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An introduction to first aid

Imagine: Whilst feeding your child, they start to gag and appear unable to breathe. You have tried slapping them on the back, with no success. They seem close to losing consciousness, their lips are turning a definite shade of blue.

People rarely give first aid a thought, until the day they need it. The above scenario is the sort of every day occurrence that can so easily lead to tragedy.

However, with the correct first aid training anyone could, in the short term (until the arrival of the emergency services) save a life.

These notes have been designed to aid you with your first aid training. It is, however, not a substitute for hands on training from a professional first aid trainer, but a reference for you to look back on when you need to.

We hope the training you undertake with us will give you the knowledge and confidence to, if the worst happens, help keep someone alive.

The Aims of first aid

Preserve life

This doesn't just refer to the injured party, but yourself and anyone helping you. Far too often, a helper will inadvertently put themselves in danger and subsequently be another casualty for the emergency services to deal with. Please take a moment to assess the situation, and make sure there are no threats to you before you step in.

Prevent the situation from getting worse

If you are in no danger yourself, try to stop the situation from becoming worse by removing any obvious dangers (such as stopping traffic, clearing people away from the casualty, opening a window to clear any fumes, etc.). Also, act as quickly as you can to stop the casualty's condition from worsening.

Promote recovery

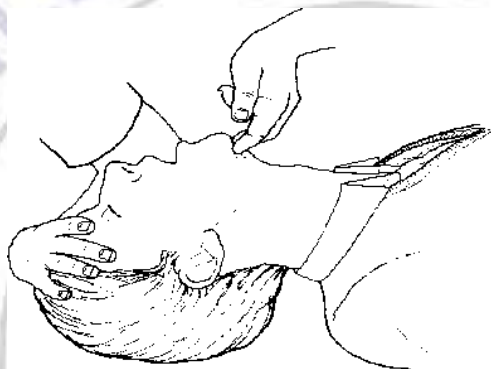
Your role as a first aider is, after ensuring that the situation can not get worse, helping the casualty to recover from their injury or illness, or stop their condition from getting worse. If the injury is severe, then the best you can do is try to keep them alive until the emergency services arrive.

The priorities of treatment

This is the course of action you should try to follow, providing the situation allows.

Primary survey (Airway → Breathing):

A. Make sure the casualty's **airway** is clear. Do this by gently tipping their head back so that the front of the throat is extended.

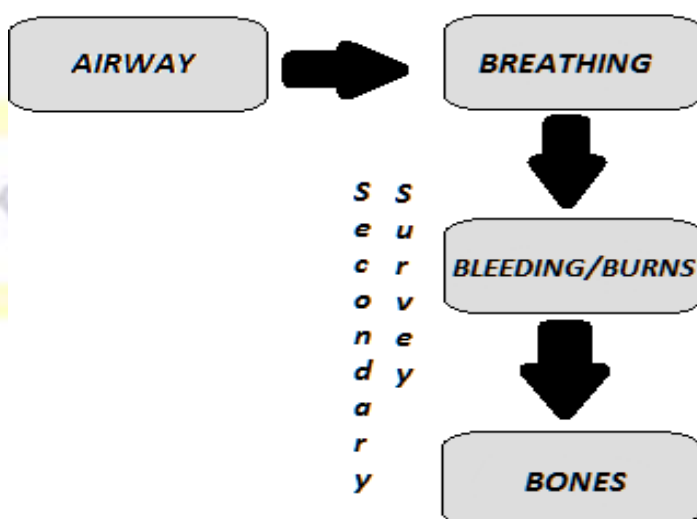


B. Check if they are **breathing** normally. You can do this by placing the back of your hand near their nose and mouth. You are looking for about two breaths every ten seconds. If the casualty is breathing, then their heart is working, which means blood is being circulated around their body.

Secondary survey (Breathing → Bleeding → Bones):

Once you are satisfied that the casualty is **breathing** normally, the second thing to do is make sure to treat any **bleeding**. This is to stem any blood loss and to ensure there is a steady supply of oxygenated blood to the casualty's vital organs. If there is no bleeding, or you have dealt with any cuts, the next priority is broken **bones**.

Primary Survey



An emergency action plan is important to have in place should you be faced with a situation requiring first aid.

- 1. REMOVE DANGER:** Make the scene safe, do not take risks.
- 2. DANGER:** Look for any further danger. If yes, go back a step, if no go to step 3.
- 3. RESPONSE:** Shout and gently shake or tap the casualty. If the casualty responds, find out what happened. Check their signs and symptoms (how does the casualty feel or look? Try to work out what's wrong), and determine a treatment (remember - if you are unsure, always seek medical advice). If there is no response, shout for help but don't leave the casualty just yet, and go to step 4.
- 4. AIRWAY:** Open the casualty's airway by lifting their chin and tilting their head back.
- 5. BREATHING NORMAL?:** Look, listen and feel for two breaths in a maximum of ten seconds. If you can clearly determine the casualty is breathing, perform a secondary survey (check for bleeding, injuries and clues). Put the casualty into the recovery position, **dial 999 if not already done**, monitor airway and breathing and keep the casualty warm. If you cannot determine if the casualty is breathing, go to step 6.
- 6. DIAL 999 FOR AN AMBULANCE NOW IF YOU HAVEN'T DONE SO ALREADY.**
- 7. RESUSCITATION:** Give 30 chest compressions followed by 2 rescue breaths, continue giving cycles of 30 compressions to 2 breaths. If there is more than one first aider on hand, change over every 2 minutes to prevent fatigue. Continue until the ambulance arrives.

Resuscitation

To maintain life, we need our hearts to pump oxygenated blood to our vital organs. To achieve this we need to be breathing and our hearts need to be pumping. Should either of these functions stop, our brain and other vital organs will start to deteriorate (brain cells usually die within 3-4 minutes due to lack of oxygen) which will eventually lead to death.

'Ventricular fibrillation' is the most common result of cardiac arrest, caused by heart attack. When this happens, the best chance of survival for the patient is to

have their heart 'restarted' with a defibrillator. These are carried on all ambulances, and can also be found in some public places (shopping centres, etc.). These days' defibrillators are very sophisticated, and will talk you through the process, but you should be trained in the use of them before attempting to use one. However, even if you are trained to use one, you must call an ambulance first, as this will give the casualty the best chance of survival.

Even so, we need to keep the heart and brain oxygenated as best we can while help is on the way; this is when we start **Cardio Pulmonary Resuscitation (CPR)**.

Cardio Pulmonary Resuscitation (CPR) – Primary Survey:

D Danger – ensure the area is safe and find out what has happened

- Make sure that it is safe for you to approach the casualty. Do not put yourself in any danger, because if you get injured you won't be able to help the casualty.
- Remove any danger from the casualty, or if that is not possible, and it is safe to do so, try to move the casualty away from the danger area.
- Try to find out what happened, making sure that you are safe doing so. **DO NOT PUT YOURSELF IN ANY DANGER.**
- How many casualties are there? Can you cope with the situation?

R Response – is the casualty conscious?

- Try to get a response from the casualty. Gently shake their shoulders, shout and clap your hands in front of them, pinch their underarm or fingernail to get a pain response.
- If they do not respond, immediately shout for help, or call 999 if you have a mobile phone on you. Whatever you do, **do not leave the casualty alone.**

A Airway – clear the airway

- Clear the airway by placing your fingertips under the casualty's chin and lifting, so the front of the neck is extended. Simultaneously placing your other hand on their forehead to gently tilt the head back.

B Breathing – is the casualty breathing normally?

- When their airway is cleared, check if they are breathing normally. You are looking for two breaths in ten seconds. Take no longer than this to assess their breathing, as every second counts.
- Check whether their chest and abdomen are rising and falling.
- Listen for breath (more than a sporadic gasp).
- Use the back of your hand (lick the back of your hand if that will help) or your cheek to feel for any breath from the casualty.

This will all determine if the casualty is breathing normally. If they are, you will need to place them in the recovery position, which will be covered later in the notes.

If the casualty is not breathing normally:

The first thing to do in this situation is **call 999 for an ambulance**. If someone is with you, get them to do this so you don't have to leave the casualty. If you are alone, and do not have a mobile with you, you may need to leave the casualty to do this. However, it is vital that an ambulance is called, as the casualty will stand a much better chance of survival with help on the way. Once the ambulance is called, start CPR:



- Place the heel of one hand in the centre of the casualty's chest. Place the other hand on top and interlink your fingers.
- Take a position next to the casualty's chest, kneeling at whichever side feels more comfortable for you.
- Press down firmly on the casualty's breastbone *current guidelines suggest pushing down to a depth of 6cm*) then release the pressure, but try not to lose contact with the casualty. This is known as a chest compression. When applying pressure, avoid doing so on the ribs, upper abdomen or the end of the casualty's breastbone.
- Each compression should take the same amount of time.
- Carry out 30 chest compressions at a speed of 100-120 compressions per minute.
- After 30 chest compressions, you must administer two rescue breaths (see images below).

In an ideal situation, the casualty will be on a flat hard surface to be able to administer CPR. However, this isn't always the case, and you may find that you

need to perform CPR on a casualty who is, for example, in bed. If this situation arises, try to get the casualty onto the floor without hurting yourself or the casualty. If it is not possible, remove any pillows or cushions so the casualty is lying flat and attempt CPR. This is still better than doing nothing.



Combining chest compressions with rescue breaths:

- After chest compressions, make sure the casualty's airway is clear by tilting their head back.
- Pinch the casualty's nose closed; this will make sure the breath you give them does not escape.
- Take a breath and place your mouth over the casualty's, forming a seal.
- Steadily blow into the casualty's mouth, making sure their head is tilted back and the airway is open. Keep your eyes down on the casualty's chest to make sure it rises (this should take about a second). This is known as a rescue breath.
- Remove your mouth from the casualty's and leave enough room for you to take a fresh breath of air. Keep the casualty's airway open and watch for the chest deflating, as the air is expelled.
- Place your mouth over the casualty's forming the seal again and give another rescue breath. You need to do this twice.
- Replace your hands on the casualty's chest immediately and perform another 30 chest compressions, followed by 2 more rescue breaths.

Continue swapping between 30 chest compressions and 2 rescue breaths.



Should your rescue breaths not be effective, follow the steps below:

- Give a further 30 chest compressions.
- Remove any visible obstructions in the casualty's mouth.
- Make certain their airway is clear by tilting their head back and lifting the chin. If the airway is not clear, the breath you give will not fill their lungs.

Do not give the casualty more than two rescue breaths before continuing with chest compressions.

If you have someone with you, take it in turns to administer chest compressions. Every 1-2 minutes, change over so one person administers chest compressions while the other gives the rescue breaths. Ensure there is as little delay in swapping as possible, so the casualty is constantly receiving CPR.

Continue CPR until:

- The emergency services arrive to take over.
- You become too fatigued to continue.

Resuscitation for babies and children:

Understandably, some people are reluctant to perform CPR on a child or baby for fear of causing further harm to them. However, a child in this state is likely to suffer far worse consequences if CPR is not administered. Please keep that in mind should the situation ever arise.

CPR on a child is very similar to CPR on an adult. There are only a few minor modifications to the process, which are detailed below:

- Give the child **5 rescue breaths** before starting CPR, then switch back to 30 chest compressions to 2 rescue breaths.
- If you are alone, perform CPR for about a minute before going for help.

Chest compressions on a child should be about one-third of the depth of the chest. For a baby under 1 year old, only use **two fingers** to administer CPR. For a child over 1 year use either one or two hands to compress the chest, again one third of the depth of the chest.

Full details on child CPR is covered later in the notes.



Resuscitation with chest compressions only

An adult cardiac arrest casualty will probably still have oxygen in their blood stream. If there is any reason you cannot give the casualty rescue breaths, you can still help the casualty by giving them 'chest compression only' resuscitation. Although not ideal, it will still circulate the residual oxygen in their blood to their vital organs, so it is better than no CPR.

If you are only giving chest compressions, the continuous rate should be 100-120 compressions per minute.

If you have someone with you, take it in turns to administer chest compressions. Every 1-2 minutes, change over so one person administers chest compressions while the other rests and maintains the casualty's airway. Ensure there is as little delay in swapping as possible, so the casualty is constantly receiving chest compressions.

Vomiting during CPR:

It is not uncommon for an unconscious casualty who has stopped breathing to vomit. This is an autonomic reaction from the unconscious casualty which you may not notice until you come to give a rescue breath, or their breath comes out with a gurgling noise.

- If this happens, turn their head to the side and allow the vomit to drain.
- Before continuing resuscitation, clean the casualty's face, and if you have a face shield handy use it.

Points of hygiene during resuscitation:

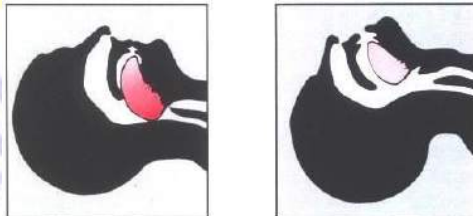
- Use a cloth, or whatever you have to hand to wipe the casualty's mouth clean.
- Face shields are useful to have on you, as they protect you from any serious infections such as TB, Hepatitis, etc. Always use one if you have it with you.
- If you do not have a face shield to hand, a piece of plastic with a hole cut or torn into it will suffice, as will a handkerchief or any piece of material which will help to prevent direct contact.
- If you are in any doubt about the safety of giving rescue breaths, you can perform 'chest compression only' resuscitation as a last means (this is described above).
- If you have protective gloves, use these. Always wash your hands afterwards to prevent any contamination.

Main causes of unconsciousness in a casualty:

Unconsciousness is an interruption to normal brain activity. Unconsciousness disrupts the body's autonomic reflexes such as coughing. The worst position for an unconscious casualty is lying on their back, as they may 'swallow' their tongue (the tongue slides back in the throat blocking the airway) which will

suffocate them, or they may asphyxiate on their vomit.

If a casualty is unconscious, you need to take immediate action: clear the airway, call for an ambulance by dialling 999 and if you can, treat the cause of their condition.



To help you remember the main causes of unconsciousness in a casualty, try to remember **FISH SHAPED**. These points are dealt with more fully elsewhere in these notes.

| | | | |
|----------|-------------------|----------|--------------------|
| F | Fainting | S | Stroke |
| I | Imbalance of heat | H | Heart attack |
| S | Shock | A | Asphyxia (choking) |
| H | Head injury | P | Poisoning |
| | | E | Epilepsy |
| | | D | Diabetes |

Responses in casualties:

To correctly ascertain the level of consciousness in a casualty, you can use the **AVPU** scale:

A Alert

The casualty is fully alert

The casualty is awake and fully aware of their surroundings (they will usually know the answer to general questions like the date, their name, where they are, etc.)

V Voice

Confused

The casualty may not be fully aware of their surroundings, but will ask and answer questions.

Inappropriate words

This refers to casualties who are conscious, but may not be able to string a coherent sentence together. Words may be in the wrong place or missing

altogether from responses.

Making sounds

The casualty is not able to respond verbally, but may make grunts or moans in response to painful stimuli.

No sounds

In this case the casualty will make no vocal sounds.

P Pain

Locating pain

The casualty will be able to locate painful stimuli, and tell you where it is being applied (pinch on the underside of the arm, pressing firmly on a finger nail, etc.).

Pain response (but not able to locate the pain)

The casualty will respond to painful stimuli, but not be able to locate where the pain is.

U Unresponsive

The casualty is not able to respond to pain or vocal stimuli. They will remain unresponsive.

You can perform primary and secondary surveys of the casualty, which will help you to decide in which order to treat the casualty, the most urgent first. You can then go on to assess the casualty further, which may help with diagnosis and treatment. The more information you can give the ambulance crew the better.

Primary survey:

When you perform the **DRAB** check, this is usually the primary survey. This has been covered previously (*page 4*). Primary surveys are to assess whether the casualty is breathing. Once you have established this, you can move onto the secondary survey.

Secondary survey:

If a casualty is unconscious, but breathing, you must protect the airway. As detailed before, risks are swallowing the tongue, vomiting, etc. Place the casualty in the recovery position immediately, as described here (*see page 12*). The secondary survey needs to be done quickly in the following order of importance:

Bleeding

- Check the casualty from head to toe for bleeding.

- Make sure to check any covered areas, such as the back.
- Stop or control any bleeding you find (*see page 36*).

Head and neck

- Check for any signs of bruising, swelling or bleeding, particularly from the ears.
- Make sure to examine the whole of the head and face.
- Feel the back of the neck, as this is a hidden area.
- Try to ascertain if the casualty has been in an accident that is likely to damage the neck (*for spinal injuries, see page 55*).

Shoulders and chest

- Check both shoulders by placing your hands on them to see if there are any irregularities.
- Run your fingers across the collarbones to check for any damage.
- Run your hands over the ribcage, squeezing and rocking gently, to make sure there are no breaks, as a broken rib could easily puncture a lung.

Abdomen and pelvis

- Press the abdomen gently with the palm of your hand to see if there are any irregularities or pain response.
- Gently put pressure on the pelvis to check for any fractures.
- Check if the casualty is bleeding or is incontinent.

Legs and arms

- Run your hands down the legs gently, checking for any fractures or breaks.
- Repeat the action with the arms.
- Check the casualty for any clues to their condition (medic alert jewellery, needle marks, smell of alcohol, etc.).

Check the pockets

- Check there is nothing in the pockets that will injure the casualty further when you roll them into the recovery position.
- Try to have a witness present if you need to remove any items from the casualty who can vouch for you.
- Be wary, there may be sharp objects in the casualty's pockets such as needles or a knife.
- Be sure to loosen any restrictive clothing, such as ties and belts.

Recovery

- Gently place the casualty in the recovery position (*see page 12*).
- If you have any suspicion that the casualty may have an injured neck, try to get someone to hold the head in line with the body while you turn the casualty

(see *spinal injuries*, page 55) to lessen the risk of further damage.

- Be careful not to cause further injury to the casualty or exacerbate suspected injuries.

Mechanics of injury

Before attempting to move a casualty, it is important to think about the 'mechanics of injury'. This is the process of figuring out what has happened, and what injuries are likely to have been sustained by the casualty. If you suspect there is a neck injury involved, you must try to get someone to help you by keeping the casualty's head in line with their body at all times, even when the casualty is lying still. Any movement can cause serious, irreparable damage. See page 55 for how to do this, under *treatment of spinal injury*.

The recovery position

When an unconscious casualty is lying on their back, their breathing can be hampered by them 'swallowing their tongue' (the tongue slides back in their throat, cutting off the airway). Or, the person can vomit while unconscious, and are not able to reflexively heave or expel the vomit, which can suffocate them. By placing the casualty on their side (the recovery position), this ensures the airway is clear by stopping the tongue sliding back in the throat and allowing vomit to drain from the mouth.

