

# **I 3 FIRST AID AND MANAGEMENT OF MINOR INJURIES**

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Serious accidents and injuries on expeditions are rare. However, minor injuries of one kind or another are encountered on most expeditions. In some cases injured expedition members need to be evacuated to medical care, but most injuries can be managed adequately in the field. First aid books are of limited use to expeditions going overseas as they place great emphasis on getting medical help which in many parts of the world may be many days' travel away. This chapter covers the following topics:

- Approach to the injured casualty
- Resuscitation
- Disorders of consciousness
- Wound care
- Wound infections
- Burns
- Bone and joint problems
- Pain management.

## **APPROACH TO THE INJURED CASUALTY**

When approaching any injured patient, stop and think. After an accident it is vital to avoid producing other casualties. Ask yourself the question: "Am I safe?" If it is safe to approach try to avoid moving the casualty. Occasionally you will need to "scoop and run", for example if there is a danger of rock fall or avalanche. In these cases move the casualty to a safe place as carefully and quickly as possible. Particular care will be required if you suspect a back or neck injury. Using the principles of first aid assess the casualty.

**TABLE 13.1 PRINCIPLES OF FIRST AID**

- Assess the situation
- Make the area safe
- Assess the casualty
  - starting with the ABC of resuscitation
  - identify the injury or illness
- Give easy, appropriate and adequate treatment in a sensible order of priority
- Make and pass on a report
- Organise removal of casualty to secondary care where appropriate

First aiders will be familiar with the following system for assessing and examining any casualties: ABCDE (Table 13.2).

**TABLE 13.2 PRINCIPLES OF RESUSCITATION**

- A **A**ssessment of the scene
- A **A**irway with neck control
- B **B**reathing
- C **C**irculation with control of bleeding
- D **D**isability
- E **E**xposure with environment control

## **BASIC RESUSCITATION**

Basic life support is the maintenance of breathing and circulation without the use of equipment apart from a simple airway device or a shield to protect the person being resuscitated from possible infection. The combination of (mouth-to-mouth) expired air resuscitation and chest compression is known as cardiopulmonary resuscitation (CPR). The best way to learn about CPR is to go on a first aid course (see Chapter 4). The main points are summarised here as a reminder.

### **Outcome of cardiopulmonary resuscitation**

Survival from cardiac arrest is most likely when the collapse is witnessed, when early cardiopulmonary resuscitation is started and defibrillation (electric shock treatment of the heart) and advanced life support are started at an early stage. On an expedition, it is unlikely that advanced life support will be available. If attempts at resuscitation are not successful after 30 minutes, the chances of success are extremely low.

There are two important exceptions: where a victim has been struck by lightning or has been immersed in cold water. In these cases successful resuscitation has occurred after 2 hours or more.

**Important note.** If the pulse is absent (cardiac arrest) it is unlikely that the casualty will recover as a result of cardiopulmonary resuscitation alone. Once the heart has stopped beating the casualty is dead, and if your attempts to resuscitate are unsuccessful the casualty remains dead. It is important to remember this if the casualty does not recover.

### **Outline of resuscitation (revised guidelines 2000)**

At the scene of an incident on an expedition where there appears to be an unresponsive patient:

- Stop and think.
- Do NOT put yourself in danger – ask the question “Am I safe?”
- Approach the casualty and assess the situation.
- Assess the casualty’s response; say loudly: “Are you OK?” *Gently* shake the shoulders.

If the casualty responds:

- Assess and treat any injuries or medical conditions (see Chapter 12).
- Consider placing the casualty in the recovery position (Figure 13.1), but always remember that a spinal injury may be present.

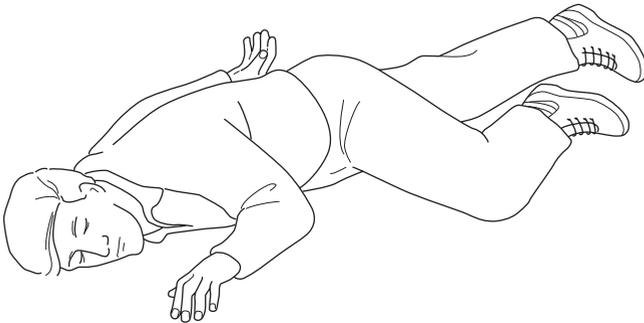


Figure 13.1 *The recovery position*

If there is no response:

- Shout for help.
- Open the airway by lifting the jaw upwards (chin lift), but avoid extending the neck more than necessary (head tilt).
- Remove any obvious obstructions in the mouth but do not poke fingers blindly into the mouth.
- Look at the chest, listen and feel if the casualty is breathing out against your cheek for 10 seconds.

