoxia.

Delirium – a state of extreme excitement and restlessness.
Delusion – a belief that is not in accordance with fact and cannot be corrected by appeal to reason.
Depressive illness – an emotional state of dejection and unhappiness – may be normal or abnormal.
Diabetes mellitus – a disorder due to lack of insulin characterised by high blood and urinary sugar.
Diabetic coma – coma state caused by uncontrolled diabetes.
Diaphragm – the muscle separating the abdominal cavity from the thoracic cavity and the major muscle of respiration.
Diastole – the period between heart beats when the heart muscle is relaxed.
Dilated – stretched open.
Diverticular disease – a condition of the large bowel where numerous pouch-like processes penetrate the bowel wall and may give rise to abdominal pain.
Dura, Dural – the outer membrane lining the brain.
Duodenum – the first part of the small intestine beginning at the stomach.
Dyspnoea – a feeling of difficulty in breathing.

Eclampsia – a condition associated with pregnancy which is characterised by high blood pressure, fluid retention and fits.
Eclamptic fit – a convulsion occurring as part of eclampsia during late pregnancy.
Ectopic beat – a beat arising other than in the normal electrical pacemaker mechanism of the heart.
Ectopic pregnancy – a pregnancy arising outside the uterus, usually in the fallopian tube.
Electrocardiograph (ECG) – a recording of electrical impulses in the heart.
Embolus – a portion of foreign material present in the circulation. This may be a blood clot, air or fat.
Emphysema (pulmonary) – a lung condition characterised by destruction and distension of the alveoli and small bronchioles.
Encephalitis – inflammation of the brain.
Endocardium – the smooth lining of the heart.
Endotracheal – the inner aspect of the trachea.
Endotracheal tube – a tube inserted into the trachea.
Epithelium – the skin and lining of respiratory, digestive and urinary tracts.
Epilepsy – a sudden temporary recurring disturbance of cerebral function usually with convulsions and loss of consciousness.
Exhalation – the passive phase of respiration – breathing out.
Extra-dural – outside the dural membrane.
Eyelid – one of the two movable folds of skin in front of the eye.

Fallopian tube – the tube leading from the ovary to the uterus.
Femur – the thigh bone.
Fibrillation – irregular twitching of muscle.
Fibula – the thinner and more lateral of the two long bones of the lower leg.
Flail chest – abnormal or paradoxical mobility of the chest due to multiple rib fractures.
Foetus – the developing baby in the uterus.
Full-term infant – an infant at the 40th week of pregnancy.

Glucose – one form of sugar – a carbohydrate.

Haematemesis – vomiting of blood.
Haematoma – a bruise; a collection of blood in the tissues.
Haemoglobin – the oxygen carrying pigment in the red blood cells.
Haemoptysis – the coughing of blood from the lungs.
Haemorrhage – bleeding.
Haemothorax – blood in the pleural space, between the chest wall and the lung.
Hallucination – a mental impression of a sensation present without an obvious stimulus, e.g., seeing pink elephants.
Hemiparesis – a weakness of one side of the body.
Hemiplegia – paralysis of one side of the body.
Hernia – an abnormal protrusion of an organ outside its normal cavity.
Hormone – a chemical substance produced in special glands and travelling via the circulation to other organs to modify their function.
Humerus – the bone in the upper arm.
Hyper- – excessive, or beyond.
Hypercarbia – excess carbon dioxide in the blood.
Hyperglycaemia – raised level of blood sugar found as part of diabetes.
Hypertension – high blood pressure.
Hyperthermia – raised body temperature.
Hyperventilate – to take rapid deep breaths.
Hyphaema – haemorrhage into the anterior chamber of the eye.
Hypo- – beneath, or deficient.
Hypoglycaemia – low blood sugar, usually caused by insulin excess.
Hypothermia – a low body temperature.
Hypovolaemia – a low blood volume, as may be found in shock.
Hypoxia – oxygen deficiency.

Ileum – the distal 3/5th of the small intestine beginning at the jejunum and ending at the caecum.
Incubation – to maintain at the optimal temperature.
Infarction – an area of dead tissue produced by the occlusion of an artery.
Infection – the invasion of the body by disease producing organisms.
Inflammation – the reaction of the body to any injury or infection.
Infusion – the administration of a substance intravenously.
Inhalation – the method of administration of substances or drugs through the lungs.
Insight – the patient's awareness of his illness or personality.
Inspiration – the act of breathing in.
Insulin – a hormone which regulates blood sugar levels.
Inter- – between, or among.
Intercostal – between the ribs.
Intra- – within, or into.
Intracerebral – within the brain substance.
Intrathoracic – within the chest.
Intravenous – in the vein.
Iris – the circular contractile disc in the eye between the cornea and the lens.
Ischaemia – reduction in the blood supply due to partial obstruction of an artery.
Ischial, Ischium – part of the bony pelvis upon which the body rests when sitting.