Try, if possible, to move the casualty onto their left, as this will keep any contents in the stomach from escaping. However, always place breathing first, so if a casualty has any damage to their right lung for example, place them on their right to protect the one working lung.

Step 1

- Remove any dangers from the casualty (remove glasses, check pockets for anything that will cause further injury) and straighten the legs.
- Preferably move the left arm out, with their elbow bent and palm face up.

Step 2

- Now bring the far side leg into a bent position, with the foot on the floor, tuck their foot under the near side leg to keep it up.

Step 3

- Bring the far side arm across the chest, with the back of the hand against the casualty's cheek, and hold it there.
- Now using the bent knee as leverage and holding the back of the hand against the cheek, pull the knee towards you, rolling the casualty onto their side.

Make sure their knee is touching the ground so that they don't roll back.

Step 4

- Make sure that the upper leg is bent at both the hip and the knee, as though the casualty is in a 'running' position. Keep their hand under their cheek and tilt their head back to clear the airway.
- Check the casualty's back for any hidden injuries, and if you have anything to hand, cover them for warmth and their dignity.
- Call 999 and request an ambulance.
- Monitor the casualty's breathing every 30 seconds while awaiting the ambulance. If the casualty stops breathing, return them to their backs and commence CPR.

Things not to do:

- Never put anything into an unconscious casualty's mouth.
- Never move a casualty without performing the checks mentioned first.
- Never place anything under the head of a casualty who is on their back. This could obstruct the airway.
- Never unnecessarily move a casualty as this could cause further injury.

Head injuries

Treat any suspected head injury with the utmost caution, as they have the potential to be very serious. Head injuries often lead to unconsciousness and all the attendant problems. Also, head injuries can cause permanent damage to the brain.

Head injuries may also be associated with neck and spinal injuries, so they must be treated with the utmost caution (*see spinal injuries, page 55*).

The three main areas of concern with head injuries are concussion, compression and a fractured skull.

Concussion

Concussion occurs when the brain is violently shaken. Our brains are cushioned within our skulls by 'cerebro-spinal fluid' (CSF), so any blow to the head can cause the brain to bang against the skull which disrupts its usual functions. A casualty may pass out briefly (no more than 2-3 minutes), and when they come round their level of response should return to normal.

Concussion casualties should return to normal if no complications arise.

However, a concussed casualty should not be left on their own and should ideally be monitored for 24 hours. No sporting activity should be undertaken for at least three weeks after a concussion.

Compression

Compression injuries are very serious, as the brain is under extreme pressure which is caused by bleeding or swelling in the cranial cavity. Compression can arise from a skull fracture or head injury, but can also be brought on by illness (type of stroke, brain tumour, meningitis, etc.).

Fractured skull

Fractures to the skull are very serious as the broken bone of the skull can cause direct damage to the brain which can cause bleeding and therefore compression. Treat any casualty who has had a head injury, and whose response level is low, as having a fractured skull.

Possible signs and symptoms of head injury

| Concussion | Compression | Fractured Skull |
|--|--|---|
| Casualty is unconscious for short period, after which response levels are back to normal, recovery is usually quick. | Possible history of recent head trauma with recovery, followed by deterioration. | Casualty may suffer from concussion or compression also, so symptoms of these may be present. |
| Short term memory loss, groggy, confused irritable. | Response level deteriorates as the condition develops. | Bleeding, swelling or bruising of the head. |
| Mild headache. | Severe headache. | Soft, egg shell feeling of the scalp. |
| Pale, clammy to the touch. | Flushed, dry skin. | Bruising apparent around the eyes. 'Panda eyes'. |
| Shallow to normal breathing. | Deep, slow and noisy breathing (due to pressure on brain). | Bruising or swelling behind one or both ears. |
| Rapid, weak pulse. | Slow, strong pulse caused by raised blood pressure. | Blood or fluid coming from an ear or the nose. |
| Pupils are normal and react to light. | One or both pupils may dilate as pressure on the brain increases. | Deformity or lack of symmetry of the head. |
| Nausea and vomiting can occur on recovery. | As condition worsens, fits may occur, with no recovery. | Blood visible in the white of the eye. |

Treatment of head injuries

Keep in mind that a casualty with any head injury may well be suffering from neck and spine injuries also. Treat the casualty with the utmost care, and call for an ambulance immediately.

- If the casualty is or has been unconscious, you suspect a fractured skull, or their responses deteriorate **CALL AN AMBULANCE IMMEDIATELY.**
- Keep their airway clear and monitor their breathing.

- If the casualty is unconscious, and you don't wish to move them as you suspect a neck injury, you can use the jaw thrust method of keeping the airway clear (*see page 58*).
- If you are unable to use the jaw thrust method, and you cannot keep the airway clear, put the casualty in the recovery position but **make sure the head, neck and body are in line as you turn them to avoid any further damage to a neck or spinal injury.**
- If the casualty is conscious, you can help them lie down, making sure to keep the head and neck in line with the body. You can help stop any movement of their head by placing your hands on either side of the head and keeping it still.
- If there is bleeding, help to control it by applying pressure directly to or around the wound. However, if there is blood or fluid coming from an ear, do not try to stop the flow, as the fluid must be allowed to drain.
- If there are any other injuries on the casualty, attempt to treat these.

Some tips for treating head injuries:

- Monitor the casualty's breathing, pulse and response levels. If the casualty appears to recover, monitor them closely as they may well deteriorate and their response levels drop.
- If a casualty has been concussed, try to make sure they are not left alone for the next 24 hours. Advise them to seek medical help as soon as possible.
- If a casualty suffers any of the following in the few days after concussion, they should **go to A&E immediately:** worsening headache, nausea or vomiting, drowsiness, weakness in a limb, problems speaking, dizzy spells, blood or fluid from an ear or the nose, problems seeing, seizures or confusion.
- If the concussion is received playing sports, do not allow the concussed player to continue until they have seen a doctor. Usually, concussed players are not allowed to participate for up to three weeks after being concussed.

Stroke

Strokes must always be treated as a medical emergency, and an ambulance called immediately. Any delay in the treatment of a stroke can have a dramatic effect on the casualty's recovery. If you suspect a stroke, **CALL AN AMBULANCE IMMEDIATELY.**

There are two types of stroke:

1. A blood clot blocks a blood vessel that supplies part of the brain. This is the most common.
2. A ruptured blood vessel in the brain. The build-up of blood 'squashes' an area of the brain.

With either type of stroke the signs are similar, with the result that a part of the brain dies. There is no age definition of a stroke casualty; anyone of any age

can have a stroke.

Signs and symptoms of a stroke:

A stroke must be treated immediately. If you suspect a stroke, carry out the following **FAST** test:

F Facial weakness

Can the casualty smile? Has their mouth or eye drooped?

A Arm weakness

Can the casualty raise both arms?

S Speech problems

Can the casualty speak clearly? Do they have problems understanding you?

T Time to call 999

If the casualty fails any of these tests, **call 999 immediately** as a stroke is a medical emergency.

There may be other signs to look for, but the **FAST** check is the quickest and may save time. However, please note the following may occur:

- One side of the face or body becomes suddenly numb.
- Loss of balance.
- Lack of co-ordination.
- Suddenly developing a severe headache.
- Sudden confusion.
- Problems seeing with one or both eyes.
- Pupil size becomes unequal

Treatment of stroke:

- Clear the airway and maintain breathing.
- **DIAL 999 FOR AN AMBULANCE IMMEDIATELY.**
- If the casualty is unconscious, place in the recovery position.
- If conscious, lay the casualty down with their head and shoulders raised.
- Be sure to talk to and reassure the casualty. Just because they may not be able to speak, they still may be able to understand and react to you.
- Monitor their breathing, pulse and response levels. Keep a record if possible for when the ambulance arrives.

Hypoxia

Hypoxia means low oxygen in the blood stream. This condition has the potential to be fatal, so it is vital for a first aider to recognise the signs and know how to treat the casualty.

There are five categories for the causes of hypoxia. These are:

External causes

There is not enough oxygen in the air surrounding the casualty, such as:

- Suffocation by smoke or gas.
- Drowning.
- Suffocation by earth, sand or a pillow/cushion, etc.
- High altitude (lower oxygen levels)

Airway causes

These can be swelling or narrowing of the airway caused by:

- Swallowing or swelling of the tongue.
- Vomit.
- Choking.
- Burns.
- Strangulation.
- Hanging.
- Anaphylactic shock.

Breathing causes

The lungs are unable to function properly, caused by:

- Crushing of the chest.
- A collapsed lung.
- Injury to the chest.
- Poisoning.
- Asthma attack.
- Disease or illness.

Circulation causes

Oxygenated blood is unable to circulate around the body, falling blood pressure, or oxygen is not absorbed by the blood, caused by:

- Heart attack.
- Cardiac arrest.
- Angina.
- Severe bleeding.
- Poisoning.
- Anaemia.

Control centre causes

The respiratory control centre in the brain, or the nerves connecting it to the lungs, fails, caused by:

- Stroke.
- Head injury.

- Drug overdose.
- Poisoning.
- Spinal injury.
- Electric shock.

Signs and symptoms of hypoxia

- Skin appears pale and feels clammy to the touch. For dark skinned casualties, check the skin inside the lips and eyelids.
- A bluish tinge to the casualty's skin and lips (*cyanosis*).
- Increased pulse.
- Weakening pulse.
- Nausea or vomiting.
- An increase to the casualty's breathing rate (caused by lack of oxygen).
- A decrease to the casualty's breathing rate (check for control centre causes).
- Distressed breathing, or gasping.
- Confused or dizzy.
- Decreasing levels of consciousness.
- Look for clues from the cause of the hypoxia (bleeding, injury, chest pain, etc.).

Treatment of hypoxia

- Clear the airway and maintain breathing.
- Try to remove or treat the cause of hypoxia (stop bleeds, open windows to clear smoke or gas, etc.).
- Do not allow the casualty to eat, drink or smoke.

How the body responds to hypoxia

Adrenalin is released if the body detects that there are low levels of oxygen in the blood. The effect this has on a body is:

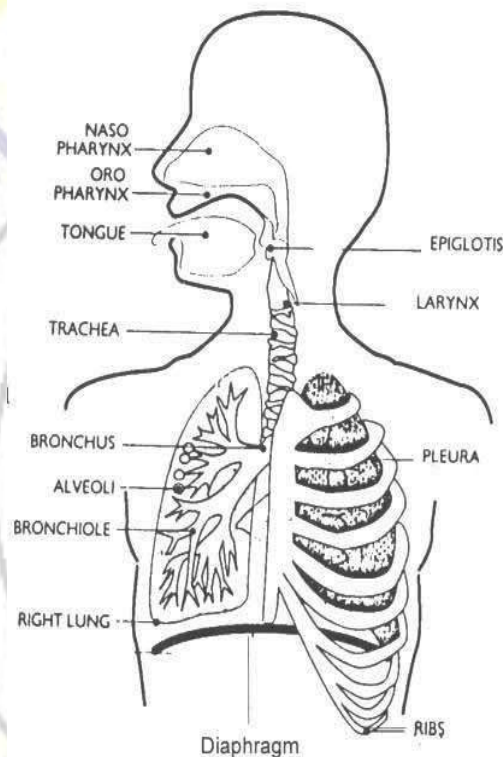
- Increases the heart rate.
- Increases the strength of the heartbeat, and therefore blood pressure.
- Diverts blood away from the skin, stomach and intestines.
- Diverts the blood towards the brain, heart and lungs.
- Dilates the air passages (*bronchioles*) in the lungs.

Adrenaline being released into the body has a dramatic effect on the signs and symptoms that it is vital you as the first aider recognise.

The respiratory system

Air is taken in through the nose and mouth where it is warmed, filtered and moistened. It then travels through the throat and past the epiglottis (the flap of

skin at the back of the throat that closes over the airway when we swallow), where it enters the larynx (the voice box or ‘Adam’s apple’). It then continues between the vocal cords in the larynx and on into the trachea (windpipe). The trachea is protected by cartilage rings that surround it and stop it from kinking. The trachea then splits into two ‘bronchi’, each supplying oxygen to a lung.



The bronchi are divided into ‘bronchioles’, or smaller air passages. Right at the end of the bronchioles are ‘alveoli’, microscopic air sacks. The walls of the alveoli are one cell thick, which allows oxygen to pass through them and into the blood, which is carried in capillaries around the alveoli. The waste gas from our body is carbon dioxide, which passes from the blood through the alveoli and is breathed out.

The ‘thoracic cavity’ is in the chest, and is where the trachea, bronchi and lungs are all situated. To enable us to draw air into the thoracic cavity, the diaphragm flattens and the chest walls expand, which increases the size of the thoracic cavity creating a void which draws in air.

Each lung is encased in a two layered membrane known as the ‘pleura’. Between these two layers is a thin layer of fluid called ‘serous fluid’. This allows the chest walls to move without friction.

The ribs curl around from the spine, connecting to the sternum (breast bone),

and protects the thoracic cavity.

| 'Normal' respiratory rates | Breaths per minute |
|----------------------------|--------------------|
| Adult | 12 - 20 |
| Child | 20 - 40 |
| Baby | 30 - 60 |

Choking

Choking is a very common occurrence, and is probably one of the most useful skills you can have as a first aider. Choking can lead to tragedy if not dealt with properly.

Signs and symptoms

- Casualty is unable to talk, breath or cough.
- They may be gasping and clutching their throat.
- They may appear distressed.
- They may become pale and show signs of cyanosis in later stages.
- Becoming unconscious.

Treatment of an adult or child over 1 year:

Ask the casualty if they are choking firstly to establish this is the case. If they are not doing so already, ask them to cough as this will usually dislodge minor obstructions. However, if this doesn't work, follow the steps below:

1 – Back slaps

- If there is no help around, shout for help. Do not leave the casualty alone.
- Bend the casualty forward at the waist so their head is lower than the chest. If the casualty is a young child, you can place them over the knee to help with this.
- Find the hollow spot between the shoulder blades and administer five firm slaps with your open hand. Make sure to check between blows if the obstruction has dislodged.
- If this does not work, go to step 2.

2 – Abdominal thrusts (Heimlich Manoeuvre)

- Stand (or kneel if it is a child) behind the casualty and place both your arms around their waist.
- Make a fist and place it just below the casualty's ribs with your thumb facing inwards (as if you're looking at a watch).

- Grasp your fist with your free hand and pull in sharply. Do this up to five times, making sure you check between each thrust if the obstruction has dislodged.



- If this does not work, repeat step 1 and follow with step 2 until the obstruction is dislodged.
- If the back slaps and abdominal thrusts do not appear to be working, shout for someone to call 999 for an ambulance, but do not stop administering the treatment if the casualty is conscious.

Choking in a baby under 1 year

The baby may attempt to cough on their own. If the choking is not serious, this will clear the obstruction. The baby may cry which indicates they are now breathing properly.

If the obstruction is not cleared by coughing, follow the steps below:

1 – Back slaps

- Shout for help immediately, but do not leave the baby alone.
- Lay the baby over your arm facing downwards with their legs either side of your elbow with their head below their chest.
- Administer up to five slaps firmly between the shoulder blades with the palms of your fingers, not your open hand.
- Check between each slap if the obstruction has dislodged.
- If this does not work go to step 2.



2 – Chest thrusts

- Turn the baby over, so they are laying chest up on your other arm, keep their head below their chest.
- Using two fingers on the baby's chest give up to 5 chest thrusts. This is a similar manoeuvre to chest compressions in CPR, but sharper and administered at a slower rate.
- Check between each thrust if the obstruction has dislodged.
- If this does not work, repeat step 1 and follow with step 2 until the obstruction is dislodged.

Never administer abdominal thrusts on a baby.

If the obstruction has still not dislodged repeat steps 1 and 2.

If the casualty becomes unconscious make sure they are laying on the ground (or on a flat firm surface for a baby) and commence CPR. Make sure there is an ambulance on the way. Continue CPR until help arrives or you become fatigued.

Anaphylactic shock

Anaphylaxis is an extreme allergic reaction which can be fatal. This is triggered by a massive over reaction by the immune system. Severe anaphylactic reaction is a rare occurrence, usually triggered by drugs such as penicillin, insect stings, nuts such as peanuts and shellfish such as prawns, latex, dairy produce, etc.

When the body detects a 'foreign protein' the immune cells release **histamine**. Histamine can have the following effects on the body if released in massive quantities:

- Dilates blood vessels.
- Constricts the bronchioles in lungs.
- Makes blood capillary walls weaken and leak, which causes severe swelling and shock.
- Weakens the heart's contractions.
- Makes the skin itchy and come out in a rash.

Signs and symptoms

An allergic reaction can occur in seconds, so recognising the problem is essential:

- Casualty's face, tongue, neck, lips and eyes may suddenly swell up.
- Their voice may become hoarse, developing a 'lump in the throat' which may lead to loud, noisy breathing which may stop altogether.
- Tightness in the chest, difficulty breathing, wheezing (the casualty may have

the equivalent of an asthma attack, with the addition of a swollen airway).

- Weak, rapid pulse.
- Nausea, stomach cramps, vomiting, diarrhoea.
- Itchy, red or blotchy skin.
- Anxiety, a feeling of impending doom.

Treatment of anaphylactic shock

- **Dial 999 for an ambulance immediately.**
- Lay the casualty in as comfortable position as possible. If the casualty is having problems breathing, they may want to sit up to ease this.
- **If the casualty is feeling faint, do not let them sit up.** Keep them lying flat and raise their legs.
- If the casualty is aware of their condition, they may be carrying an adrenaline shot. This can save the casualty's life if administered promptly.
- The casualty can usually give themselves the adrenaline shot, but if they are unable you may have to help them.
- If the casualty becomes unconscious, check their **airway** and **breathing** and resuscitate as necessary.
- The adrenaline shot (*epinephrine*) can be given again if there is no improvement, or symptoms return after five minutes.

Asthma

Asthma is a fairly common allergic reaction in the lungs, usually caused by pollution, dust, pollen or traffic fumes. The muscles surrounding the bronchioles spasm and constrict which makes it very difficult for the casualty to breathe. Asthma sufferers normally carry around medication in the form of an inhaler which when breathed in dilates the bronchioles helping to relieve the condition.

Asthma attacks can be very traumatic for the casualty, especially children, so be sure to reassure them and keep them as calm as possible. This is best achieved by being calm yourself and let them know you are a first aider. If the casualty is not calmed in a timely manner, their attack may lead to 'hyperventilation' after the inhaler has been used and their breathing has eased.