If there is no breathing:

- Give two breaths of expired air resuscitation. Pinch the casualty's nostrils, take a breath, place lips over the casualty's lips and breath out steadily into the casualty's chest. This should take about 2 seconds. Watch to ensure that the chest rises. Use a protective shield if available.
- After two breaths check the carotid pulse (if trained to do so) in the neck for 10 seconds and look for other signs of circulation: choking, coughing, return of colour.

If there is no pulse or sign of circulation commence chest compressions.

- First identify the site for chest compressions: run fingers along the rib margin to the breast bone.
- Place your index and middle fingers together at this point then slide the heel of the other hand to touch above your fingers. Ensure that only the heel of the hand is in contact with the casualty.
- Interlock the fingers and leaning well over the casualty with your arms straight, press down vertically at a rate of approximately 100 compressions per minute. In an adult the compressions should be about 4–5cm in depth. Compression and release phases should be equal in time.
- After 15 compressions give two breaths of expired air resuscitation and repeat. Do not stop to check for a pulse – if resuscitation is successful the casualty will start to cough, swallow or choke.

### **Dangers of resuscitation**

There is understandable concern about the transmission of blood-borne diseases during resuscitation – particularly HIV and hepatitis. Although viruses can be isolated from the saliva of infected persons, transmission is rare and there are only fifteen documented cases of CPR-related infection in the literature. Three cases of HIV have been reported and were acquired during resuscitation of infected patients – on

two occasions from a needle-stick injury and in the third after heavy contamination of broken skin.

To minimise the risk of acquiring infection rescuers should wear gloves and use barriers whenever possible. Great care must be taken with sharp objects.

## **DISORDERS OF CONSCIOUSNESS**

It is very worrying if someone cannot respond normally on an expedition because of an accident or illness. There are many reasons why someone may not be fully conscious; some of the commoner causes are:

- Head injuries
- Fainting
- Convulsions
- Death.

### **Head injuries**

Head injuries are a significant risk on expeditions, particularly in mountaineering accidents, motor vehicle accidents and on building project sites. Head injuries can result in changes in conscious level, bleeding, infection and disability.

It is very important to avoid injuring the neck when moving patients after head injuries as about 10% of individuals who receive a head injury that causes unconsciousness will have an associated neck injury. Be suspicious of a neck injury in anyone who has a significant injury above the collarbones.

Minor head injuries may cause a transient loss of consciousness, but serious open head injuries are usually rapidly fatal. It is helpful to know a little more about head injuries so that decisions about the need for evacuation can be made. The following types of head injuries will be discussed:

- Closed head injuries
- Closed head injuries
  - with internal bleeding
  - with brain swelling
- Open head injuries
- Base of skull fractures.

#### *Closed head injuries*

In closed head injuries the skull remains intact and there is no communication between the brain and the outside world. Bleeding or brain swelling may complicate closed head injuries.

### *Closed head injuries with internal bleeding*

Any head injury may result in loss of consciousness. If the head injury is serious a patient may never regain consciousness; conversely, a minor injury may result in a brief loss of consciousness with mild concussion (a temporary loss of brain function). Where bleeding inside the skull complicates a head injury, the patient may be knocked out at the time of the injury, regain consciousness (the lucid interval) and then lose consciousness again. As blood collects inside the skull it exerts pressure on the brain tissue. Increasing pressure inside the skull results in increasing coma and eventually death. The Glasgow Coma Scale describes the changes as a patient becomes more deeply unconscious (see pages 125–7).

### *Closed head injuries with brain swelling*

During a head injury, the brain moves inside the skull and may be damaged against the bony ridges inside the base of the skull or by the impact against the inside of the skull. The greater the degree of swelling, the deeper and longer the coma is likely to be.

### *Open head injuries*

These injuries are usually serious because there is communication between the inside of the skull and the outside world and hence the main danger is the risk of infection. A common scenario might be a large scalp laceration with an underlying skull fracture. If available, antibiotics should be given during evacuation. In severe open head injuries the skull is open with brain substance exposed. Great force is required to produce these injuries and the outcome is usually severe disability or death, even if the injury occurs near a properly equipped hospital.