Jejunum – the upper 2/5th of the small bowel between the duodenum and ileum.

Ketones – toxic organic compounds produced in uncontrolled diabetes.

Labour – the process of repeated muscular contractions of the uterus, leading to childbirth.
Laceration – a cut.

Larynx, Laryngeal – the voice box, located at the upper end of the trachea.
Laryngectomy – removal of the larynx.
Lateral – to the side (as opposed to medial or the middle).
Left ventricular failure – congestion in the lungs, caused by weakness of the left ventricle.
Lens – situated behind the iris in the eye.
Lymph – the colourless fluid that circulates in the lymphatic vessels.
Lymph node or gland – small oval or bean-shaped bodies situated in the course of lymph vessels.

Mania – a form of mental disorder characterised by great excitement.
Medial – towards the middle, as opposed to lateral.
Mediastinum – the interval between the 2 lungs extending from the top of the sternum above to the diaphragm below, and containing the trachea, oesophagus and heart.
Melaena – the passage through the rectum of dark tarry stools containing altered blood, usually coming from the stomach or duodenum.
Meninges – the membranes, including the dura, covering the brain and spinal cord.
Meningitis – inflammation of the meninges.
Menstrual bleeding – the normal recurrent monthly discharge of blood from the uterus.
Micturition – the act of voiding urine.
Miscarriage – an abortion or premature expulsion of the foetus before the 28th week of pregnancy.
Mitral valve – valve between the left atrium and left ventricle in the heart.
Multiple sclerosis – a progressive degenerative disease of the brain and spinal cord, caused by patchy damage of nervous tissue.
Myocardium – the muscle of the heart wall.
Myocardial infarction – death of heart muscle, caused by blockage of a coronary artery.
Myocardial ischaemia – inadequate blood supply to heart muscle, caused by narrowing of a coronary artery leading to chest pain on exertion.

Nasopharynx, Nasopharyngeal – the space between the back of the nose, the base of the skull and upper end of the oesophagus.
Neonate – baby less than 1 month old.
Neurosis, Neurotic – a mental or emotional disturbance. In contrast to psychoses, the neuroses do not involve gross distortions of reality or personality.
Normal saline – saline at 0.9% strength commonly used for intravenous infusions.

Oedema – an abnormal accumulation of fluid in the tissues.
Oesophagus – the gullet or the food tube which extends from the pharynx to the stomach.
Open pneumothorax – air in the pleural space as a consequence of a penetrating injury to the chest wall.
Orbit, Orbital – the bony cavity containing the eyeball.
Organic brain syndrome – refers to a mental disorder caused by a physical disease or injury to the brain.

Paediatric – relating to children.
Pallor – paleness.
Palpable – capable of being touched or felt.
Palpitations – a fluttering or a consciousness of the beating of the heart caused by rapid or irregular heart beat.
Paranoia, Paranoid – the mental disorder characterised by feelings of suspicion or delusions of persecution.
Paralysis – loss of power of movement of the affected part.
Paresis – partial paralysis or weakness of the affected part.
Pelvic ring – the ring of bones forming the pelvis.

Peptic – pertaining to digestion.
Peptic ulcer – ulceration in the stomach or duodenum.
Perineum – the area between the scrotum or vagina in front, buttocks behind, and the medial aspect of the thighs.
Pharynx – the air space behind the mouth and nose.
Phobia – an unreasonable fear or dread.
Photophobia – an abnormal fear or discomfort with light; often found in brain disorders.
Placenta – the organ responsible for supply of oxygen and nutrients to the foetus. It is attached to the lining of the uterus.
Pleura – the membrane lining the outside of the lungs and the inside of the chest wall.
Pleural space – the potential space between the two layers of pleura.
Pleurisy – inflammation of the pleura.
Pneumonia – an infection within lung tissue.
Pneumothorax – air in the pleural space.
Post- – after, or behind.
Posterior chamber (of the eye) – the largest part of the eye, lying behind the lens.
Pre-eclampsia – a condition peculiar to pregnancy which is said to occur when 2 or 3 of the following are present: oedema, hypertension, protein in the urine.
Precordium – the area of the chest wall overlying the heart.
Pregnancy – the state of being with child.
Premature – appearing before the proper time, e.g., premature infant.
Prolapsed cord – the condition in which part of the umbilical cord is delivered before the baby is born.
Protein – a large and elaborate chemical substance made up of amino acids. Proteins are widely distributed within the body and are the principle constituents of the cell protoplasm.
Psychosis – a severe mental illness or insanity, in which there is considerable personality degeneration.
Pubis – the anterior part of the pelvis.
Pulmonary – pertaining to the lungs.
Pulmonary valve – valve between the right ventricle and pulmonary artery.
Pupil – the circular aperture through which light enters the eye.
Pylorus, Pyloric – the distal or duodenal aperture of the stomach.