Signs and symptoms

- Difficulty in breathing.
- Wheezy breathing, originating in the lungs.
- Difficulty with speaking (needing breath in the middle of a sentence).
- Clammy, pale skin.
- Cyanosis, blue or greyish colour to the lips and skin.

- Use of muscles in the upper chest and neck help the casualty to breath.
- If it is a severe attack, the casualty may become exhausted.
- If the attack is prolonged, the casualty may become unconscious and stop breathing.

Treatment of an asthma attack

- Sit the casualty upright, with their back to a wall, table or chair for support.
- Help the casualty to use their inhaler (usually a blue inhaler for an attack). This can be administered every few minutes, if the attack does not abate.
- Keep talking to the casualty, reassuring them and keep them calm. Ask them simple questions; keep their mind off the attack.
- Should the attack be severe, prolonged, appears to be getting worse or the casualty is becoming exhausted **dial 999 for an ambulance.**
- Frigid, winter air can worsen an attack, so do not take the casualty outside for fresh air.
- Keep the casualty sitting upright while they are conscious, even if they become too weak to sit upright on their own. Only ever lay a casualty having an asthma attack down if they become unconscious, then place them in the recovery position and be prepared to carry out resuscitation.

Croup

This is a condition usually suffered by infants, where the larynx and trachea become infected and swell. These attacks usually occur during the night and can be very alarming but usually pass without any lasting harm being done to the child.

Signs and symptoms

- Distressed, difficult breathing
- A loud pitched or whistling sound as the casualty breathes.
- A short 'barking' cough.
- Clammy, pale skin.
- Cyanosis, blue or greyish colour to the lips and skin.
- Use of muscles in the upper chest and neck help the casualty to breath.

Treatment of croup

- Keep calm as panic will distress the child and worsen the attack.
- Sit the child upright and keep reassuring them.
- Call a doctor.
- If the attack is a severe one, does not ease or the child is running a temperature, **dial 999 for an ambulance.**

Never try to put your fingers down the child's throat as there is a small chance that the condition could be 'epiglottitis'. If it is then the epiglottis may swell even more and totally block the child's airway.

Hyperventilation

Hyperventilation means 'excessive breathing'. When we breathe in we take in a trace amount of carbon dioxide and when we breathe out this rises to about 4% carbon dioxide. Hyperventilation results in low levels of carbon dioxide in the blood which is what causes the symptoms of this condition.

Hyperventilation attacks can be brought on by anxiety, a panic attack or a sudden fright, and can be confused with an asthma attack. Asthma sufferers may hyperventilate after using their inhalers, once their airway has opened. The difference can be told by the large amounts of air being taken in by the hyperventilating casualty compared to the tight, wheezing breath of the asthma casualty.

Signs and symptoms

- Unnaturally fast deep breathing.
- Dizziness and faintness.
- Complaining of a 'tight' chest.
- Cramping in the hands and feet.
- Flush skin, and no signs of cyanosis.
- Pins and needles in the arms and hands.
- The casualty may feel they can't breathe.
- A prolonged hyperventilation attack may result in the casualty passing out, and may stop breathing for up to 30 seconds.

Treatment of hyperventilation

- Reassure the casualty, but be firm and stay calm.
- Move them to a quiet, preferably isolated area.
- Explain to the casualty that they are hyperventilating and need to calm down.
- Try to coach their breathing, slowing it and calming them.
- Ask the casualty to take tiny sips of water. This will reduce the amount of breaths they can take.
- Ask them to breathe through their nose, as this reduces the loss of carbon dioxide. They may need lots of reassurance to do this.
- If the attack continues, or you are in any doubt, seek medical advice.

Drowning

It is a misconception that drowning victims breathe in a large amount of water.

In truth, 90% of drowning fatalities are caused by a relatively small amount of water in the lungs which interferes with the oxygen exchange in the alveoli (known as wet drowning). The other 10% are caused by spasms in the muscles near the epiglottis and larynx which blocks the airway (known as dry drowning). The casualty will have swallowed a large amount of water, which may be vomited during resuscitation.

Please remember that drowning can have many factors such as alcohol, hypothermia or a medical condition such as heart attack or epilepsy.

Secondary Drowning:

When a small amount of water is taken into the lungs it causes irritation and fluid is drawn from the blood into the alveoli. This reaction could happen several hours after a near drowning, the casualty may relapse after appearing to have recovered fully and have difficulty breathing later on. This is why any drowning casualty who has been resuscitated should be taken to hospital as a matter of urgency.

Treatment of drowning

Firstly, do not endanger yourself as you getting in trouble won't help the casualty. Try not to enter the water yourself unless you have been trained to do so. If possible, try to reach the casualty with a stick, rope or a floating object (lifesavers or similar).

- Do not put yourself at risk. Try to reach the casualty with a rope, stick or float.
- Try to keep the casualty horizontal during the rescue as they may go into shock.
- Check their airway and breathing. Perform CPR if necessary.
- **Dial 999 for an ambulance.** Do this even if they appear to have fully recovered, as secondary drowning may occur.

Collapsed lung / sucking chest wound

The lungs are surrounded by two layers of membrane, known as the 'pleura'. Between the membranes is a 'pleural cavity' which contains a very thin layer of 'serous fluid'. This fluid enables the layers to move against each other as we breathe.

A casualty with a penetrating chest injury will have had the outer layer of the pleura damaged. This causes air to be sucked in from the outside of the chest into the pleural cavity which in turn causes the lung to collapse (*pneumothorax*).

With any serious chest injury the inner layer of the pleura may become perforated, which will cause air to be drawn from the lung into the pleural

cavity causing the lung to collapse. If air is continuously drawn into the pleural cavity, but is unable to escape, pressure will build in the collapsed lung (*tension pneumothorax*). This pressure may squeeze both the heart and uninjured lung preventing both from functioning properly.

Signs and symptoms

- Severe difficulty breathing.
- Cyanosis of skin and lips (grey or bluish colouration).
- Painful breathing.
- Clammy, pale skin.
- Breathing is fast and shallow.
- Chest will not move symmetrically as the injured side may not rise.

If there is a sucking chest wound

- Sound of air being drawn into the wound along with bubbling blood.
- ‘Crackling’ feeling to the skin around the wound due to air entry.

Treatment of collapsed lung / sucking chest wound

- Immediately cover the wound with either your, or the casualty’s hand (if they are conscious) to help prevent air being sucked in.
- **Dial 999 immediately for an ambulance.** Ask someone to do this if you are not alone.
- Place a sterile pad over the wound and cover with plastic (cling film, kitchen foil or any other air tight covering will do).
- Tape the plastic covering on three sides only, as you want to stop air getting in but not getting out.
- If the casualty loses consciousness, open the airway and check their breathing.
- Perform CPR if necessary. If they are breathing, place them in the recovery position with the injured lung lowest, to help protect the uninjured lung.

Flail chest

This refers to a condition where the ribs surrounding the chest have been fractured in several places creating a ‘floating’ section in the chest wall.

As the casualty draws breath the chest moves normally, but the flail section will move inwards and outwards when the rest of the chest is moving outwards and inwards. These are known as paradoxical chest movements.

Signs and symptoms

- Severe breathing difficulties.
- Painful, shallow breathing.
- Same signs and symptoms of a fracture.

- Paradoxical chest movement.

Treatment of flail chest

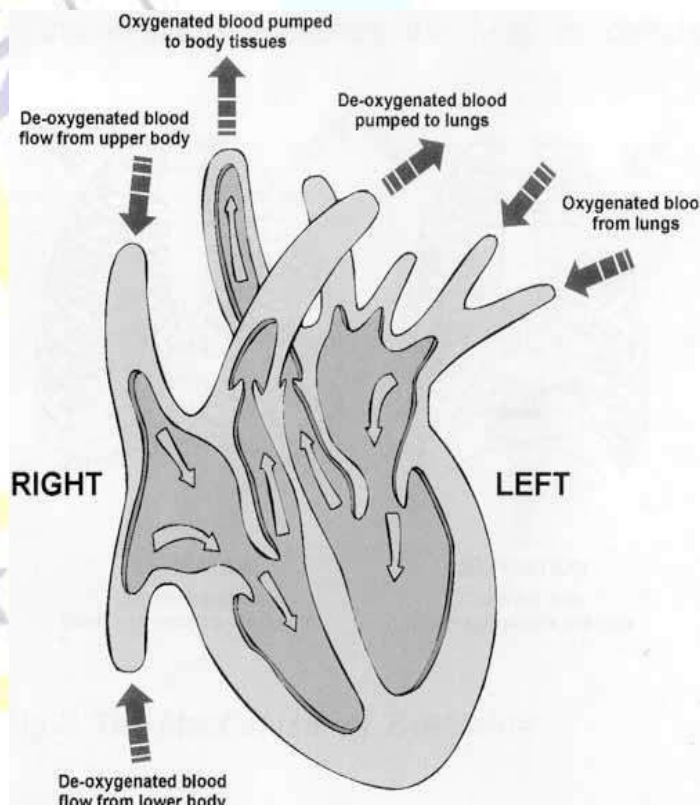
- **Dial 999 immediately for an ambulance.**
- Place the casualty in the most comfortable position for them, preferably sat up and inclined towards the injury.
- Place large amounts of padding over the flail area.
- Put the arm of the injured side in an elevated sling, squeezing the arm gently against the padding to help provide gentle, firm support to the injury.

The circulatory system

The circulatory system consists of a closed network of tubes (*arteries, veins and capillaries*) which are all connected to a pump (*the heart*).

Arteries carry the blood **away** from the heart. They have strong, muscular, elastic walls which expand as the blood from the heart surges through them. The largest artery is the 'aorta', which connects directly to the heart.

Veins carry the blood **towards** the heart. Their walls are thinner than artery walls as the blood they carry is under less pressure. They have one way valves to keep the blood flowing towards the heart. The largest veins are the 'vena cava', which connect to the heart.



Capillaries are tiny blood vessels which float between the arteries and veins and carry oxygen, carbon dioxide and nutrients in and out of the body's cells.

The heart is basically a four chambered pump. The left and right sides are separate. The left side of the heart takes oxygenated blood from the lungs and pumps it around the body, whereas the right side of the heart takes blood from the body and pumps it to the lungs.

The two sides are separated into two chambers known as the 'atria' and the 'ventricles'. The **atria** are the top chambers which collect blood as it returns from both the lungs and the body, pumping it to the ventricles. The **ventricles** in turn pump the blood out of the heart to the lungs and around the body.

The blood

60% of blood is made up of a clear yellow fluid called 'plasma'. Within the plasma are red blood cells, white blood cells, platelets and nutrients.

Red cells contain haemoglobin, which carries oxygen that is used by the body's cells. Red cells give blood its colour.

White cells are what help us fight infections.

Platelets trigger complicated chemical reactions if a blood vessel is damaged forming a clot.

Nutrients are derived from food by the digestive system. When nutrients are combined with oxygen within the cells of the body they provide energy, keeping the cells alive.

- The blood carries carbon dioxide (waste gas produced by the cells) in the form of 'carbonic acid', which is diluted within the plasma.
- The blood also circulates heat (generated mostly by the liver). This heat is carried to the skin by the blood if the body needs cooling down.

The pulse

Whenever the heart contracts, blood is pumped through the arteries. The elastic walls of the arteries expand as the blood flows through them, which can be felt wherever arteries come close to the skin.

When you check a pulse use the pads of your fingers not your thumb, as thumbs have their own pulse. The first aider should make a note of the following when checking for a pulse:

Rate – Is the pulse slow or fast? Count how many beats there are in a minute.

Rhythm – Is there a regular pulse? Are there any beats missed?

Strength – Is the pulse strong or weak?

The main areas you will find a pulse are in the neck (*carotid pulse*), the wrist (*radial pulse*) and in the upper arm (*brachial pulse*).

| Age | Normal heart rate at rest |
|-------|---------------------------|
| Adult | 60 - 90 bpm |
| Child | 90 - 110 bpm |
| Baby | 110 - 140 bpm |

Capillary refill

Circulation to the end of the arms and legs can be momentarily checked by squeezing the tip of a finger or toe. The skin will appear pale when squeezed – if the circulation is working properly the colour will return within two seconds when released. This process can take a little longer if the hands or feet are cold.

Angina

Angina (*angina pectoris*) is a condition that is usually caused by the build-up of cholesterol plaque on the lining of a coronary artery. Cholesterol is a fatty chemical that is part of the outer lining of cells in the body. Cholesterol plaque is a hard, thick substance which builds up from the deposits of cholesterol on the artery wall. Over time the build-up of cholesterol plaque causes the arteries to narrow and harden.

When we exercise or get excited the heart requires more oxygen, but the narrowed arteries are not able to increase the blood supply that is being demanded. The result of this is an area of the heart will suffer from a lack of oxygen. The casualty will feel pain in the chest as a result.

Usually angina attacks occur with exertion but subside with rest. However, if the narrowing of the artery reaches a critical level angina may occur during rest (known as '*unstable angina*'). Casualties with angina, especially unstable angina, are at a high risk of suffering from a heart attack in the near future.

Heart attack

A heart attack (*myocardial infarction*) is usually caused when the surface of a cholesterol plaque build-up in a coronary artery cracks and develops a 'rough surface'. This may lead to a blood clot forming on the plaque which in turn completely blocks the artery resulting in the death of an area of the heart muscle.

However, unlike angina, the death of the heart muscle from a heart attack is permanent and will not be eased with rest.

Signs and symptoms

Please bear in mind that each heart attack is different. They may not show all the signs below, in fact up to a quarter of heart attacks are 'silent' and happen without any chest pain.

| | Angina | Heart Attack |
|------------------------|---|---|
| Onset | Sudden, during exertion, stress or extreme weather. | Sudden and can occur at rest. |
| Pain | 'Vicelike' pain, can be described as 'dull', 'tightness' or 'pressure' in the chest. May be mistaken for indigestion. | 'Vicelike' pain, can be described as 'dull', 'tightness' or 'pressure' in the chest. May be mistaken for indigestion. |
| Location of pain | Central chest area, can radiate to either arm (usually the left), the neck, jaw, back or shoulders. | Central chest area, can radiate to either arm (usually the left), the neck, jaw, back or shoulders. |
| Duration | Normally lasts 3 to 8 minutes rarely longer. | Normally lasts more than 30 minutes. |
| Skin | Pale, could be sweaty. | Pale, ashen, may sweat a lot. |
| Pulse | Varies, depending on which area has the lack of oxygen. Often the pulse is irregular or misses beats. | Varies, depending on which area has the lack of oxygen. Often the pulse is irregular or misses beats. |
| Other signs & symptoms | Shortness of breath, anxiety and weakness. | Shortness of breath, dizziness, nausea, vomiting. A sense of 'impending doom'. |
| Factors giving relief | Rest, reduce stress, taking 'G.T.N.' medication. | Giving 'G.T.N.' medication may give partial or no relief. |

Treatment of angina / heart attack

- Sit the casualty down and make them comfortable. Try to stop them from walking around or doing anything strenuous. Sit them in the Fowler position (or the 'W' position). Have them lean against a wall, or your knees if no other option, and raise their knees.
- Ask the casualty if they have any medication with them. If they do, allow them to take their own glyceryl tri-nitrate (G.T.N.) medication if they have it. **DO NOT GIVE IT TO THEM DIRECTLY BUT HELP THEM SELF MEDICATE.**
- Reassure the casualty. Remove any causes of stress or anxiety if possible.

- If you have any reason to suspect a heart attack – check if the casualty is allergic to aspirin, older than 16 or if they are taking any ‘anti-coagulant’ drugs such as warfarin. If all is clear, allow them to chew an aspirin tablet **slowly**, as this may be beneficial. If, however, you are unsure of any of the above, wait for the ambulance to arrive.
- Monitor the casualty. If it is a heart attack and the casualty becomes unconscious it is more than likely the heart has stopped and you will need to perform CPR, so be prepared.

Aspirin helps stop clotting in the blood. Having a casualty chew an aspirin tablet allows the drug to be absorbed into the blood stream through the skin of the mouth, helping it work faster. The ideal dose of aspirin is 300mg, but any strength will do in these cases.

Dial 999 for an ambulance if:

- You have any reason to suspect it is a heart attack.
- The casualty has no history of angina.
- The symptoms suffered are different or worse than the casualty’s usual angina attacks.
- The pain from an angina attack is not relieved by the casualty’s medication and rest after 15 minutes.
- You have any doubts at all. It is always better to be safe than sorry in these situations.

Left ventricular failure

Left ventricular failure (*LVF*) is where the left ventricular of the heart loses power and cannot empty itself. The right side of the heart is still working and pumping blood into the lungs. This causes a ‘back pressure’ of blood in the pulmonary veins and arteries in the lungs. Fluid from the back pressure of blood seeps into the alveoli which results in **severe breathing difficulties**.

The condition may be brought on by a heart attack, chronic heart failure or high blood pressure. Casualties with chronic heart failure more often than not suffer attacks at night.

Signs and symptoms

- Severe breathing difficulties.
- Crackly, wheezy breathing due to fluid on the lungs.
- Pale, sweaty skin.
- Cyanosis of the skin/lips (grey or bluish discolouration).
- Coughing up frothy, bloody sputum.
- Possibly the same signs and symptoms of heart attack.

- Casualty needs to sit up to be able to breathe.
- Confusion, dizziness and anxiety.

Treatment of LVF

- Sit the casualty upright, with their feet dangling.
- **Dial 999 for an ambulance as soon as you can.**
- If the casualty has it, allow them to take their own G.T.N. medication.
- Be prepared to perform CPR as this condition can deteriorate rapidly.

Shock

The usual association with the word shock is a nasty surprise, an earthquake or electrical shock.

The medical definition of shock is '*inadequate tissue perfusion, caused by a fall in blood pressure and blood volume*'. This means there is an inadequate supply of oxygenated blood to the tissues of the body.

Understanding what shock is can help understand why casualties who are in shock need immediate treatment, or the condition can result in death.

The most common causes of life threatening shock are:

- Hypovolaemic Shock.
- Cardiogenic Shock.
- Anaphylactic Shock.

Hypovolaemic Shock

Hypo = low **vol** = volume **aemic** = blood

Hypovolaemic shock is caused by loss of bodily fluids, the result of which is low blood volume. Hypovolaemic shock is usually caused by:

- External bleeding.
- Internal bleeding.
- Burns.
- Vomiting and diarrhoea.
- Excessive sweating.

Signs and symptoms

Usually the first response is a release of adrenaline which will cause:

- Pulse rate to rise.
- Pale, clammy skin. For dark skinned casualties check the colour of the skin inside the lips.