### *Fractures of the base of the skull*

These are open head injuries, because in fractures of the base of the skull infection may spread from the nose, ears or sinuses. Features of base-of-skull fractures are as follows:

- Raccoon eyes – bruising around both eyes following a blow to the head
- Battle's sign – bruising behind the ear
- Cerebrospinal fluid leaking from the ears or nose.

Cerebrospinal fluid (CSF) is the straw-coloured fluid that bathes the brain and spinal cord and helps to protect them from injury. Bloodstained fluid from the ears or nose may contain blood and CSF. If the fluid is dripped onto a sheet or handkerchief, two concentric rings are formed if both blood and CSF are present. Because of the risk of infection, antibiotics should be given during evacuation.

*Treatment of head injuries*

All head injuries should be treated according to first aid principles:

- A Assessment of the scene.** Ensure that you do not endanger yourself.
- A Airway with neck control.** An unconscious casualty's airway is at risk as many people vomit following a head injury. The gag and cough reflexes may not function normally to clear the airway, depending on the level of unconsciousness, so it is important to place the casualty carefully in the recovery position (see Figure 13.1). A chin lift and head tilt will normally open the airway. Remember the possibility of an associated neck injury, but always give the airway priority. Try to avoid overextending the neck and stabilise the neck in a neutral position.
- B Breathing.** Once the airway is secure, check that breathing is adequate and measure the breathing rate.
- C Circulation** with control of bleeding. Look for any obvious external haemorrhage and control bleeding with direct pressure. Measure the pulse rate.
- D Disability.** Assess the response level using AVPU:
  - Awake and Alert
  - Voice – responds to voice
  - Pain – responds to pain
  - Unresponsive.

Look at the pupils and check that they constrict when a light is shone into the eye. Rising pressure inside the skull may mean that one or both pupils fail to respond to light and are fixed and dilated. This is a serious sign and means evacuation should be arranged immediately.

The Glasgow Coma Scale (see Chapter 12) allows a more comprehensive assessment of unconsciousness.

- E Exposure** with environment control. Examine the casualty carefully from head to toe by undressing but always be aware of the risk of hypothermia. Do not move the casualty unnecessarily.

*Head injuries and the need for evacuation*

When a head injury occurs in a remote place, it is often difficult to know whether you should cancel your expedition plans and head off to the nearest hospital or whether it is safe to observe a casualty in a base camp or similar.

Three groups of patients always need to be evacuated for expert medical assessment:

1. Patients who remain unconscious.
2. Patients who have open or base-of-skull fractures.
3. Patients who have had a convulsion or fit.

It is more difficult to decide whether to evacuate a conscious patient following a head injury. The following pointers may be helpful in deciding who to evacuate:

- Worsening headache
- Vomiting
- Drowsiness
- Confusion
- A dilated, unresponsive pupil on one or both sides
- Convulsions
- Blood or fluid seeping from the ears or nose
- Deep scalp lacerations
- Worsening Glasgow Coma Scale score.

It is always better to be overcautious where head injuries are concerned. If in doubt, make arrangements to evacuate the patient for assessment in a hospital.

### *Glasgow Coma Scale*

This Scale (see Figure 12.7, page 126) helps to assess the severity of a head injury when monitoring a casualty during evacuation. The patient's GCS score is assessed in terms of eye opening and their verbal and motor responses.

Any patient should be closely observed on a regular basis, at least every hour, following a significant head injury. A decrease in the GCS score should alert you to the need for immediate evacuation.

### **Fainting**

Fainting is not usually a serious condition and may follow severe pain, exhaustion, dehydration (for example, following a bout of diarrhoea), lack of food or an emotional upset. Faints are caused by a temporary decrease in the flow of blood to the brain. The pulse becomes very slow during a faint, unlike in shock where the pulse is rapid.

Someone who is about to faint usually becomes very pale, starts to sweat and may feel nauseated. At the first signs, encourage the patient to sit down with their head between their legs or to lie flat. If the patient loses consciousness, lay him or her flat, loosen tight clothing and elevate the legs. Usually, unconsciousness lasts only a few minutes; sometimes there are convulsive movements during the faint. After regaining consciousness the casualty should be reassured and checked for any injury that may have been sustained during the fall to the ground.