Rectum – the terminal portion of the bowel from the colon to the anus.
Renal – pertaining to the kidneys.
Rheumatoid arthritis – an inflammatory disorder involving the joints.
Right ventricular failure – weakness of the right ventricular muscle, leading to congestion and oedema, usually in the feet.
Rigor – a shivering or fit, due to infection.

Saline – a salt solution.
Schizophrenia – a psychosis characterised by disturbance in reality with disintegration of the personality.
Sclera – the firm fibrous outer coat (white) of the eye.
Septicaemia – a disease produced by bacteria in the blood.
Shock – a condition characterised by an acute reduction in tissue blood supply, often caused by loss of blood or fluid, or heart damage.
Signs – an objective manifestion of disease; facts elicited on examination.
Sino-atrial node – the electrical conducting node found in the atrium of the heart, which gives rise to the electrical impulses triggering contraction.
Sphygmomanometer – an instrument for measuring blood pressure.
Skull – bony skeleton of the head.
Sputum – material from the respiratory passages which is ejected by expectoration.

Sternum – the breast bone.
Sub- – beneath, near – less than normal.
Subarachnoid haemorrhage – type of stroke, often occurring in younger people, caused by bleeding from a weakness in one of the major blood vessels in the brain.
Subconjunctiva – the tissues beneath the conjunctiva (eye).
Subconjunctival haematoma – bleeding occurring under the conjunctiva and over the eye, and often found in association with a fractured skull.
Subdural – below the outer membrane lining the brain.
Subdural haematoma – blood clot between the dura and brain.
Supra- – above, or over.
Supraclavicular – above the clavicle.
Suprasternal – above the sternum.
Surgical emphysema – an abnormal collection of air in the tissues.
Symptom – a manifestation of disease as felt and described by the patient.
Systole, Systolic – the period during a heart beat when the heart muscle is contracted.

Tachycardia – rapid heart (pulse) rate.
Tachypnoea – rapid breathing.
Tension pneumothorax – air under pressure in the pleural space.
Thorax, Thoracic – the chest and contents.
Thrombosis – the formation of a blood clot.
Tibia – the major bone of the lower leg.
Trachea – the windpipe.
Tracheostomy – operation for making an opening in the upper end of the trachea to allow easier breathing.
Transfusion – the giving of blood intravenously.
Trauma – injury.
Tricuspid valve – valve between the right atrium and ventricle in the heart.
Trinitrin (Glyceryl trinitrate) – a drug given under the tongue to relieve angina.
Tumour – a swelling due to an abnormal growth of tissue.

Ulcer – an erosion or loss of continuity of the skin or mucous membrane.
Umbilical cord – the cord connecting the placenta with the foetus.
Umbilicus – the navel.
Urethra – the tube leading from the bladder to the exterior.
Urine – the fluid excreted by the kidneys and passed from the bladder.
Urinary incontinence – the inability of the patient to hold urine in the bladder, and may occur after injury or a fit, or in some people after coughing.
Uterus – the womb.

Vascular – pertaining to the blood vessels.
Ventilation – the supply of fresh air.
Ventricular ectopic beat – an ectopic cardiac beat arising within the ventricle, as distinct from the SA or AV node.
Ventricular fibrillation – an irregular beat arising within the ventricle which causes a rapid onset of coma and death, unless treated urgently.
Vertebrae – the irregular bones forming the spinal column.
  Cervical: 8 vertebrae in the upper part of the spine.
  Dorsal or Thoracic: 12 vertebrae of the chest.
  Lumbar: 5 vertebrae in the lower spine.
Vulva – external genital organs of the female.

Whiplash – the sudden extreme backward movement of the head on the neck, e.g., in a rear-end collision in a vehicular accident.

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