As the condition deteriorates:

- Shallow, fast breathing.
- Nausea or vomiting.
- Weak, rapid pulse.
- Dizziness or weakness.
- Cyanosis (grey/blue tinge to lips and skin).
- Sweating.

As the brain receives less oxygen:

- Deep, sighing breathing (*air hunger*).
- Unconsciousness.
- Anxiety, confusion, possible aggression.

Treatment of Hypovolaemic Shock

- Try to treat the cause of the shock (e.g. external bleeding).
- Lay the casualty on a flat surface (preferably the floor) and raise their legs so they are above the chest (heart). This will cause the blood to return to the vital organs as **40%** of the body's blood is in the legs. Take care if you suspect a fracture.
- **Dial 999 for an ambulance immediately.**
- Keep the casualty warm – place a blanket or coat under the casualty if they are on the floor or other cold surface. However, be careful not to overheat them as this dilates the blood vessels which will cause their blood pressure to drop further.
- Do not allow the casualty to drink, eat or smoke. Nil by mouth is best!
- Loosen any tight clothing such as ties and belts.
- Monitor the casualty's breathing, pulse and response levels.
- Be prepared to perform CPR.

Cardiogenic Shock

This form of shock occurs when there is a fall in blood pressure caused by the heart not pumping properly. This is the most common type of shock.

Typical causes of cardiogenic shock are:

- Heart attack.
- Tension pneumothorax.
- Cardiac failure.
- Cardiac arrest.
- Heart valve disease.

Signs, symptoms and treatment of cardiogenic shock

See section on heart conditions (*page 30*).

Anaphylactic Shock

Anaphylaxis is an extremely dangerous allergic reaction which is brought on by a massive over-reaction of the body's immune system (*see page 22*).

An anaphylactic reaction may result in shock due to a large quantity of histamine. This can result in:

- Blood vessels dilating which causes blood pressure to fall.
- Blood capillary walls may become 'leaky' causing blood volume to fall.
- Weakening of the heart's contractions which causes blood pressure to fall.

Signs, symptoms and treatment

See section on anaphylaxis (*see page 22*)

Fainting

This reaction is caused by poor nervous control of the blood vessels and the heart.

When a casualty faints the blood vessels in the lower body usually dilate which slows the heart. This results in falling blood pressure and the casualty has a temporary reduction in blood supply to the brain.

Typical causes of fainting are:

- Fright or pain.
- Extended periods of inactivity (such as standing or sitting).
- Lack of food.
- Emotional stress.
- Heat exhaustion.

Signs and symptoms

- Temporary loss of consciousness resulting in falling to the floor.
- Before fainting the casualty may have had nausea, blurred vision, stomach ache or dizziness.
- Slow pulse.
- Clammy, pale skin.
- Quick to recover.

Treatment of fainting

- Lay the casualty on a flat surface, preferably the floor and raise their legs which will return the blood to the vital organs and raise blood pressure.
- Check the casualty's airway and breathing.
- Try to remove the cause of stress such as people crowding the casualty and allow plenty of fresh air.

- Reassure the casualty as they come to. Try to stop them from sitting up suddenly.
- If the casualty feels faint again, repeat the treatment and check for an underlying cause.
- If the casualty does not recover in a short amount of time and remain unconscious, or you are unsure: check the airway and breathing again, place them in the recovery position and **dial 999 for an ambulance**.

Wounds and bleeding

A wound is an abnormal break in the continuity of the tissues of the body. Any wound will, to a greater or lesser extent, result in either internal or external bleeding. Severe blood loss could result in shock, so it is important to treat wounds promptly. There are several types of wound – identification and treatment are detailed here.

Types and basic treatment of wounds

Contusion is a bruise. Contusions are caused by ruptured capillaries bleeding under the skin. Typically these are caused by a blow or by bleeds caused by an underlying problem such as a fracture.

- Put an ice pack on the affected area, or place the area under cold running water as soon as possible.

Abrasion is a graze. This is the result of the top layer of skin being scraped off, usually as the result of a sliding fall or a friction burn. Abrasions can often contain particles of dirt which could lead to infection.

- Any dirt that is not embedded in the graze should be removed with clean water and sterile swabs.
- Always clean from the centre of the wound outwards to reduce the risk of introducing more dirt into the wound.

Laceration is a rip or tear in the skin. These are more likely to have particles of dirt than a cut but tend to bleed less.

- Treat as a bleed (*see page 36*) and prevent infection.

Incision is a clean cut. These wounds are usually caused by a sharp object, such as broken glass or a knife. If the wound is deep it could provide complications such as severed tendons or blood vessels. These wounds tend to bleed freely and may even ‘gape open’.

- Treat as a bleed (*see page 36*) and prevent infection.

Puncture is a stab wound. These wounds can be caused by such implements as

a nail or actually being stabbed. The wound is likely to be deep but may appear to be small in diameter. Damage may be deep, hitting underlying organs such as the lungs or heart, and may cause severe internal bleeding.

- **Dial 999 for an ambulance** if you suspect the wound has penetrated deep enough to damage any organs or cause internal bleeding.
- If the object is embedded in the puncture **do not remove it as it may be stemming the bleed, and removal may cause further damage.**

Gun shot is caused by a bullet or other missile travelling at a high enough speed to drive into and possibly exit the body. There may be a small entry wound and a larger, 'crater' exit wound. Severe damage to internal organs should be assumed, and will be accompanied by severe bleeding.

- **Dial 999 for both an ambulance and the police.**
- Clear the casualty's airway and check for breathing first. Be prepared to commence CPR.
- Pack the wound with dressings if possible to prevent further bleeding.

Amputation is the complete or partial removal of a limb.

- See the section on amputation (*see page 43*).

De-gloved is the severing of the skin from the body, which results in a 'creasing' or a flap of skin coming away and leaving a bare area of tissue. These wounds are usually caused by the force of an object sliding along the length of the skin, in effect skinning it.

- If possible, put the skin back in place.
- Arrange transport to hospital urgently.

Blood loss

How much blood does a body have?

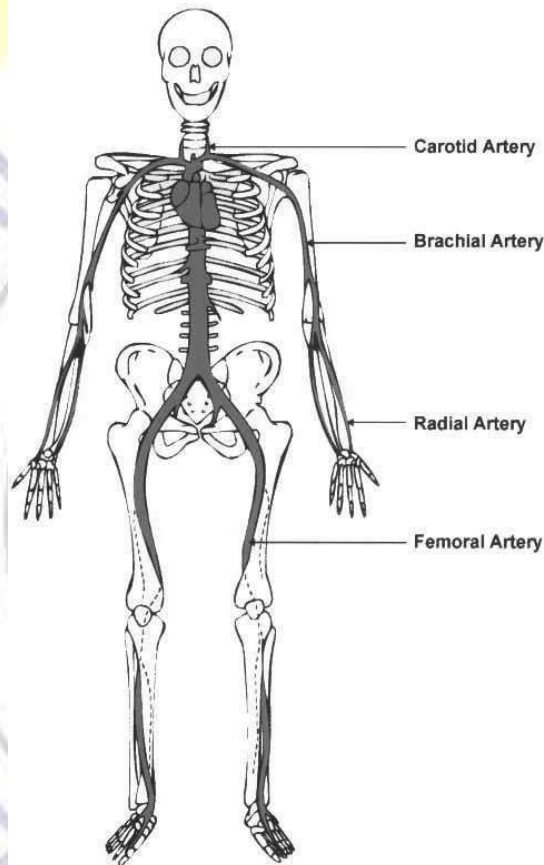
The amount of blood in a body varies depending on the size of the person. However, a rough guide is that we have approximately a pint of blood for every stone in weight (*0.5 litres per 7kg*) so the average adult will have **8 and 12 pints (4.5 to 6.5 litres)** of blood depending on their size. However, this rule does not work for someone who is overweight.

Bear in mind that children have less blood than adults and cannot afford to lose anywhere near the same amount. A baby has only approximately 1 pint of blood and can only afford to lose 1/3 of a pint before their blood pressure falls.

Types of bleeding

Arterial bleeds tend to spurt from wounds in time with the heart-beat, as blood in the arteries is under direct pressure from the heart. A wound to a major artery

may result in the blood ‘spurting’ several meters instantly with the blood volume rapidly reducing over time. Blood in the arteries is highly oxygenated and will be bright red, however this may be difficult to assess so do not rely on it as a form of identification. More importantly is *how* the wound is bleeding.



Venous wounds are damage to veins which carry blood that is not under direct pressure from the heart, but may carry the same volume of blood as the arteries. Wounds to a major vein could ‘ooze’ profusely.

Capillary bleeds occur in all wounds. These bleeds may appear fast at first, blood loss from capillary bleeds tend to be slight and is easily controlled. Capillary bleeds tend to be described as a ‘trickle’.

Dealing with wounds hygienically

- Be sure to protect yourself by covering any of your own cuts or abrasions with a waterproof dressing, especially if they are on your hands or arms.
- If they are available, wear disposable gloves and apron when administering first aid to wounds.
- Use specific cleaning products for cleaning up bodily fluids. Always follow the instructions and use disposable towels.

- Always dispose of soiled dressings or disposable towels used to clean up bodily fluid in a yellow ‘clinical waste’ container. These need to be taken away and incinerated (send the container to the hospital with the casualty if you have no clinical waste facilities where you are).
- Always wash your hands thoroughly before and after dealing with a casualty. This helps reduce the risk of infection.
- If you are dealing with body fluids on a regular basis, ask your doctor about vaccination against hepatitis ‘B’.

The effects of blood loss

Please see the table below for the effects, signs and symptoms of blood loss. The table gives the volume of blood loss as a percentage as we all have different quantities of blood, depending on the size of the person.

Please note that a casualty who has lost 30% of their blood is in a critical condition, and will deteriorate rapidly from this point onwards. Blood vessels cannot constrict anymore and the heart cannot beat any faster so their blood pressure will fall, resulting in unconsciousness and death.

Also, please be aware that any casualty who has lost over 10% of their blood should be treated for shock (*see page 33*). See also **hypovolaemic shock** (*see page 33/4*) and **hypoxia** (*see page 16*).

| | 10% Blood loss | 20% Blood loss | 30% Blood loss | 40% + Blood loss |
|---------------|---|---------------------------------|--|-----------------------------------|
| Consciousness | Normal | Could feel dizzy while standing | Lowered levels of consciousness. Restless & anxious | Unresponsive |
| Skin | Normal | Pale | Cyanosis (blue/grey tinge of skin & lips), cold and clammy | Severe cyanosis, cold and clammy |
| Pulse | Normal (this is the usual amount taken when donating) | Slightly raised | Rapid (over 100 bpm), hard to detect | Undetectable |
| Breathing | Normal | Slightly raised | Rapid | Deep sighing breaths (air hunger) |

Treatment of external bleeding

The aim of treating external bleeding is firstly to stop the bleed, then prevent the casualty from going into shock and finally to prevent infection.

The acronym **SEEP** should help you to remember the following steps:

Sit or lay Sit or lay the casualty down, ensuring they are in a position that is appropriate for the location of the wound.

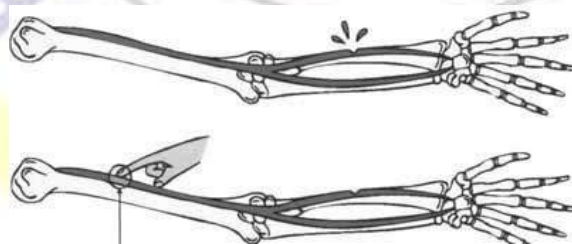
- Examine** Examine the wound for foreign objects and make a note of how the wound is bleeding. Make sure to tell the medical staff how the wound was bleeding once it is covered with a bandage.
- Elevate** Elevate the wound so that it is above the heart, which will use gravity to restrict the flow of blood to the injury.
- Pressure** Apply direct or indirect pressure to help slow the bleeding.

Direct pressure:

Direct pressure to the wound is the best way of stemming a bleed. You can use your hands to do this, but you should take precautions to minimise the risk of coming in contact with the casualty's blood, preferably by wearing disposable gloves. Keep pressure on the wound continuously for at least ten minutes. Using a firm bandage usually stops the bleeding with most minor wounds (make sure the bandage is not so tight as to cut off the circulation to the limb altogether). If there is a foreign object embedded in the wound do not remove it but you may be able to apply pressure at either side of the object.

Indirect pressure:

If it is not possible or effective to apply direct pressure to a wound, you can use indirect pressure as a last resort. This is achieved by applying pressure to the artery which is supplying blood to the limb, pressing it against the bone beneath, reducing the blood flow. This should be done for a maximum of ten minutes.



There are two indirect pressure points:

Brachial This artery runs along the inside of the upper arm. To help with this, ask the casualty to make a fist with the opposite hand and place it under the arm pit of the injured arm and ask them to squeeze down on the fist.

Femoral This artery is located where the thigh bone (*femur*) crosses the 'bikini' line. If applying indirect pressure here, be sure to explain briefly to the casualty what you are doing and why. One way of applying indirect pressure

here is to use the heel of your foot.

Dressings:

Dressings should be sterile and just large enough to cover the wound. They should be made out of a material that will not stick to the clotting blood and be absorbent (a 'non-adherent' dressing).

Usually, a firmly applied dressing is enough to stem bleeding from the majority of minor wounds, but any dressing should not restrict the flow of blood to the rest of the limb (you can check the circulation with a 'capillary refill' test, see page 30).

If the bleeding is severe, it may be necessary to apply direct pressure by hand and elevate the wound. If the dressing becomes soaked with blood, put a larger dressing on the top. If the bleeding continues and soaks the second dressing, remove both dressings and start again. This is to ensure any bacteria is removed from the wound with the first bandage.

Embedded objects

Objects embedded in a wound:

If there is an object embedded in the wound (other than a small splinter) you should not attempt to remove it as it may be stemming a severe bleed, or further damage may result.

Use sterile dressings and bandages to build up around the object, which will supply the pressure needed to stem the bleed and help support the object. Take the casualty to hospital to have the object removed safely.

Splinters:

If there is a splinter deeply embedded, difficult to remove or in a joint, do not try to remove it but follow the advice for embedded objects as above. If the splinter can be removed, follow the below advice:

- Carefully use warm soapy water to clean the area.
- Use a clean pair of tweezers to grip the splinter as close to the visible base as possible. Gently pull the splinter out at the same angle it entered at.
- Gently squeeze around the wound to encourage a little bleeding then wash the wound and cover with a dry dressing.
- Ask the casualty if they have had a tetanus shot in the last ten years, if not suggest they get one as soon as possible.

Objects embedded in the ears, nose or other orifice:

If there is a foreign body stuck in a casualty's ear, nose or other orifice, do not

attempt to remove it. Take them directly to hospital where it will be safely removed.

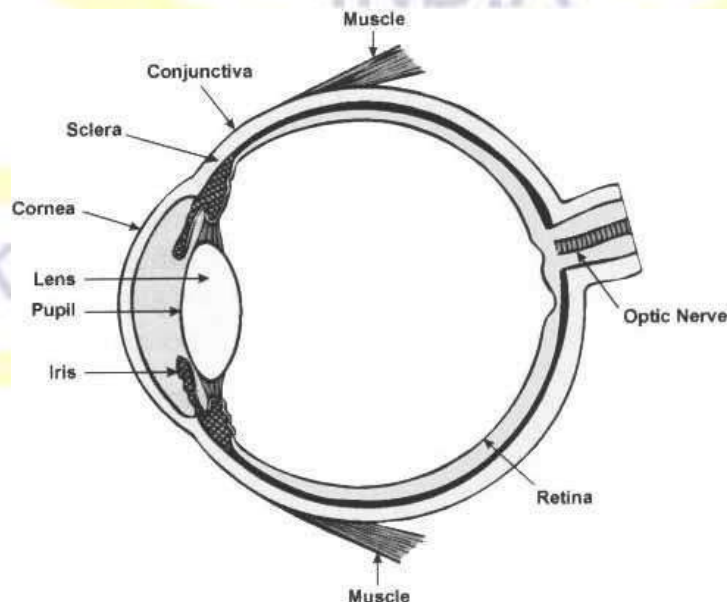
Nose bleeds

Nose bleeds are usually the result of weakened or dried out blood tissues in the nose. A nose bleed can be triggered by a bang to the nose, picking or blowing it. However, it can be the symptom of a more serious problem such as high blood pressure or a fractured skull.

- Have the casualty sit with their head tipped forward to allow the blood to drain.
- Gently pinch the soft part of the nose, and maintain constant pressure for 10 minutes.
- Tell the casualty to breathe through their mouth.
- Give the casualty some tissues or a cloth to clean up the blood while you maintain pressure on the soft part of the nose.
- Once the bleeding has stopped, recommend to the casualty that they try to continue breathing through their mouth and not blow their nose for the next couple of hours as this may trigger another nose bleed.
- However, if the bleeding continues for more than 30 minutes, or they take an 'anti-coagulant' drug (*e.g. warfarin*), get them to hospital ensuring they stay in an upright position.
- If the casualty has a history of frequent nose bleeds, recommend they visit their doctor to determine why.

Eye injury

If there are small particles of dust or dirt in the eye, this can be easily washed out using cold tap water. Make sure the water runs away from the good eye.



For more serious eye injuries:

- Try to keep the casualty still and calm. Gently place a soft, sterile dressing over the injured eye. You can tape it in place if necessary.
- Ask the casualty to close both their eyes, as any movement of the good eye will cause the injured eye to move too. If necessary, you can place a bandage over the good eye to prevent it moving. Please be sure to give the casualty lots of reassurance at this point!

If you can, take the casualty to A&E. **Dial 999 for an ambulance if you cannot take the casualty to A&E yourself.**

For chemical eye injuries:

Make sure you are wearing protective gloves if possible. Wash the injured eye with lots of clean tap water, making sure the water runs away from the good eye. Gently, but firmly try to open the casualty's eye fully to wash it as much as possible. **Dial 999 for an ambulance immediately.**

Amputation

Amputation is defined as the full or partial severing of a limb, and is extremely traumatic for the casualty. The priority here is to stop the bleeding, then preserve the amputated limb and reassure the casualty.

- Immediately treat the casualty for bleeding (*see page 36*) and shock (*see page 33*).
- **Dial 999 for an ambulance immediately.**
- Cover the wound with a low adherent, non-fluffy dressing.
- If possible, wrap the amputated part in a plastic bag and place on or in a bag of ice to preserve it as much as possible. **Do not allow the amputated part to be in contact with the ice or get wet in any way.**

Crush injuries

This type of injury usually occurs on building sites or at road traffic accidents. If the flow of blood to a limb (*such as an arm or leg*) is restricted by a crushing weight, there is the serious danger of a build-up of toxins in the muscle tissue below the crushing weight.