### **Convulsions**

A fit or a seizure is caused by abnormal electrical activity in one or more parts of the brain. Fits are most commonly seen in people with epilepsy but can occur with brain

infections (meningitis and encephalitis) or following head injuries. People with diabetes may fit when their blood sugar level becomes low. People with alcohol and drug problems may fit during withdrawal. If there are people with epilepsy in your expedition team it would be wise to learn more about the management of their disease.

If a fit does occur it is important to note the following:

- How long did the fit last?
- Was there loss of consciousness?
- Were all limbs involved in the convulsion?
- Was there eye rolling, salivation and incontinence?
- Was there a period of sleepiness after the fit?

During a fit, teeth may be broken and the tongue may be bitten. Sometimes vomit is breathed into the lungs leading to pneumonia or asphyxia. Injuries may occur as a result of falling at the beginning of a seizure. Prolonged fits may deprive the brain of oxygen and result in brain damage, although this is rare.

*Treatment of a fit (see also Chapter 15, page 173)*

- Do not restrain the person unless injury is likely.
- Open the airway with head tilt and chin lift.
- Do NOT force things between the teeth – you may break teeth or get bitten.
- Place the casualty in the recovery position (see Figure 13.1).
- If a fit occurs following a head injury, evacuate immediately.
- If meningitis appears likely treat with antibiotics and arrange evacuation. Meningitis should be suspected if a patient has a high fever, severe headache, vomiting or a stiff neck, is very sensitive to light and has a rash.

**The diagnosis of death**

Unfortunately, death is always a risk in a remote wilderness setting. It is therefore essential to diagnose death with certainty, particularly if a body is to be buried at sea or cremated in the mountains. Victims of hypothermia and cold water immersion injury should not be considered dead until they are warm and dead. In some cases where a body must be left behind it may be important to take photographs to establish the facts.

The signs of death are as follows:

- Unresponsiveness
- Absent heart sounds (listen with a stethoscope or your ear against the chest for 2 minutes)
- No breathing effort
- Pupils are fixed and dilated when a light is shone into them

- Later signs include rigor mortis (stiffness) and clouding of the cornea of the eyes.

## **WOUND CARE**

Minor cuts and grazes are common on expeditions. All wounds may be managed using the following principles:

- Stop the bleeding.
- Decrease the risk of infection by cleaning.
- Dress the injury for comfort and to maintain cleanliness.
- Promote healing and restore function.

### **Stopping bleeding**

All wounds bleed to a greater or lesser extent. In some cases, bleeding may be life threatening. As always, use first aid principles:

- Apply *direct pressure* over the wound with any available clean material or dressing.
- Lay the casualty down.
- Raise the limb above the level of the heart.
- Apply further dressings to control the bleeding on top of any original pad.
- Bandage firmly to hold dressing in place.

When there are very deep wounds it may not be possible to control bleeding by applying pressure on the surface of the skin. The only way to stop severe, persistent bleeding from deep inside a wound may be to remove the dressings, open the wound, remove clots and debris, and pack the wound open with sterile gauze. The use of artery forceps should be avoided as they may damage important structures such as tendons and nerves.

Tourniquets should be reserved for injuries where a limb has been amputated or for uncontrollable bleeding. The tourniquet should be released every 20–30 minutes otherwise tissues beyond the tourniquet will die.

### **Preventing infection**

- Clean all wounds with an antiseptic solution.
- Remove any foreign material.
- Cover wound with a non-stick dressing.
- Bandage to hold the dressing in place.

If foreign bodies are deeply embedded and cannot be removed easily, they should be

left in place for removal by a surgeon. If an object remains embedded, the surrounding wound should still be cleaned carefully and then dressed. In the UK wounds are quickly seen by a doctor or nurse; however, during an expedition it may be necessary to care for wounds for days or even weeks. Every wound should be inspected at least daily and clean dressings applied. Any pus or exudate should be gently removed but damage to healing tissues must be avoided. If dressings do stick, soaking may allow easier removal. Infection with tetanus should not be a risk for expedition wounds if all expedition members are immunised correctly prior to travel (see Chapter 2), but always check on a casualty's tetanus immunisation status.

### **Dressings and bandaging**

The principle of wound dressing is to apply layers to the wound:

1. Non-stick sterile dressing against the wound (such as Melolin or Jelonet).
2. Sterile gauze swabs to absorb any pus or exudate from the wound.
3. Crepe bandage, Tubinet or Tubigrip to hold the dressing in place.

The bandage should hold the dressing in place without producing pressure or constriction. Bandaging techniques are taught on all first aid courses.

### **Promoting healing and restoration of function**

Wound healing is aided by a healthy diet and rest. Any significant wound will heal more quickly with an increase in oxygen at altitudes below 3,000m. Rest is needed initially but prolonged splinting leads to stiffness and muscle wasting. Joints adjacent to a wound or burn should be kept mobile.

### **Methods of wound closure**

A gaping wound will heal better if the skin edges are brought together. This may be accomplished with Steri-strips or sutures.

#### *Steri-strips*

Steri-strips are paper stitches which come in a variety of lengths and widths. They are placed across a laceration and, if left in place for a week or so, result in a clean, neat scar. Steri-strips are not as effective near joints, on the palms of the hands and soles of the feet, or on the scalp. However, they are excellent for finger lacerations and facial wounds. Steri-strips stick less effectively in humid or wet environments, such as the jungle or at sea. Applying Friar's Balsam to the skin may help to keep the Steri-strips in place.

#### *Suturing (Figure 13.2)*

Steri-strips should be used where possible. If Steri-strips will not close the wound,

sutures will be necessary. Only clean wounds that are less than 12 hours old are suitable for suturing. Deep wounds may need to be closed in layers by a qualified surgeon. This is outside the skill of an expedition paramedic; in this case the wound should be cleaned, packed open and redressed daily. This may allow the wound to heal from the bottom upwards. Sutures should never be applied to animal or human bites, deep wounds or contaminated wounds.

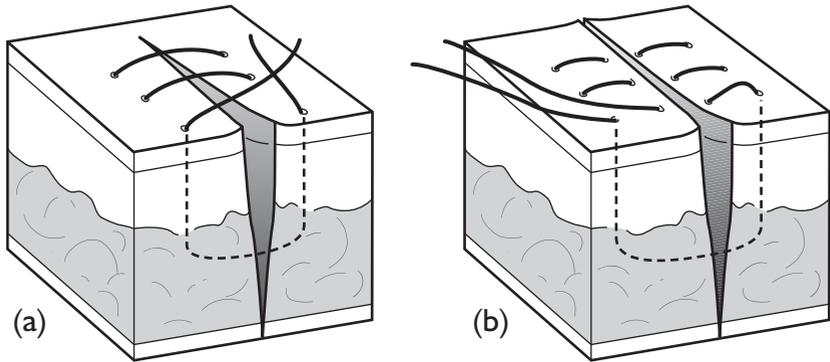


Figure 13.2 Suturing of wounds: (a) ordinary suturing; (b) eversion suturing

## Types of wounds

### Abrasions

These are grazing injuries where the top surface of the skin is removed. Abrasions should be cleaned and a non-stick dressing applied. Ingrained dirt, if not removed, will result in tattooing and makes wound infection more likely. Dressings may need to be changed once or twice daily depending on the environment. Dressings may stick and can be soaked off with clean water or saline.

### Puncture wounds

Infection may occur at the base of deep, penetrating wounds. Tetanus is a risk, particularly with puncture wounds, and all expedition team members should be immunised. The skin surface should be prevented from sealing over by placing a small wick into the wound. This allows healing to occur from the bottom of a puncture wound upwards, otherwise abscess formation may occur.

### Blisters

Blisters are best prevented. All group members should be encouraged to stop walking and to cover “hot spots” before they develop into blisters. If a blister does develop, the fluid should be drained using a clean (sterile) needle and then the area covered with an adhesive plaster or Moleskin. Compeed and Spenco are alternative dressings. Blis-

ters may become de-roofed; in this case treat as a graze with a non-adherent dressing. A thin application of Friar's Balsam at the edge of a blister may help the dressing to stay in place. Healing is rapid if friction at the blister site can be eliminated. Leaving the blister uncovered, where possible, will assist healing by allowing the area to dry out.

### ***Bruises***

Contusions or bruises are usually caused by a direct blow to the skin surface. Bleeding under the skin gives the bruise its characteristic appearance. Rest, ice, compression and elevation (RICE) all help to reduce swelling and pain. Compression may be achieved by applying a crepe bandage firmly around the affected area. Anti-inflammatory drugs such as ibuprofen or aspirin may also help. After a day or two the affected part should be mobilised to reduce stiffness. A subungual haematoma (a blood blister beneath the finger nail) can be easily treated by melting a hole through the nail using an opened paper clip heated to red heat in a flame. This is surprisingly painless and gives immediate relief.