If the flow of blood is restricted to the limb for more than 15 minutes, the toxins will build to such a level that when the weight is removed, and the toxins released into the body, they may cause kidney failure. This is known as 'crush syndrome' and may well result in the death of the casualty.

In these cases expert medical care is essential when releasing the casualty if the

blood flow has been restricted for 15 minutes or more.

Treatment for crushing lasting less than 15 minutes:

- Remove the crushing weight, or release the casualty as soon as possible.
- **Dial 999 for an ambulance immediately.**
- Treat any bleeds and cover any open wounds.
- Treat the casualty for shock (*see page 33*), but be sure not to move any injuries.
- Maintain their airway and monitor their breathing until help arrives.

Treatment for crushing lasting more than 15 minutes:

- **DO NOT RELEASE THE CASUALTY.**
- **Dial 999 for an ambulance immediately.** Give as clear and concise information about the accident as you can.
- Maintain their airway and monitor their breathing until help arrives.

Internal bleeding

This is a very serious condition, but it can be very hard to recognise in the early stages. Internal bleeding can be attributed to lung or abdominal injuries, but can also happen spontaneously to someone who appears well, such as a bleeding stomach ulcer or a weak artery.

Even though the blood is not lost from the body, it is lost internally out of veins or arteries and can quickly cause the casualty to go into shock.

Internal bleeding can result in serious, life threatening complications such as a brain haemorrhage or bleeding into the lungs.

Signs and symptoms:

You should be aware and looking for internal bleeding if there are signs of the casualty going into shock, but there is no obvious cause such as external bleeding.

There may be:

- Shock (*see page 33*).
- Pain or a recent history of pain at the site of the bleed.
- Bruising and/or swelling.
- Other symptoms at the site of the bleed (*such as difficulty with breathing if there is bleeding in the lungs*).

Treatment of internal bleeding:

- **Dial 999 for an ambulance immediately.**

- Treat the casualty for shock (*see page 33*).

Poisons

Poisons can be defined as a liquid, solid or gaseous substance that causes damage to the body when it enters in sufficient quantity.

There are 4 ways a poison can enter the body:

Ingested The substance is swallowed, either by accident or on purpose.

Inhaled The substance is breathed in, entering the blood stream very quickly through the alveoli.

Absorbed The substance comes in contact with skin (*see chemical burns, page 49*).

Injected The substance is introduced through the skin directly into tissue or a blood vessel.

A poison can be one of two things:

Corrosive These include acids, bleach, petrol, ammonia, dishwasher powder, turpentine, etc.

Non-Corrosive These include tablets, plants, drugs, perfume, alcohol, etc.

Signs and symptoms:

There are a wide variety of signs and symptoms for poisoning, depending on the substance. Some clues you can look for are:

- Bottles or containers.
- Tablets or drugs.
- Syringes or drug taking paraphernalia.
- Smell on the casualty's breath.

Some other signs that can accompany poisoning may be:

- Nausea, retching or vomiting.
- Abdominal pain.
- Burns (*or a burning sensation*) around the area of entry.
- Problems breathing.
- Hallucinations or confusion.
- Headache.
- Unconscious. Sometimes the casualty may start fitting.

- Cyanosis.

Treatment for poisoning:

For a corrosive substance firstly make sure that your safety is secure – is it safe to help the casualty?

Dilute or wash away the substance if possible:

- Substance on the skin – see chemical burns (*see page 49*).
- Ingested substances – try to get the casualty to rinse their mouth, then give frequent sips of milk or cold water.
- **Dial 999 for an ambulance immediately.** Give clear and concise information about the poison if possible. Follow any advice given by the ambulance operator.
- If the casualty becomes unconscious, immediately open the airway and check for breathing. If they are not breathing commence CPR using a protective face shield. If the casualty is breathing but unconscious, place them in the recovery position and **dial 999 for an ambulance immediately.**

Never try to get the casualty to vomit as this may damage the airway.

For non-corrosive substances:

- **Dial 999 for an ambulance immediately.** Give clear and concise information about the poison if possible. Follow any advice given by the ambulance operator.
- If the casualty becomes unconscious, immediately open the airway and check for breathing. If they are not breathing commence CPR using a protective face shield. If the casualty is breathing but unconscious, place them in the recovery position and **dial 999 for an ambulance immediately.**

It will be of help to the paramedics if you:

- Pass on the container the substance was in, or pass on any information you may have regarding what the casualty has taken.
- Let them know how much was taken, if you are able to ascertain this information.
- Let them know when the substance was taken, if you can ascertain this information.
- Keep any sample of vomit from the casualty for hospital analysis.

Burns and scalds

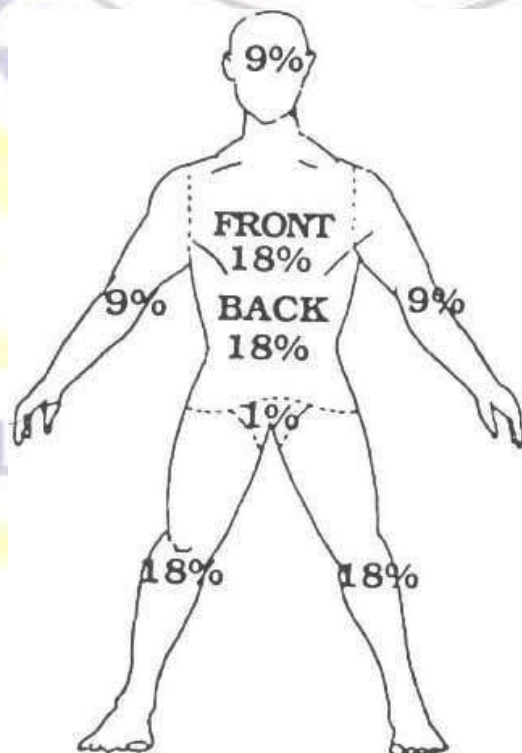
Estimating the severity of a burn:

There are five factors that affect the seriousness of a burn:

- Size** The larger the area of the burn the more severe it is likely to be. The size is usually given as a percentage of the body's surface area. An easy way to work out the percentage is to compare the size of the burn to the casualty's hand. The casualty's open hand (including the fingers) is the equivalent to 1% of their body area.
- Cause** The cause of the burn will influence the severity of the burn, for example electrical burns could leave the casualty with internal burns and some chemicals (*such as hydrofluoric acid*) may cause poisoning to the burns as an added complication.
- Age** The casualty's age will affect the severity of the burn and how long their recovery rate will be. Babies and young children will burn at a lower temperature than adults will. The elderly will take longer to heal from a burn and they may be more susceptible to infection.
- Location** The location of the burn may affect the severity, in particular the inhaling of hot gasses will burn the airway resulting in instant death. Burns to the eye may well result in permanent blindness.
- Depth** The deeper the burn, the more severe it is going to be.

Depth of burns:

Skin consists of three layers, these are the *epidermis* on the outside, the *dermis* underneath which lies on a layer of *subcutaneous* fat.



The depth of a burn can be defined as:

- Superficial** This is a burn only to the outer epidermis layer. This is most commonly caused by scalds. The burn looks sore, red and swollen.
- Intermediate** These burns affect both the epidermis and the dermis. These burns look raw and blisters will form.
- Full thickness** With this type of burn, both the epidermis and dermis are burned away completely, leaving the exposed subcutaneous fat or beyond. These burns may appear pale, charred or waxy. The casualty's nerve endings will have been burned away so pain may well be absent which can mislead both you and the casualty.

Causes of burns and treatment

Burns can be separated into five different areas, the treatment for each burn will differ slightly depending on the cause.

Electrical burns:

These burns are caused by heat from an electrical charge flowing through the bodily tissue. You may be able to determine where the current entered the body, and the point of exit, but there will certainly be deep internal burns which are not visible to the eye between the entry and exit burns. The extent of the internal damage can usually be guessed at by the severity of the entry and exit burns.

An electric shock may well cause cardiac arrest, so be prepared to perform CPR. Remember in this case that the casualty's airway and breathing are the priority.

- Ensure that it is safe to approach and help the casualty – never put yourself in harm's way. Make sure the contact between the casualty and the electrical current is broken.
- Make sure to maintain the casualty's airway and breathing.
- Try to irrigate the area of the burn, including the area between the entry and exit burns for at least ten minutes.
- **Dial 999 for an ambulance immediately.**
- Continue treating the casualty as you would for a 'dry heat' burn.

Dry heat burns:

These burns are caused by any dry heat source or friction.

- Ensure it is safe to approach and help the casualty – never put yourself in harm's way.
- Make sure to maintain the casualty's airway and breathing.
- Try to take the heat out of the burn by using cold (preferably running) water for about 10 to 15 minutes. If water is not readily available, any other cold, non-harmful liquid such as milk may be used, as some cooling to the burn is better than none. Do this initially, and move to an area where there is running water available if possible. Be careful not to cool large areas too much as this may cause hypothermia.
- If possible, remove any rings, watches, bangles, etc., during cooling as the burned area will swell. If there is any clothing that is not stuck to the burn it may be removed **very carefully**.
- Use a sterile dressing on the burn, making sure it is one that will not stick. Cling film is one of the best ways of dressing a burn, as it doesn't stick and will stop any infection entering the wound. Remove the first two turns of the roll and apply it lengthwise to the burn. Do not wrap it tightly around the burn as the area may swell and cause further discomfort to the casualty. Secure the cling film with a bandage.
- Alternatively, you can use a new, clean plastic bag, low adherent dressing or specialised burn dressings if they are available. However, do not rely on the specialised burn dressing to cool the burn, use cold water to do this.
- **Dial 999 if the burn appears to be severe or the casualty has breathed in smoke or fumes.**

Wet heat burns (scalds):

Scalds most commonly occur due to contact with boiling water, but can also be from hot fat or other liquids that reach higher temperature than water.

- Treat as you would a dry heat burn.

Chemical burns:

These are caused by chemicals coming into contact with the skin which either corrode, create heat, or both.

If chemicals are used in your place of work, it is very important for you to learn the correct first aid procedures. Remember, different chemicals require different first aid treatment.

- Make sure the area is safe, try to contain the chemical and ensure that you will not come into contact with it.

- If the chemical is a dry powder, it can be brushed off the casualty's skin before treatment. Make sure that you protect yourself.
- Use lots of cold running water to wash the chemicals off the skin. This should be done for a longer period of time than for a thermal burn, at least 20 minutes. Be careful not to wash the chemical onto unaffected areas of the body. Try not to let any contaminated pools of water collect under the casualty.
- **Dial 999 for an ambulance immediately.** Take note of what the chemical is and give this information to the ambulance operator if you can.
- Carefully remove any contaminated clothing from the casualty while you are washing the burn.
- If the chemical is in the casualty's eye, wash it as recommended on page 43, making sure the water runs away from the casualty's uninjured eye.
- Some chemicals cannot be safely diluted with water, in this case health & safety regulations insist that an 'antidote' be available in case of an emergency. You and any other first aider should be trained in the use of the antidote.

Radiation (sun) burns:

These are most commonly seen as sunburn.

- Persuade the casualty to get out of the sun, preferably indoors.
- Give the casualty frequent sips of water to stave off heat exhaustion (*see page 63*).
- Cool the burns with cold water. If, however, the burns are extensive, cool them under a cool shower or get the casualty to sit in a bath of cool water for 10 minutes.
- If the burns are extensive and blistering, or you are unsure, seek medical advice.
- If the burns are mild, then you can apply after sun cream or calamine lotion to help soothe the area.

Seek medical advice for burns if:

- **The burn is larger than 1 square inch.**
- **The casualty is a baby or child.**
- **The burn is all the way around a limb.**
- **Any part of the burn appears to be full thickness.**
- **The burn is to the hands, feet, genitals or face.**
- **You are not sure.**

Never do any of the following when burns are concerned:

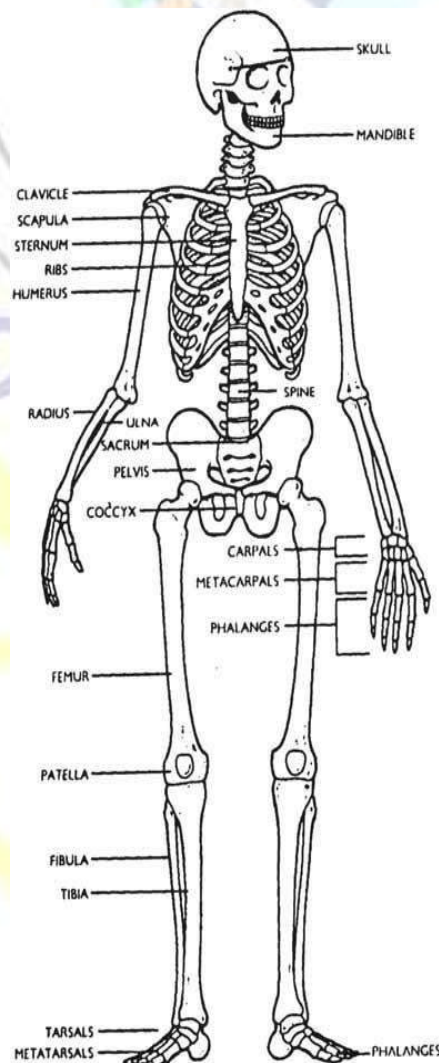
- Burst a blister or blisters (*the blisters are there to protect against infection*).
- Touch the burn.

- Apply lotions, ointments or fats to a burn as they may introduce infection and will need to be removed once the casualty is in hospital.
- Apply adhesive tape or dressings as the burn may be larger than it first appears.
- Remove clothing that is stuck to the wound, as this will invariably cause more damage.

The skeletal system

There are 206 bones in the human skeleton, the functions of which are:

- To provide support to the body's soft tissue. This gives the body its shape.
- To provide protection for vital organs such as the brain, lungs and spinal cord.
- To allow movement by incorporating different types of joints and attachment for muscles.
- To produce red blood cells, some white blood cells and platelets within the marrow of bones such as the femur.
- To provide a store of minerals and energy, such as calcium and fats.



Causes of injury

Different types of force can cause injury to the bones, muscles and joints.

- Direct force** Damage will result at the location of the force, such as a kick or blow.
- Indirect force** Damage will result away from the point where the force was applied, for example a fractured collar bone may result from landing on an outstretched arm.
- Twisting force** Damage will result from torsion force on the bones and muscles, for example a twisted ankle.
- Violent movement** Damage will result from sudden, violent movements, for example a knee injury from violently kicking.
- Pathological** Damage will result from the bones becoming weak or brittle due to disease or old age.

Types of fracture

A fracture is a 'break in the continuity of the bone'. These are the basic categories for a fracture:

- Closed** A clean break or crack to the bone with no complications arising.
- Open** A broken bone will break the skin, and may or may not still be protruding from the wound. Please bear in mind that these types of injury carry a high risk of infection.
- Complicated** There are usually complications with this type of fracture, such as trapped blood vessels or nerves.
- Green stick** These are more likely to occur in children who have young, more flexible bones. The bone splits, but is not completely severed. Green stick fractures can easily be mistaken for sprains and strains as only a few of the signs of fracture are present.

Dislocations

A dislocation occurs when a bone becomes partially or completely dislodged at the joint, usually resulting from a wrenching movement or sudden muscular

contraction. The most common areas of dislocation are the jaw, thumb, knee cap, shoulder or finger.

Fractures can occur at or near the site of a dislocation, along with damage to ligaments, tendons and cartilage. It is sometimes difficult to distinguish between a fracture and a dislocation.

Never try to manipulate a dislocated joint back into place as this is best left to medical experts, and the process can be extremely painful and traumatic to the casualty. Also, you may inadvertently cause further damage.

Sprains and strains

A *sprain* is an injury to the ligament at a joint. A *strain* is an injury to a muscle. These types of injury are usually caused by sudden wrenching which causes the joint to over stretch tearing the surrounding muscles and ligaments.

Minor fractures can be easily mistaken for a sprain or a strain. If you have any doubts, treat the injury as if it were a fracture to be on the safe side. The only way you can be sure if it is or is not a fracture is by x-ray.

Signs and symptoms of fracture:

- | | |
|------------------------------|---|
| Pain | Pain will occur at the site of the fracture. The casualty may have taken strong pain killers, have nerve damage or dementia, so be aware. |
| Loss of power | For example, the casualty will not be able to lift anything with a fractured arm. |
| Unnatural movement | If a limb is moving in an unnatural way, it is likely to be an 'unstable' fracture and care should be taken to prevent the fracture from moving and causing further damage. |
| Swelling and bruising | This usually occurs around the site of the fracture. |
| Deformity | If the limb is bent in the wrong place, it is broken. |
| Irregularity | There will be lumps or depressions along the surface of a bone where the broken ends overlap. |

Crepitus This is the feeling, or sound, of bone grating on bone when the broken ends rub together.

Tenderness This occurs at the site of the injury.

Treatment of a basic fracture:

See also:

- Head injuries (*see page 13*)
- Flail chest (*see page 27*)
- Spinal injuries (*see page 55*)

- Reassure the casualty and tell them not to move.
- Use your hands to keep the injury still until it can be immobilised professionally. The casualty may be able to do this on their own, but bear in mind they may be in shock.
- Do not move the casualty before the injury is immobilised, unless they are in direct danger (as in the middle of a road).
- Do not try to bandage the injury if you have already called for an ambulance, just keep it still. If there is an open wound, you may cover it with a sterile dressing while you wait for help.
- Do not allow the casualty to eat, drink or smoke, as they may need surgery later.

For injury to an upper limb:

- Carefully, and gently place the arm in a sling against the body. It is common to use a support sling for arm fractures. For collar bone fractures, it is common to use an elevated sling (*keep the casualty's elbow down at their side when using an elevated sling for a fractured collar bone*).
- Should the casualty be in severe pain, circulation or nerves to the arm are affected, the casualty is having problems breathing or you are at all unsure **dial 999 for an ambulance immediately**.
- Arrange for the casualty to be transported to hospital.

For injury to a lower limb:

- Keep the casualty still, and ensure they are kept warm. **Dial 999 for an ambulance immediately**.
- If there is any delay to the ambulance reaching you (*for example you are in a remote part of the country*) immobilise the injury by gently bandaging the injured leg to the uninjured one.
- Check that their circulation has not been cut off beyond the injury and bandages. If necessary, loosen the bandages.