### ***Crush injuries***

Large amounts of tissue may be damaged in crushing injuries and the potential for infection is high. The crushed part should be carefully cleaned and then elevated. Swelling in the affected part may cut off the blood supply to the limb beyond the injury. If the injury is severe there may be a risk of losing the limb and it is important to evacuate the casualty for medical assessment.

### ***Amputation***

A digit or limb may be replaced by microsurgery if the patient and the amputated part can be delivered to a surgeon in less than 6 hours. The amputated part should be kept cool, preferably in a container with ice, but not in direct contact with the ice. In an expedition setting it is highly unlikely that such surgical facilities will be available; in this case, treat the bleeding with direct pressure and elevation. The stump should be cleaned gently and then covered with a non-adherent dressing such as paraffin gauze. People with these injuries need to be evacuated to allow surgical treatment to shorten any bone ends and cover the stump with a flap of skin so that healing can take place.

### ***Impalement***

An impaled object protruding from a wound should be left in place. Removing an impaled object may cause further damage and therefore should be done in a suitably equipped hospital. Large objects, such as arrows or fence posts, may need to be stabilised and carefully cut to allow evacuation. Pain relief will be required.

## **Wounds causing particular problems**

### *Deep wounds*

In a deep wound underlying structures, for example arteries, nerves, tendons and muscles, may be damaged. It is important to assess:

- **Movement:** the patient should be asked to move the affected part through the full normal range.
- **Circulation:** check by feeling for pulses and look for capillary refill (see below).
- **Sensation:** check beyond the level of the injury.

To check for capillary refill press firmly over a fingernail or bony prominence for 5 seconds to produce blanching. When the pressure is released the colour should begin to return quickly (in less than 2 seconds), otherwise indicating the patient to be extremely cold or shocked, or that the blood supply to the limb is interrupted. If the blood supply to a limb is completely interrupted it will be painful, pulseless, pale and cold. Surgical treatment is required within a few hours to salvage the limb. Deep wounds are also prone to infection. They should be cleaned carefully and packed open so that the wound can heal from the bottom upwards. Dressings should be changed daily until the wound can be dealt with surgically.

### *Neck wounds*

Injuries to the neck may be associated with damage to important underlying structures such as blood vessels, nerves and the airway. Neck wounds should be cleaned carefully but never probed. Unless the wound is clearly superficial it should be assessed medically. Bandages should never be placed around the neck as subsequent swelling may compromise the airway.

### *Flaps*

Flap wounds are caused by slicing injuries, for example with machetes on expeditions. Proximal structures are those near to the trunk; distal structures are those further away. In a proximal flap the point of attachment of the flap of skin is towards the trunk. Since arteries travel away from the heart, proximal flaps have a reasonable blood supply. Conversely, in a distal flap the point of attachment of the skin lies distal to the rest of the wound. The blood supply is therefore poor and so the skin overlying distal flaps often becomes infected and dies.

When managing a flap wound:

- Turn the skin flap back and clean underneath.
- Snip away small pieces of dead tissue with sterile scissors.
- Apply a non-stick dressing around the edges of the wound, under the flap. This stops the wound from sealing and allows exudate to drain away.

It is important to let a flap wound heal from its base to its tip. Distal flaps usually become dusky and either dry out and go black or become infected. Patients with such flaps need to be evacuated for surgical treatment and usually require skin grafting. Treated properly, however, proximal flaps often heal well without infection. Flap wounds need to be re-dressed daily and a little less non-stick dressing applied each day so as to allow the flap to heal. Flap wounds should not be closed with sutures.

### *Contaminated wounds*

Wounds are very likely to become contaminated in some environments such as the jungle. Wounds should be cleaned carefully to remove any foreign material that might form a focus for infection. Painkillers given half an hour before scrubbing out a wound may decrease pain during the procedure; alternatively, an injection of local anaesthetic may make the task of cleaning the wound easier if someone is available to administer it. Debris can be flushed out of the wound using sterile saline. Contaminated wounds should not be sutured closed. It is better to let the wound heal from the bottom upwards by packing the wound open and changing dressings daily. Oral antibiotics may be necessary if wounds are very deep or contaminated, particularly if there are signs of infection (see below). These wounds should heal but there may be scarring.

### *Hand and foot wounds*

Wound complications in the hands or feet may result in crippling deformity. Any significant foot wound will not heal while an expedition member continues to walk around, so rest is imperative. Wounds should be treated by cleaning, careful assessment of movement, circulation and sensation, and then rest in the position of function. In the case of the hand, this means bandaging the hand with a sock or a crepe bandage initially, followed by gentle mobilisation. It should never be splinted with the hand and fingers straight, since if there is any stiffness after the injury the hand will be useless. Infections in the hands or feet can be devastating. If there is any suspicion of infection antibiotics should be started sooner rather than later (flucloxacillin or erythromycin).

### *Facial wounds*

Facial wounds usually heal quickly and with little infection. They should be cleaned, closed using Steri-strips rather than sutures where possible, and dressed as usual.

### *Eye abrasions*

Corneal abrasions can be caused by the removal of part or all of the top surface of the transparent cornea. This may be caused by a foreign body such as a contact lens, which may or may not leave a remnant in the eye. These abrasions can be extremely painful and visually debilitating. Immediate relief and some restoration of vision can

be achieved with a drop of amethocaine, which can be repeated but should not be used in excess. If the patient is in safe surroundings, a drop of tropicamide and chloramphenicol ointment can be applied and the eye should then be firmly padded, taking care that the lids are closed beneath the pad. Even a total removal of the corneal top layer should heal within 36 hours. If not, further specialised attention should be sought to exclude an infection or retained foreign body.

### *Bites*

Animal and human bites almost invariably become infected. Wounds should be cleaned very carefully and any dead tissue snipped away with a pair of sterile scissors. As these wounds are likely to become infected it is sensible to use antibiotics (co-amoxiclav or Augmentin) prophylactically (see also Chapter 20).

### *Scalp wounds*

The scalp has a very good blood supply and lacerations usually bleed copiously. Bleeding should be stopped with direct pressure. The skin edges may be brought together by tying the hair together, by using surgical “superglue” (for example Histoacryl) or by suturing the skin edges.

## **Foreign bodies**

### *Foreign bodies in the eye*

The patient is usually sure that something has gone into the eye. Check the surface of the eye carefully by asking the casualty to look in all directions. It may be possible to see the offending object and to remove it with a moistened cotton bud. However, often the foreign body is under the upper lid or there is too much spasm of the eyelid muscle to allow a good view. A couple of drops of local anaesthetic (amethocaine drops) will produce numbness after momentary stinging. It should then be possible to examine the eye more easily and evert the cartilagenous tarsal plate of the upper lid to check for a foreign body. To evert the lid ask the patient to look downwards. Grasp the upper eye lashes firmly while applying a cotton bud or match-stick to the skin crease of the upper lid. Push down with the cotton bud while lifting the eyelashes upwards with the other hand. This should provide a good view of the underside of the upper lid. Any foreign body can then be removed. If the foreign body cannot be removed easily the patient should be assessed by a doctor or nurse. Relief is usually instant and dramatic but the foreign body may have left an abrasion that can feel like a persistent foreign body. The treatment of an abrasion is described on page 143.

### *Foreign bodies in the ear*

Insects and ticks may crawl into the ear on expeditions. This may be very frightening for the individual. Water or oil should be poured into the ear. This will kill the insect

and may allow it to float out. Avoid using instruments to try to remove foreign bodies in the ear as they may cause damage.

### *Splinters*

Splinters can usually be removed using a fine pair of tweezers (the ones on Swiss Army knives are good) or a sterile needle. For more stubborn splinters, soaking may help. Spines from sea urchins are easier to remove after a couple of days when the wound becomes inflamed, or after softening the skin by soaking or applying salicylic acid ointment.

### **Wound infections**

Any wound can become infected. However, certain wounds, particularly bites, contaminated wounds and deep wounds, are more likely to become infected. Signs and symptoms of wound infection are pain, redness, heat, swelling and loss of function. In the later stages, red lines may be seen running from a limb wound up towards the body. Lymph nodes in the armpit, groin or neck may become enlarged and fever may develop.

### *Abscesses*

An abscess is a collection of pus. Even small collections of pus around the fingernails or toenails (whitlows) are extremely painful and debilitating. As pus accumulates, the skin over the abscess thins; this is referred to as pointing. Once the pus discharges through a breach in the thinned skin the pain, which is usually described as throbbing, rapidly resolves. If an abscess develops during an expedition, local heat and oral antibiotics (for example, flucloxacillin) may help. However, once pus is present it may be quicker and kinder to drain it. The skin may be numbed by applying ice, and then a swift crescent-shaped cut in the skin will produce a large enough hole to let the pus drain. A small piece of gauze soaked in saline inserted into the incision will act as a wick and stop the roof of the abscess healing over before all the pus has drained. In this way the abscess cavity will heal from the bottom upwards. The wick should be changed daily until the abscess has healed.