Treatment of sprains and strains:

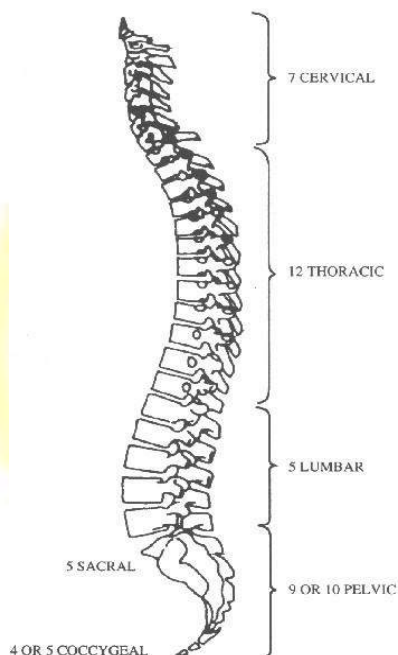
The best way to treat sprains and strains is to follow the **RICE** mnemonic:

- Rest** Ensure the casualty rests the injury. For example, do not allow a sportsman to continue (*remind them it is better to miss one game than the next ten!*).
- Ice** As soon as you can, apply an ice pack (*frozen vegetables such as peas or, if you have it, a refrigerant gel pack*). This helps to reduce swelling and speeds recovery. Be sure not to place the ice pack directly onto the skin, as this can cause frostbite. A tea towel or any sort of thin barrier will suffice. Do this for 10 minutes every 2 hours for 24 hours for maximum effect.
- Compression** Apply a firm (*not constricting*) bandage to the injured area. This also will help reduce the swelling, and provide support. The bandage can be applied over an ice pack for the first ten minutes, but be sure to remove the ice pack after this time.
- Elevate** Elevate the injury, as this helps reduce swelling.

Please bear in mind that minor fractures can very easily be mistaken for a sprain or strain. The only way to be sure there is no fracture is to send or take the casualty to hospital for an x-ray.

Spinal injuries

THE VERTEBRAL COLUMN



Approximately 2% of trauma (*injury*) casualties suffer spinal injury. Although this percentage appears to be fairly low, suspecting and correctly treating a spinal injury is essential. Poor treatment of a casualty with a suspected spinal injury may result in them being crippled for life, or even in death.

The spinal cord is an extension of the brain stem, and is located down the back of the spinal vertebrae. The spinal cord houses vital nerves which control breathing and movement. The most vulnerable part of the spinal column is the neck, and a neck injury can often be the most severe type of spinal injury. This is because as mentioned, the nerves controlling breathing are

housed here and may become severed.

Suspected spinal injury:

Always assume the worst if the casualty has:

- Received a blow to the head, neck or back (*this is especially important if the blow results in a loss of consciousness*).
- Fallen from a height. For example, from a horse, a ladder or off a roof.
- Dived into shallow water.
- Been involved in a speed accident like a car accident, or been knocked down.
- Been in a 'cave in' type accident (*e.g. crushing, or a scrum in rugby union*).
- Multiple injuries.
- Any pain or tenderness to the neck or back after being involved in an accident. However, be aware that strong pain killers or other severe injuries may mask the pain that would normally alert you to a spinal injury.
- You are in any doubt at all. Remember with this kind of injury it is better to be safe than sorry.

Possible signs and symptoms of a spinal injury:

Please remember – if any of the signs and symptoms below are present, nerves may already have suffered damage. Always treat a casualty that you suspect of having a spinal injury to prevent the signs and symptoms developing.

- Any pain or tenderness in the neck or back.
- Any sign of a fracture to the neck or back.
- Loss of control or sensation in limbs below the site of the injury.
- A feeling of pins and needles, or a burning sensation in the limbs.
- Difficulty breathing.
- Incontinence.

Treatment of spinal injury:

If the casualty is conscious:

- Tell the casualty not to move and keep reassuring them.
- Do not allow the casualty to move or be moved, keep them in the position you found them in until help arrives. They should only be moved if they are in severe and immediate danger.
- It is vitally important to immobilise the casualty's head. Do this with your hands on either side and try to keep their head and neck in line with the upper body.
- **Dial 999 for an ambulance immediately.** Keep the casualty still and warm until help arrives.

If the casualty is unconscious:

- Do not move, or allow the casualty to be moved unless they are in severe and

immediate danger.

- Check their airway and breathing. If they are breathing fine on their own, the airway is clear so there is no need to move the head back. However, if need be you can use the ‘jaw thrust’ technique to keep the airway open without moving the head (*this technique is explained on page 58*). Keep a close eye on their breathing.
- **Dial 999 for an ambulance immediately.**
- Using your hands, keep their head still and in line with their upper body.
- If for any reason you have to **leave** the casualty, if they begin to **vomit** or if you have concerns about their airway at all, place the casualty in the **recovery position**. Make sure you keep the head, neck and upper body in line when you turn the casualty. To do this effectively, you will inevitably need more than one rescuer, so get local help if you can (*see page 55 for instructions on how to place a suspected spinal injury casualty in the recovery position*).
- Keep the casualty still and warm. Keep a close eye on the **airway** and **breathing** until help arrives.

If the casualty is not breathing normally:

- If the casualty is having trouble breathing the airway will need to be opened. The head tilt may be used, but the tilt should be kept to a minimum to allow unobstructed rescue breaths to be administered.
- **Only if you are trained and confident, you can try to use the ‘jaw thrust’ technique.** If this does not work and the casualty is still not breathing normally, you should open the airway using the head tilt method before carrying out resuscitation.
- Check their breathing once the airway has been opened.
- If this does not help and the casualty is still having problems breathing **dial 999 for an ambulance immediately**, then carry out resuscitation.
- Try to obtain the help of others; they can support the head while you perform resuscitation.

Remember – if the resuscitation results in paralysis from a neck injury it is a tragedy, but failing to maintain an open airway will result in death.

Managing the airway with a spinal injury casualty

If an unconscious casualty is laid on their back, the airway is in danger of becoming blocked by vomit or their tongue sliding back.

An uninjured but unconscious casualty can simply be turned into the recovery position to help protect the airway. However, if a spinal injury is suspected, you must take great care not to move the spine.

If the casualty is already lying on their side (*not on their backs*) you may not need to move them at all. Check that the airway is not in danger of becoming blocked by vomit or their tongue. If not, keep the casualty in the position you find them.

Try to monitor the casualty's breathing, if it is normal you may be able to keep them still until the ambulance arrives, even if the casualty is on their back.

However, should the tongue slide back or the casualty vomit then immediate action is required to keep their airway clear.

Jaw thrust:

If the casualty is breathing, but the tongue is starting to slide back and obstruct the airway (*the casualty starts making a snoring sound when they breathe*) then the jaw thrust technique can be employed to keep the airway open:

- Kneel at the casualty's head, knees apart to keep your balance.
- Rest your elbows on your legs (*or the floor*) for support and hold the casualty's head with your hands, keeping their head and neck in line with the body.
- Place your middle and index fingers under their jaw line (*under the ears*).
- Keeping their head still, lift the jaw upwards with your fingers. This action gently lifts the tongue away from the back of the throat keeping the airway clear.

Do not attempt the jaw thrust technique during CPR – tilt their head back instead to open the airway.

Log roll:

If you have to **leave** the casualty for any reason, if they begin to **vomit** or you are at all concerned about their **airway** being clear, the casualty will have to be put on their side. Always remember to keep the head, neck and upper body in line when you turn the casualty.

The most effective method of turning a casualty with a suspected spinal injury is the log roll technique.

However, you will need at least three helpers to perform this on the casualty:

- Supporting the head of the casualty, keep the head, neck and upper body in line.
- The helpers should kneel along one side of the casualty. Ask them to gently straighten the casualty's arms and legs.
- Ensuring that you all work together, ask the helpers to roll the casualty towards them on your count of three. You should gently move the head in time with the body as the helpers roll the casualty onto their side.
- Make sure you keep the head, neck, body and legs in line the whole time. If

you can, keep the casualty in this position until the ambulance arrives.

Recovery position:

In the event that you have to turn a casualty onto their side to protect their airway, but you are on your own, you will have to use the recovery position method. Keep the head, neck and body in line to the best of your ability as you roll the casualty onto their side. Have some form of padding to hand (*e.g. a folded coat or jumper*) to help support the casualty's head once they are on their side.

If you do have one or two others with you, you should keep the casualty's head supported while the helper(s) turn the casualty.

- Start by keeping the casualty's head supported, keeping the head, neck and upper body in line.
- Ask your helper(s) to gently manoeuvre the casualty's arms and legs into position, ready to turn the casualty into the recovery position.
- Ensuring that you work together, the helper(s) should roll the casualty into the recovery position. The helper(s) should pull equally on the casualty's far leg and shoulder as they turn the casualty, keeping the spine in line. You need to gently move the head to keep it in line with the upper body as the casualty is turned.

Effects of heat and cold

This part of the notes deals with the effects of over exposure to both heat and cold on the body.

Severe Hypothermia or Heat Stroke can be potentially fatal conditions and require skilful treatment from the first aider.

Those who are most at risk from these conditions are babies, children, the elderly or infirm and people who take part in outdoor activities like hiking, sailing or running a marathon.

Body temperature

The ideal temperature for the body to work at is 37°C (98.6°F). The temperature is maintained by an area of the brain known as the '*hypothalamus*'. If the body should become too hot we start to sweat, which evaporates from the skin cooling it down. Blood vessels near the surface of the skin dilate (*which causes skin to flush*) and the cooled blood is then circulated around the body.

If the body should become too cold we start to shiver, which creates heat from

our muscles moving. Blood vessels near the surface of the skin constrict (*which causes skin to appear pale*), keeping the blood closer to the warmer core of the body. The hair on the skin stands up, trapping warm air (*better known as goose pimples*).

Injuries that result from exposure to extremes of temperature can be ‘localised’ (*for example sunburn and frostbite*), or ‘generalised’ (*for example hypothermia and heat stroke*).

Signs and symptoms of changes to body temperature:

The symptoms of over-exposure to heat or cold can be seen in the table below. As the body’s temperature rises and becomes too hot or drops and becomes too cold, the hypothalamus stops working, and the condition rapidly deteriorates as the body stops fighting the condition.

| Temperature | Condition | Symptoms |
|------------------------|--------------------|---|
| 109.4-104°F / 43-40°C | Heat stroke | Unconsciousness / fitting. Confused / restless. Headache, dizzy, uncomfortable. Strong, pounding pulse. Flushed, dry skin, hot to the touch. |
| 104-100.4°F / 40-38°C | Heat exhaustion | Cramps in stomach / arms / legs. Pale, sweaty skin. Nausea / loss of appetite. |
| 100.4-96.8°F / 38-36°C | Normal | Normal body temperature. |
| 96.8-89.6°F / 36-32°C | Mild hypothermia | Shivering. Fatigue, slurred speech. Confusion, forgetfulness. Shivering stops, muscle rigidity. Very slow, very weak pulse. Noticeable drowsiness. |
| 87.8-75.2°F / 31-24°C | Severe hypothermia | Severe reduction in response levels. Unconsciousness. Dilated pupils. Pulse undetectable. Appearance of death. Death. |

Hypothermia

Hypothermia will occur when the core temperature of the body falls below 35°C. If the casualty is suffering from the mildest form of hypothermia, they will usually make a full recovery with professional treatment. Should the casualty’s core body temperature fall below 26°C, it will most likely be fatal. However, there have been cases of successful resuscitation of casualties with body temperatures of as low as 10°C, so it’s always worth the attempt.

The usual cause of hypothermia is over exposure to cold temperatures, but the different types of casualty and condition may have an effect on the risk:

- The hypothalamus of a baby or young child is underdeveloped, which can lead to hypothermia from as little as a cold room.
- The elderly or infirm tend not to generate as much body heat so any prolonged time in the cold will lower their core temperature.
- Wet clothes or submersion in cold water results in the body cooling much faster than when dry, as water conducts heat away from the body.
- Inadequate clothing in windy weather will result in cold air in continuous contact with skin, resulting in the body cooling faster.

Signs and symptoms:

- Skin appears pale and cold to the touch.
- Initial shivering, with the body stiffening as the body cools further.
- Bodily functions slow, including pulse, speech, breathing and thought.
- Appears to be drunk – lethargic, confused, disorientated.
- Lowered levels of response leading to unconsciousness and finally death.

Treatment of hypothermia:

If the casualty is unconscious:

- Clear the airway and check the casualty is breathing. If not, commence CPR.
- **Dial 999 for an ambulance immediately.**
- If the casualty is breathing, carefully place them in the recovery position. Do not move the casualty unnecessarily as the slightest jolt may cause the heart to stop.
- Place insulating materials, such as blankets, under and around the casualty making sure to cover the head.
- Remember to monitor the casualty's breathing. Their pulse may be hard to locate, but it is safe to assume the casualty's heart is beating if they are breathing.

If the casualty is conscious:

- Try to get the casualty to shelter if possible, remove any wet clothing and replace with dry, warm clothing. Cover the head, as a lot of heat is lost here.
- If the casualty is young, fit and able then ask them to get into a warm bath ($40^{\circ}\text{C} / 104^{\circ}\text{F}$). **Do not allow an elderly casualty to do this.**
- If the option of a bath is not viable, wrap them in warm blankets, heat the room to a warm temperature ($25^{\circ}\text{C} / 77^{\circ}\text{F}$).
- If the casualty is outdoors, try to insulate them from the environment as much as possible. Use a survival bag and shelter if you have them. Also share your body heat with them.

- Give the casualty something warm to drink and eat.
- **Seek medical advice** if the casualty is a child, elderly or you are unsure about their condition.
- If their condition appears severe, **dial 999 for an ambulance immediately.**

It is vital to NEVER:

- Give the casualty alcohol, as it dilates blood vessels which will cool the casualty further.
- Place a heat source directly on or near the casualty, this will draw the blood to the skin causing the blood pressure to fall and place stress on the heart.
- Try to warm a baby or elderly person quickly by placing them in a warm bath.

A hypothermia casualty's heart is in grave danger of '*ventricular fibrillation*', which causes cardiac arrest. Always handle a hypothermic casualty with care as the slightest jolt can induce the condition.

Frostbite

This condition usually affects the extremities (*such as fingers, toes, ears, etc.*) when they are exposed to cold. The cells become frozen, causing ice crystals to form in the cells which in turn cause them to rupture and die. Frostbite can often be accompanied by hypothermia, which also needs to be treated. Severe frostbite can result in the loss of the affected area, normally fingers and toes.

Signs and symptoms:

- Pins and needles, numbness.
- Skin hardens and stiffens.
- Skin colour changes – firstly white, then blue tinge and eventually black.
- Once recovered, the affected area will be hot, red, blistered and extremely painful.

Treatment of frostbite:

- Carefully remove any rings, watches, bracelets, etc.
- Try to stop the freezing getting worse if the casualty is outdoors by placing the limb under their arm or holding it in your hands.
- Do not rub the affected area as this will cause damage.
- Do not try to re-warm the affected area if there is a chance of it refreezing. Move the casualty indoors before you attempt to treat them.
- Place the affected area in warm water. Be sure to test the water yourself first, use your elbow as you would for a baby's bath.
- If the casualty is an adult, they may take up to two paracetamol tablets (*providing they are not allergic*) for intense pain.
- Arrange transport for the casualty to hospital as soon as possible.

Heat exhaustion

This condition is the body responding to loss of water and salt through excessive sweating. The most common cause of heat exhaustion is working or exercising in a hot temperature (*such as marathon runners*).

Signs and symptoms:

- Confusion and dizziness.
- Pale, sweaty skin.
- Nausea, loss of appetite and vomiting.
- Fast, weak pulse and breathing.
- Cramping in the arms, legs and abdomen.
- The casualty may complain of being cold, but will be hot to the touch.

Treatment of heat exhaustion:

- Remove the casualty to a cool area.
- Remove any excessive clothing and get them to lie down.
- Give the casualty plenty of water, or preferably some form of oral re-hydration such as 'Diaoralyte' or isotonic drinks as this replaces their lost salt too.
- Get medical advice, even if the casualty quickly recovers.
- If the casualty's response levels deteriorate, place them in the recovery position and **dial 999 for an ambulance immediately**. Monitor the casualty's airway and breathing.
- Treat the casualty for heat stroke if necessary.

Heat stroke

This is a very serious condition which results from the hypothalamus failing (*the temperature control centre*) in the brain. The sweating mechanism fails resulting in the body being unable to cool down and the core temperature reaching a dangerously high level (*over 40°C*) in a relatively short time (*around 10 to 15 minutes*).

Heat stroke can be caused by prolonged exposure to heat or a high fever, and usually follows heat exhaustion.

Signs and symptoms:

- Severe confusion, restlessness.
- Flushed, dry hot skin, no sweating.
- Strong, fast pulse.
- Throbbing headache.
- Dizziness.
- Nausea and vomiting.

- Response levels reduced, leading to unconsciousness.
- Possible seizures if casualty is unconscious.

Treatment of heat stroke:

- Move the casualty to an area that is cool and shaded.
- **Dial 999 for an ambulance immediately.**
- Use whatever methods you can to cool the casualty as quickly as possible. Remove outer clothes, wrap the casualty in a cool, wet sheet. Keep the sheet wet and cold until the casualty's temperature returns to a normal level, then remove and replace with a dry sheet.
- Other ways to cool the casualty can include continual sponging with cold water, fanning the casualty to help the water evaporate (*as would normally happen with sweat*), place the casualty in a cool shower if they are conscious and able to stand, spray with water (*such as with a garden hose*).
- If the casualty has a seizure, treat them as you would for a *febrile convulsion* (*see page 69*).

Taking a temperature

There are modern, easy to use thermometers available now, such as disposable strips that you place on the forehead, and digital thermometers. Follow the manufacturer's instructions on how to use them. If, however, you have an old fashioned mercury thermometer, the following advice may be helpful:

- Be careful when using the thermometer as the mercury inside is poisonous.
- Make sure it is thoroughly cleaned before use.
- Hold it by the end opposite to the silver, mercury bulb.
- Shake the thermometer until the mercury falls below the 35°C mark.
- Place it under the tongue of a conscious adult, or in the armpit of a child.
- Keep it in place for at 3 minutes.
- The level the mercury rises to will indicate the casualty's temperature.

Diabetes

This condition occurs when the casualty does not produce enough of the hormone insulin naturally.

The body uses insulin to break down the sugar that we digest, so that it can be used by the cells or stored for later use. Basically, insulin reduces the amount of sugar in the blood.

Should diabetes go untreated, the casualty's blood sugar levels will rise dangerously over 1 or 2 days (*this depends on the severity of their condition*).

Diabetes is split into three different types, which are categorised by the treatment used to control it:

Diet controlled The person still produces insulin naturally, so they can control the levels of sugar in their blood through what they eat.

Tablet controlled The person still produces a small amount of insulin naturally, but rely on tablets to control the amount of sugar in their blood. This is usually in conjunction with a controlled diet.

Insulin dependent The person produces little or no insulin naturally and has to administer insulin by injection twice or more a day. This helps keep the sugar levels in their blood under control.

High blood sugar (*hyperglycaemia*)

This occurs when the diabetes is not treated effectively with any of the methods mentioned above.

The sugar levels in the blood climb and acids build up. The signs and symptoms displayed by a hyperglycaemic person are a result of the body trying to excrete the acid build up.

Low blood sugar (*hypoglycaemia*)

This condition occurs mainly with diabetic people who are insulin dependent, as the level of insulin in the body is 'fixed' due to the dose administered by injection.

Because the amount of insulin is fixed, they must balance it with the amount of food they eat.

Blood sugar levels fall if:

- The person has not eaten enough food.
- The person over exerts (*burns off the sugar in their blood*).
- The person has injected a too high dose of insulin.

Why low blood sugar is dangerous:

Unlike the other cells in the body, glucose (sugar) is the only energy source the brain can use. If the sugar in the blood drops, this literally starves the brain.

Please refer to the table below for signs and symptoms of both low and high blood sugar. The result is the 'hungry' brain cells become disordered, causing the release of adrenaline into the body (*see 'the body's response to hypoxia', see page 16*).

Signs and symptoms:

| | High blood sugar (hyperglycaemia) | Low blood sugar (hypoglycaemia) |
|-------------------|--|---|
| Onset | Slow – 12 to 48 hours | Fast – 2 mins to 1 hour |
| Level of response | Deterioration is slow during onset: <ul style="list-style-type: none"> • Drowsy, lethargic. • Unconsciousness if left untreated. | Deterioration is fast during onset: <ul style="list-style-type: none"> • Weak, dizzy. • Confused, memory loss. • Lack of coordination. • Slurred speech. • Bizarre, uncharacteristic, un-cooperative, possible violence. • Unconscious within 1 hour. |
| Skin | Dry and warm. | Pale, cold and sweaty. |
| Breathing | Deep, sighing breaths. | Normal to shallow and rapid. |
| Pulse | Rapid. | Rapid. |
| Other symptoms | Excessive urination. Excessive thirst. Hunger. Fruity odour on the breath. | Please note – the signs can be easily confused with intoxication. |

Treatment of high blood sugar (hyperglycaemia):

- Arrange for the casualty to see a doctor as a matter of urgency.
- Should the casualty become unconscious, maintain their airway and breathing, place in the recovery position. **Dial 999 for an ambulance immediately.**

Treatment of low blood sugar (hypoglycaemia):

If the casualty is conscious:

- Sit the casualty in a comfortable position.
- Give the casualty a sugary drink (*isotonic sports drinks are the best option as they are high in sugar*), sugar lumps, glucose tablets, chocolate or other sweet foods.
- If the casualty responds quickly to this treatment, wait five minutes then give them some carbohydrates (*a sandwich, pasta, etc.*).
- Stay with the casualty, do not leave them alone. Let them rest until they are fully alert and their response levels are back to normal.
- Suggest to the casualty they see their doctor, even if they appear to have fully recovered.
- If the casualty does not respond to the treatment within 10 minutes, or they become unmanageable, **dial 999 for an ambulance immediately.**

- Consider the possibility that there may be another cause for the casualty's symptoms.

If the casualty is unconscious:

- Open the airway and check for breath. Resuscitate if necessary.
- Place the casualty in the recovery position if they are breathing normally.
- **Dial 999 for an ambulance immediately.**

Epilepsy

People with this condition have a tendency to have seizures (*fits*) that come from a disturbance in the brain. However, bear in mind that one in twenty people will experience a seizure at some point in their lives, so the casualty may not be epileptic.

The causes of a seizure are many, such as hypoxia, stroke, a head injury or even a high body temperature.

Seizures are common in babies and children whose temperature is too high due to illness and fever. This is covered under the heading 'febrile convulsions', which follows.

Minor seizures

This condition is also known as 'absence seizures' or 'petit mal' seizures. The person may suddenly appear to be daydreaming (*even in mid-sentence*). This may only last a couple of seconds before recovery, and the person may not even realise what just happened. On some occasions a minor seizure may be accompanied by unusual movements such as twitching in the face, jerking of a limb or lip smacking. The person can at times make a noise such as a sudden cry.

Treatment of minor seizures:

- Remove any danger near the casualty, such as cutlery or hot drinks they may be holding.
- Help the casualty to sit in a quiet place, and reassure them.
- Stay with them until they are fully alert.
- If the casualty is unaware of any condition, suggest they see their doctor.

Major seizures

This is the more serious type of seizure, resulting from a major disturbance in the brain which causes aggressive fitting throughout the body.

These types of fit can be very frightening to see, but try to remain calm as prompt action is essential for the casualty.

Signs and symptoms:

There is usually a pattern to a major seizure.

Aura If the casualty has had a history of seizures, they may recognise when a fit is imminent. The warning signs (*or aura*) could include a taste in the mouth, a smell or a peculiar feeling. This warning may give them sufficient time to seek help or simply find somewhere quiet to lie down before they fall.

‘Tonic’ phase This phase is where every muscle in the body goes rigid. The casualty may emit a cry and fall to the floor. Their back may arch and their lips may turn blue (*cyanosis*). This typically lasts less than 20 seconds.

‘Clonic’ phase The casualty’s limbs make sudden, violent jerking movements, their eyes may roll, they may clench their teeth, they may drool from the mouth (*sometimes it can be bloody due to biting their tongue*) and there could be a ‘snoring’ sound when they breathe. Also, the casualty may lose control of their bladder and/or bowel.

The clonic phase can last from 30 seconds to hours, but most stop within a couple of minutes. If the seizure lasts more than 15 minutes, or they have a number of consecutive seizures, it is a dire medical emergency and should be treated as such.

Recovery phase This is when the body relaxes even though the casualty may still be unresponsive. Their response levels will improve within a few minutes, but they may not be fully alert for about 20 minutes or so. They may want to sleep to recuperate, and be unaware of their actions.

Treatment of major seizures (fits):

During the seizure:

- If you can, help the casualty to the floor to avoid injury.
- Try to cushion the casualty’s head, to avoid head trauma. This can be accomplished with a folded coat, jumper or even your hands.
- Loosen any tight clothing around their neck to help them breathe.

- Try to move any objects from the area around the casualty, to lessen the risk of them hurting themselves, and ask bystanders to move away if necessary.
- If you have any concerns about their airway, roll them onto their side.
- Take an exact note of the time the seizure started and how long it lasts.
- If the casualty is a stranger to you, check for any identification.

Dial 999 for an ambulance if:

- The seizure lasts for more than 3 minutes.
- Once the seizure has run its course, if their response levels don't improve within 10 minutes.
- The casualty has a second seizure.
- If the casualty has no history of epilepsy, or this is their first major seizure.
- You do not know the casualty.
- You are at all unsure.

As soon as the seizure stops:

- Check the casualty's airway and breathing. Resuscitate if necessary.
- Place the casualty in the recovery position.
- Try to keep the casualty warm (*unless a high temperature caused the seizure initially*) and reassure them.
- Monitor their airway and breathing.
- Move any bystanders away before the casualty comes to, and try to preserve their dignity.
- Keep a close eye on their response levels and **dial 999 for an ambulance** if their condition doesn't improve within 10 minutes, or if you are unsure at all.

Febrile convulsions

The part of the brain that regulates temperature (*the hypothalamus*) is not yet fully developed in babies and young children, which can lead to the body's core temperature reaching dangerously high levels, which may lead to a child having a fit.

A child having a febrile convulsion can be a very frightening and distressing sight for a parent or guardian. When the child is in the 'tonic' phase, s/he may stop breathing as the diaphragm goes rigid resulting in the lips and face turning blue (*cyanosis*). It is vital, therefore, to remain as calm and reassuring as possible in this situation.

The child may have been unwell recently and be hot to the touch.

Treatment of febrile convulsions:

- Remove any clothing and bedclothes from the child. Try to provide fresh, cool

air to help reduce the child's temperature. Be careful not to overly cool the child however.

- To protect the airway, place the child in the recovery position (*on their side*) if it is possible.
- Remove any dangers from around the child and use some padding to ensure the child isn't hurt during the fit. It is very important to protect the child's head.
- **Dial 999 for an ambulance immediately.**
- If the child continues to fit, use a sponge with tepid water to help the cooling process. However, do not cool them down too much.
- Keep a close eye on the child's airway and breathing until the ambulance arrives.

Please remember:

- **Never place anything in a fitting casualty's mouth, especially your fingers.**
- **Never try to restrain them or hold them down – allow the fit to run its course.**
- **Never move a fitting casualty unless they are in imminent danger.**

Health & Safety (first aid) Regulations 1981

Employer's responsibility:

It is the responsibility of the employer to make sure sufficient first aid provision is made in the workplace, under Health & Safety law. This includes:

- Assessing the first aid needs of the workplace – how many first aiders are needed, what type of training is required, are they following the guidance from the HSE (*Health & Safety Executive*).
- Provide training and re-qualification courses for the appointed first aiders.
- Ensure there are enough first aid kits and equipment for the workplace, and that they are well stocked.
- Ensure that all staff are aware who the first aiders are and where to find them should they need treatment.

Following is advice for employers on their responsibilities, but first aid training organisations are usually happy to give further advice if needed.

First aid kits

The first aid kit should be easily accessible; preferably near somewhere the first aider can wash their hands. The kits should be easily identified by a large white cross on a green background. The container should protect the contents from dust and damp.

First aid kits should be available at all workplaces. However, larger sites will need more than one first aid kit to cover the greater amount of people. The kits should contain the following, as a guide only:

- A leaflet with general guidance on first aid.
- 20 individually wrapped sticking plasters of assorted sizes and absorption, suited to the type of work (*e.g., blue plasters are to be used by food handlers, as they are highly visible*). Hypoallergenic plasters can be provided too.
- 2 sterile eye pads.
- 4 individually wrapped triangular bandages, preferably sterile.
- 6 safety pins.
- 6 individually wrapped medium, sterile wound dressings (*approx. 12cm x 12cm*).
- 2 individually wrapped large, sterile wound dressings (*approx. 18cm x 18cm*).
- 1 pair of disposable gloves. Please remember some people are allergic to latex, so try to find an alternative (*such as Nitrile*).

The above contents are not mandatory and equivalent items can be used. You can also add items such as scissors, adhesive tape, disposable aprons, individually wrapped moist wipes, face shields, etc. Keep them in the first aid kit, if there is room, or nearby if not.

You may also wish to consider keeping other equipment close to the first aid kit such as blankets (*to help protect casualties from the elements, keep them warm if they are in shock, etc.*), breathing apparatus (*should the first aider need to enter a dangerous atmosphere*), etc.

Eye wash:

If there is no access to tap water for eye irrigation, there should be at least 1 litre of sterile water, or 'saline' solution available in a sealed, disposable container(s).

Travelling first aid kits

If the employees travel, it is advisable to provide them with a first aid kit, which will typically include:

- A leaflet with general guidance on first aid.
- 6 individually wrapped sterile plasters.
- 2 individually wrapped triangular bandages, preferably sterile.
- 2 safety pins.
- 1 individually wrapped large, sterile wound dressing (*approx. 18cm x 18cm*).
- Individually wrapped moist cleansing wipes.
- 1 pair of disposable gloves. Please remember some people are allergic to latex, so try to find an alternative (*such as Nitrile*).

First aid needs assessment

Employers must carry out a first aid needs assessment, which should answer the following questions:

- What is the nature of the work? What are the hazards and risks of the workplace?
- What is the size of the organisation?
- What is the nature of the workforce?
- What is the organisation's history of illness and accidents?
- What are the needs of travelling, remote or lone workers, if applicable?
- What are the work patterns (*such as shift work*)?
- What is the distribution of the workforce?
- How far away is the closest emergency medical service (*medical centre, etc.*)?
- How many employees are there working on shared or multi-occupied sites?
- Are there enough first aiders to cover each other over annual leave and other absences?
- Is there first aid provision for non-employees?

Workplace hazards and risks

One of the more difficult areas of a first aid needs assessment is taking into consideration the nature of the work and workplace hazards and risks.

Employers should take into consideration the risks and identify the possible injuries which could occur in order to ensure the first aid provision is sufficient. The table below, compiled using information from the HSE, should help in identifying some common workplace risks, and the possible resulting injuries:

| Risk | Possible injuries |
|---------------------|--|
| Manual Handling | Fracture, laceration, strain and sprain |
| Slip / Trip Hazard | Fracture, laceration, strain and sprain |
| Machinery | Crush injury, amputation, fracture, eye injury, laceration |
| Work at Height | Head injury, unconsciousness, spinal injury, fracture, strain and sprain |
| Workplace Transport | Crush injury, fracture, spinal injury, strain and sprain |
| Electricity | Electric shock, burns |
| Chemicals | Poison, unconsciousness, burns, eye injury |

All these aspects should be taken into consideration by the employer to determine how many people should be trained in first aid, and to what level to ensure their workplace is safely covered.

First aiders

An employer should consider a number of things when choosing an employee to be a first aider. Ideally, a first aider will have the following:

- Reliability, good disposition and communication skills
- An aptitude and ability to absorb new skills and knowledge
- An ability to cope with stressful and physically demanding emergency procedure
- Normal workplace duties that can be left if an emergency situation arises

As of October 2009, there have been introduced a new training regime for first aiders. The HSE (Health & Safety Executive) have introduced two levels of first aider:

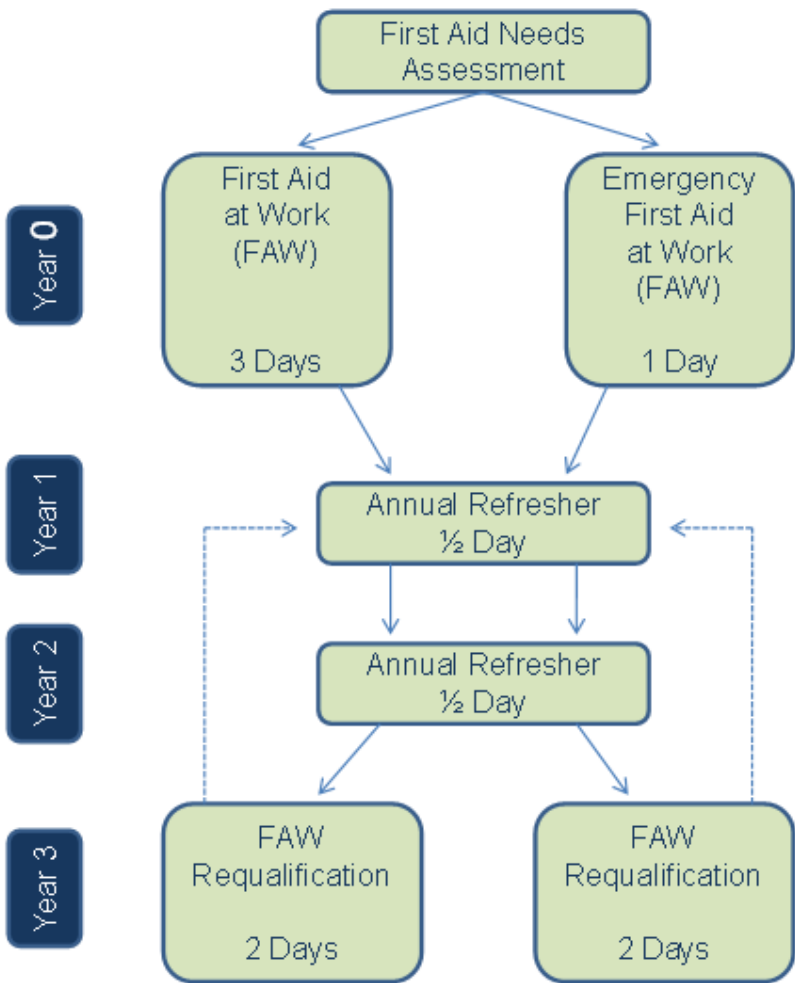
- First Aider at Work
- Emergency First Aider at Work

Contents of HSE First Aid Courses:

| <u>EFAW – Emergency First Aid at Work (1 day course)</u> <u>FAW – First Aid at Work (3 day course)</u> | EFAW 1 Day (6 hours) | FAW 3 Days (18 hours) |
|---|-------------------------|--------------------------|
| Acting safely, promptly & effectively in an emergency | Y | Y |
| Cardio Pulmonary Resuscitation (CPR) | Y | Y |
| Treating an unconscious casualty (inc seizure) | Y | Y |
| Wounds & bleeding | Y | Y |
| Shock | Y | Y |
| Minor injuries | Y | Y |
| Choking | Y | Y |
| Preventing cross infection, recording incidents & actions & the use of available equipment | Y | Y |
| Fractures | X | Y |
| Sprains & strains | X | Y |
| Spinal injuries | X | Y |
| Chest injuries | X | Y |
| Severe burns & scalds | X | Y |
| Eye injuries | X | Y |
| Poisoning | X | Y |
| Anaphylaxis | X | Y |

| | | |
|--------------|---|---|
| Heart attack | X | Y |
| Stroke | X | Y |
| Epilepsy | X | Y |
| Asthma | X | Y |
| Diabetes | X | Y |

HSE Recommended Sequence of Training



* Please note: If the level of first aid assessment identifies that the workplace needs first aid at work training (3 day course), it is **not acceptable** to provide emergency first aid at work training (1 day course).

Annual refresher training

The HSE recommend that all employees trained in first aid attend an annual refresher course due to the evidence on the severity of 'first aid skill fade'.

The above flow chart shows the HSE's recommended sequence of training.

Reporting incidents at work

All accidents in the workplace must be recorded in an accident book, no matter how small the resulting injury. The incident may need to be reported to the HSE under RIDDOR regulations.

RIDDOR 1995 regulations

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995.

These regulations specify that it is the responsibility of the **employer or person in control of the premises** to report the following incidents directly to the HSE:

- Death (*report immediately*)
- Major injury (*report immediately*)
- Dangerous occurrences (*report immediately*)
- Incident resulting in a person being off work (*or unable to carry out full duties*) for more than 3 days (*report within 10 days*)
- Diseases (*report asap*)

For further information, please visit the RIDDOR website at **www.riddor.gov.uk**.

Accident book

An accident at work must be recorded in an accident book, no matter how severe the injury. The accident book may be filled in by anyone on behalf of the casualty, or if they are capable the casualty themselves.

The recorded information can help the employer to identify accident trends and possible areas for improvement in control of health and safety risks. It can also be used for future first aid needs, assessments and could also be helpful for insurance investigation purposes.

The first aider is often the one to fill in an accident book, so the following notes are given as advice:

- An accident book is a legal document
- Any information recorded in the accident book is usually considered to be 'stronger evidence' in court than something recalled from memory
- Complete the report in the book at the same time, using the same pen (*not pencil*)
- In compliance with the Data Protection Act, all personal information entered in the accident book must be kept confidential. With this in mind, the accident book should be one where

the pages can be removed to be stored securely

- There should be one member of staff nominated to be responsible for the safekeeping of completed accident reports (*e.g. in a secure cabinet*). Always hand the completed accident report to that person
- The casualty may wish to take a photocopy of the accident report. If this is the case, they can take a copy before the report is handed in. They should keep a record of the accident report number

You should include in your report:

- The name, address and occupation of the casualty
- The name, address, occupation and signature of the person completing the report
- The date, time and location the accident occurred
- A description of how the accident happened, include the cause if known
- Details of the injury sustained

First aid casualty report form

It is useful for the first aider to complete a patient report form for all casualties. Please note that this is not in place of the accident report book, which still has to be completed for any accidents in the workplace.

The casualty report form is designed to help the first aider keep an accurate record of the exact treatment provided. It is especially useful if the casualty refuses treatment against the advice of the first aid provider.

- If the casualty refuses treatment, make sure that they are capable of making that decision (*e.g. they are a fully conscious adult*). If they are not capable of making the decision, seek medical advice
- Follow the advice given for completing the accident report book when completing the form
- A copy of the completed form can be given to ambulance or hospital staff as it will contain valuable details on the incident, treatment and casualty. Ask the nurse to take a copy so you can retain the original for your records
- To comply with the Data Protection Act, all personal details on the report must remain confidential, so the report should be securely stored (*e.g. in a secure cabinet*)

AVPU score:

The AVPU scale is the simplest way to record the conscious level of a casualty. A detailed explanation can be found on page 9.

The scale should also be on the casualty report form, so you don't have to memorise it. There is a score provided for each level of consciousness. Note the score in the observations chart each time you measure it.

Appendix: Resuscitation – child over 1 year:

NOTE: This section deals with the differences between adult and child resuscitation.

REMEMBER: If you are at all unsure, it is better to perform the adult sequence on a child who is unresponsive and not breathing than not to do anything at all.

Child resuscitation:

Danger

Make sure you are safe to help, **do not put yourself in danger**

Response

- Gently tap the child's shoulders and shout 'are you alright?'
- If the child does not respond shout for help, but don't leave the child yet

Airway

Carefully ensure the airway is open by gently tipping the child's head back with the 'chin lift':

- Place your hand on the child's forehead and gently tilt their head back
- Using your fingertips under the point of the chin, lift the chin to open the airway

Breathing

Ensuring the airway is kept open; look, listen and feel to ascertain whether the child is breathing normally. Do not take more than ten seconds to do this.

- If the child is able to breath **normally**, carry out a secondary survey and place the child in the recovery position (*see page 12*)

If the child is not breathing normally:

- If you are not alone, ask the nearest person to **dial 999 for an ambulance immediately**. If you are alone and need to leave the child to ensure help is on the way, perform resuscitation for about 1 minute first:
 - Maintain the child's airway by tilting their head and lifting the chin
 - Pinch the fleshy part of the nose and seal your mouth around the child's
 - Give 5 initial rescue breaths. Blow in just enough air to make the child's chest rise visibly
- Combine rescue breaths with chest compressions:***
- Using 1 or 2 hands as required to depress the child's chest a third of its depth
 - Give 30 chest compressions at a rate of 100 compressions per minute
 - Open the airway again by tilting the child's head and lifting the chin, and give 2 more rescue breaths
 - **Continue to administer 30 chest compressions followed by 2 rescue breaths**

If your rescue breaths do not make the child's chest rise effectively:

Give a further 30 chest compressions before attempting the following:

- Check inside the mouth and remove any clearly visible obstruction (*do not reach blindly into the child's throat*)
- Recheck that the head is adequately tilted back and the chin is lifted
- Do not administer more than 2 rescue breaths before resuming chest compressions

Note: If there is another rescuer with you, change over every two minutes to prevent either of you getting fatigued. Ensure as short a delay as possible as you change over.

Appendix: Resuscitation – baby under 1 year:

NOTE: This section deals with the differences between adult and baby resuscitation.

REMEMBER: *If you are at all unsure, it is better to perform the adult sequence on a child who is unresponsive and not breathing than not to do anything at all.*

Baby resuscitation:

Danger

Make sure you are safe to help, **do not put yourself in danger**

Response

- Gently tap the baby's shoulders and shout to try to wake the baby
- If the baby does not respond shout for help, but don't leave the baby yet

Airway

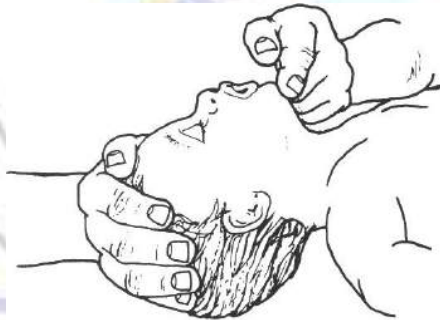
Carefully ensure the airway is open by gently tipping the baby's head back with the 'chin lift':

- Place your hand on the baby's forehead and gently tilt their head back. **DO NOT OVER-EXTEND THE BABY'S NECK**
- Using your fingertips under the point of the chin, lift the chin to open the airway

Breathing

Ensuring the airway is kept open; look, listen and feel to ascertain whether the baby is breathing normally. Do not take more than ten seconds to do this.

- If the baby is able to breath **normally**, consider the baby's injuries and place them in the recovery position (*see page 12*)



If the baby is not breathing normally:

- If you are not alone, ask the nearest person to **dial 999 for an ambulance immediately**. If you are alone and need to leave the baby to ensure help is on the way, perform resuscitation for about 1 minute first:
- Maintain the baby's airway by tilting their head and lifting the chin ensuring you do not over-extend the baby's neck
- Seal your mouth around the baby's nose and mouth
- Give 5 initial rescue breaths. Blow in just enough air to make the baby's chest rise visibly.
Be careful not to over inflate the baby's lungs

Combine rescue breaths with chest compressions:

- Use 2 fingers to depress the baby's chest to a third of its depth
- Give 30 chest compressions at a rate of 100 compressions per minute
- Open the airway again by tilting the baby's head and lifting the chin, and give 2 more rescue breaths
- **Continue to administer 30 chest compressions followed by 2 rescue breaths**

If your rescue breaths do not make the baby's chest rise effectively:

Give a further 30 chest compressions before attempting the following:

- Check inside the mouth and remove any clearly visible obstruction (*do not reach blindly into the baby's throat*)
- Recheck that the head is adequately tilted back and the chin is lifted
- Do not administer more than 2 rescue breaths before resuming chest compressions

Appendix: Resuscitation with an Automated External Defibrillator (AED):

The most common cause of a heart stopping (*cardiac arrest*) is a 'heart attack' (*see page 30*). It is worth noting that a heart attack does not always result in cardiac arrest. The majority of heart attack victims remain conscious and survive.

If a heart attack, or another cause, results in cardiac arrest, it is usually because it has interrupted the heart's electrical impulses. When this happens the heart 'quivers' chaotically instead of beating in the usual co-ordinated rhythm. This is known as 'Ventricular Fibrillation' (*VF*).



Normal Sinus Rhythm



Ventricular Fibrillation

The definitive treatment for ventricular fibrillation is to administer a controlled electric shock to the heart, which stops the 'quiver' and enables it to start beating normally again. This treatment is called 'defibrillation'.

An Automated External Defibrillator (*AED*) is a safe and reliable computerised device that analyses the heart rhythms and enables a non-medically qualified person to safely administer the life-saving shock, with some small amount of training.

Using an AED can drastically increase the chances of a casualty's survival if their heart stops beating, but prompt use is paramount. For every minute's delay in delivering the shock, the casualty's chance of survival is reduced by 10%.

Resuscitation with an AED

Danger

- Make sure you are safe to help, **do not put yourself in danger**
- Consider the safety implications of using an AED in this situation

Response

- Gently shake the shoulders and ask in a loud voice 'Are you alright?'
If there is no response from the casualty:
- Shout for help immediately
- If you have people with you, ask one helper to **dial 999 for an ambulance** and ask **the other to get the AED**, but do not leave the casualty yourself just yet

Airway

- Carefully ensure the airway is open by gently tipping the head back lifting the chin

Breathing

Ensuring the airway is kept open; look, listen and feel to ascertain whether the casualty is breathing normally. Do not take more than ten seconds to do this.

- If the casualty is able to breath **normally**, consider possible injuries and carefully place them in the recovery position (*see page 12*)

If the casualty is not breathing normally:

- If you are alone, **dial 999 for an ambulance** and **get the AED** – you may have to leave the casualty to do this
- If you have people with you, start CPR immediately while one helper **dials 999 for an ambulance** and **the other helper gets the AED**. Continue CPR yourself until the AED arrives

When the AED arrives:

- If you have someone helping you ask them to take over CPR while you get the AED ready.
NOTE: If the person with you is untrained in CPR it may be easier for them to administer the chest Compressions only (see page 4).

Switch on the AED immediately and follow the voice prompts:

- Attach the leads to the AED if they are not already attached, and attach the pads to the casualty's bare chest (*if possible, do this while the person helping you continues CPR*)
- It may be necessary for you to towel dry or even shave the casualty's chest so the pads adhere to their skin properly. Only shave where the pads are going to go, try to delay defibrillation as little as possible
- Peel the backing from the pads one at a time and place them firmly in position, following the instruction on the pads
- Place the first pad below the casualty's right collar bone
- Place the second pad on the casualty's left side, over the lower ribs. Try to place the second pad vertically if possible.

DO NOT REMOVE THE PADS ONCE YOU HAVE PLACED THEM IF THEY ARE THE WRONG WAY ROUND – THE AED WILL STILL WORK.

Wait while the AED analyses the casualty's heart rhythm – stop CPR while this happens and ensure no one touches the casualty

If the AED advises a shock:

- Ensure no one is touching the casualty (*check from top to toe and clearly shout 'stand clear!'*)
- Push the shock button when prompted (*if the AED is fully automated it will deliver the shock automatically*)
- Continue as directed by the voice or visual prompts from the AED

If the AED does not advise a shock:

- Immediately resume CPR using the ratio of 30 chest compressions to 2 rescue breaths
- Continue as directed by the voice or visual prompts from the AED

Placements of the pads:

Wet chest

If the casualty's chest is wet (*from sweating for example*) it must be dried before the pads can be applied so they can stick to the skin properly. Also be sure to dry the area of the chest between the pads, as electricity can 'arc' across the wet skin.

Excessive chest hair

Hair on the chest will stop the pads from sticking to the skin properly and will interfere with electrical contact. You only need to shave the chest if the hair is excessive, and even then take as little time as possible as you don't want to delay defibrillation by any longer than is absolutely necessary. If there is no razor immediately available, do not delay defibrillation.

Pad positioning

Research shows that the position of the pad on the lower left side of the chest has an impact on the effectiveness of the shock. When placing the pad, make sure it is placed around the side of the chest (*not on the front*) and place it vertically. This will help ensure the maximum electricity flows through the heart rather than across the surface of the chest. If the AED has not been updated, the pads will have a diagram showing horizontal placement – ignore this advice and place the pad vertically.

AED safety considerations:

Electric shock

Studies have shown that, providing the pads are stuck to a dry chest in the correct positions, the risk of electrical shock is very low as the electricity wants to travel from one pad to the other, not to 'earth' itself like mains electricity. However, to be on the safe side, always briefly check that no one is touching the casualty before a shock is delivered.

DO NOT delay defibrillation because the casualty is lying on a wet or metal surface, providing the chest area is dry it is safe to administer the shock.

Medication patches

Some casualties will wear a patch to administer their medication (*e.g. a nicotine patch*). Some heart patients wear a 'glyceryl tri-nitrate' (GTN) patch. Please be aware that this type of patch can explode if electricity is passed through it. Remove any visible medication patches before administering a shock as a precaution.

Jewellery

Be aware when placing the pads that you do not place them on any jewellery, such as a necklace. This would conduct the electricity and burn the casualty. There is no need to remove any piercings, but avoid placing the pads over any.

Implanted devices

Some heart patients have pacemakers or defibrillator implants. These can usually be seen or felt under the skin when the chest is exposed, there may also be a scar. The implants are usually situated just below the left collar bone and should not be in the way of the AED pad. However, if the device has been implanted elsewhere, try not to place the pad directly over it.

Highly flammable atmosphere

As with any electrical equipment, there is a possibility of the AED creating a spark when the shock is administered, so it should not be used in a highly flammable atmosphere (*in the presence of a gas leak for example*).

Inappropriate shock

AED machines have been proven to analyse the heart's rhythm extremely accurately. However, the casualty needs to be motionless while the AED does the analysis. You must not use an AED on a casualty who is fitting (*violent, jerking movements*), and ensure vehicle engines or vibrating machines are switched off wherever possible.

AED use on children:

The AED pads are suitable for both adults and children older than 8 years. Smaller pads that reduce the current delivered in a shock are available for children aged 1 to 8 years. These should be used for the appropriate age range whenever possible. Some AEDs have a 'paediatric' setting.

If the child is over 1 year and you do not have smaller pads, use the AED as it is. But please note that the use of adult sized pads on a child under 1 year old is not recommended.

Most paediatric pads are designed to be placed with one in the centre of the child's chest and the other in the centre of the child's back. The pads should have a diagram showing their correct positions.

Some paediatric pads are designed to be placed in the same position as the adult pads – always follow the diagrams on the pads to ensure you are placing them in the correct place.

Glossary

| | |
|------------------------------------|---|
| <i>Abdomen</i> | the area between the lowest ribs and the pelvis |
| <i>Acute</i> | sudden onset |
| <i>Adrenaline</i> | Hormone secreted by the body in times of shock |
| <i>Airway</i> | the passage from the mouth and nose to the lungs |
| <i>Alveoli</i> | minute air sacks in the lungs, through which the exchange of gasses take place |
| <i>Asphyxia</i> | deficiency of oxygen caused by an interruption in the passage of air to the lungs |
| <i>Atrium</i> | top, 'collecting' chamber of the heart (of which there are two) |
| <i>Baby</i> | person under 1 year old |
| <i>Breathing</i> | inspiration and expiration of air into and out of the lungs |
| <i>Bronchioles</i> | small air passages in the lungs, leading to the alveoli |
| <i>Cardiac / cardiogenic</i> | concerned with the heart |
| <i>Cell</i> | smallest structural living unit of an organism |
| <i>Cerebral-spinal fluid (CSF)</i> | fluid that surrounds the brain and spinal cord, to cushion it and provide nutrients |
| <i>Cerebrum</i> | the largest part of the brain |
| <i>Cervical</i> | concerned with the neck |
| <i>Child</i> | person between 1 year old and puberty |
| <i>Chronic</i> | long term |
| <i>Circulation</i> | the movement of blood around the body |
| <i>Compression</i> | bleeding or swelling in the cranial cavity, exerting pressure on the brain |
| <i>Concussion</i> | shaking of the brain, causing temporary loss of consciousness or function |
| <i>Consciousness</i> | alertness, 'normal' activity of the brain |
| <i>Constrict</i> | to close down, become narrower |
| <i>Convulsion</i> | fit or seizure |
| <i>CPR</i> | Cardio Pulmonary Resuscitation, manually squeezing the heart and breathing for a casualty |
| <i>Cranium</i> | the cavity in the skull in which the brain lies |
| <i>Cyanosis</i> | blue/grey tinges to the skin, especially the lips, due to lack of oxygen |
| <i>Defibrillation</i> | the delivery of a large electric shock to the chest in an attempt to re-start the heart |
| <i>Dilate</i> | become wider, open up |
| <i>Enzyme</i> | substance that enables a biological reaction to happen |
| <i>Epistaxis</i> | nose bleed |
| <i>Face shield</i> | protective mask with a one-way valve for performing mouth-to-mouth rescue breaths |
| <i>Febrile</i> | relating to fever or high body temperature |
| <i>Haemothorax</i> | bleeding into the pleural cavity of the lungs |
| <i>Hepatic</i> | relating to the liver |
| <i>Hyper...</i> | high |
| <i>Hypo...</i> | low |
| <i>Hypothalamus</i> | area of the brain that controls the body's temperature |
| <i>Hypovolaemic</i> | low volume of blood, a type of shock |
| <i>Hypoxia</i> | low levels of oxygen in the blood |

| | |
|---------------------------------|--|
| <i>Inferior</i> | below |
| <i>Insulin</i> | hormone secreted by the pancreas that enables the usage and storage of sugar |
| <i>Jaw thrust</i> | manoeuvre to open the airway without moving the head, by thrusting the jaw forwards |
| <i>Mesenteric</i> | relating to an area of the intestines |
| <i>Nausea</i> | feeling sick |
| <i>Neurogenic</i> | concerned with the brain and nervous system |
| <i>Perfusion</i> | supply of oxygen and nutrients, and the removal of waste gases and products |
| <i>Pleura</i> | a two layered membrane surrounding the lungs, between which is a 'serous' fluid |
| <i>Pneumothorax</i> | air entry into the pleural cavity of the lung |
| <i>Pulmonary</i> | concerned with the lungs |
| <i>Regurgitation</i> | vomiting, being sick |
| <i>Rescue breath</i> | blowing air into the casualty's lungs, sufficient to make the chest rise |
| <i>Respiration</i> | breathing |
| <i>Seizure</i> | fit or convulsion |
| <i>Shock</i> | inadequate supply of oxygen to the tissues as a result of a fall in blood pressure or volume |
| <i>Spinal cord</i> | group of nerves which emanate from the brain and pass down the spinal column |
| <i>Spine</i> | the column of vertebrae which form the back |
| <i>Stroke</i> | bleed or blockage of a blood vessel within the brain |
| <i>Superior</i> | above |
| <i>Symptoms</i> | the feelings of a casualty e.g. 'I feel sick' |
| <i>Syncope</i> | faint |
| <i>Tension pneumothorax</i> | air entry into the pleural cavity of the lung that has become pressurised, impairing the function of the good lung and the heart |
| <i>Thoracic</i> | the area within the rib cage containing the lungs |
| <i>Tourniquet</i> | a tight band placed around a limb which was used to stop blood flow, no longer used in first aid |
| <i>Ventricle</i> | lower, larger 'pumping' chamber of the heart (of which there are two) |
| <i>Ventricular Fibrillation</i> | quivering, vibrating movements of the ventricles of the heart, producing no effective pumping action |

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