### *Cellulitis*

Cellulitis means infection of the skin. There may not be an obvious source of infection but the signs are the same as for a wound infection, i.e. redness, heat, pain and swelling. Treatment with antibiotics for streptococci or staphylococci will be necessary (amoxicillin plus high-dose flucloxacillin, or erythromycin).

## **BURNS**

Burns may be caused by dry heat, chemicals, friction or hot liquids. On expeditions

open fires and fuel stoves commonly cause injuries, particularly when people refuel lighted stoves or burn rubbish with petrol.

### **Classification of burns**

Burns may be divided into superficial, partial-thickness and full-thickness burns.

- Superficial burns: characterised by redness, swelling and tenderness; for example, mild sunburn or a scald from hot water.
- Partial-thickness burns: characterised by painful, red, raw skin and blisters.
- Full-thickness burns: characterised by pale, waxy and sometimes charred skin with a loss of sensation.

On an expedition it is important to differentiate between partial-thickness and full-thickness burns. Full-thickness burns need skin grafting so evacuation to medical help will be necessary.

### **Extent of burns**

The “rule of nines”, which divides the surface area of the body into areas of approximately 9%, is used to calculate the proportion of the body that is burned and so helps determine treatment (Figure 13.3). It may be easier to remember that the patient’s palm and outstretched fingers constitute approximately 1% of the body surface area. The severity of burns is often underestimated, even by doctors and nurses, and extensive burns need specialist assessment and treatment.

### **Treatment of burns and scalds on an expedition**

The usual first aid aims of caring for a burned patient are to:

- halt the burning process and relieve pain;
- resuscitate if necessary;
- treat associated injuries;
- minimise the risk of infection;
- arrange urgent removal to hospital.

In practical terms, to treat a burned patient:

- Resuscitate as appropriate, following ABC guidelines.
- Lie the casualty down.
- Douse the burn with copious amounts of cold water.
- Clean the burn carefully, leaving any adherent burnt clothing, etc., on the skin.
- Drain large blisters, as appropriate, by inserting a sterile needle at the edge of the blister, although the skin should not be removed.

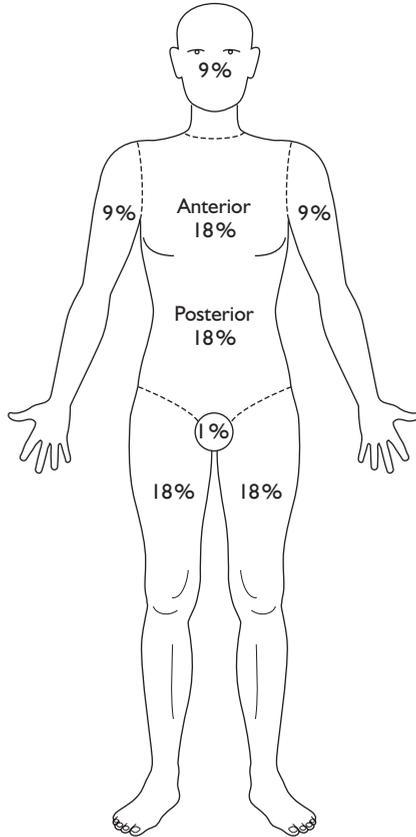


Figure 13.3 “Rule of nines”, a method to help assess the percentage of body surface burnt (a patient’s palm is approximately 1% of body surface area)

- Apply Flamazine cream (silver sulphadiazine) or Bactroban cream as an antiseptic.
- Dress with a protective layer, such as plastic kitchen Clingfilm or a polythene glove for a hand burn.

Dressings should be changed every one or two days as necessary, remembering that each dressing change increases the likelihood of infection.

### Sunburn

Sunburn, like blisters, should be avoided. Young people particularly try to get a sun-tan on the first day of an expedition and thus end up with sunburn. Graded exposure

to the sun, high-factor sun creams and sensible use of clothing should prevent sunburn. Once sunburn occurs, hydrocortisone cream or calamine lotion may relieve the discomfort of mild conditions.

## **BONE AND JOINT PROBLEMS**

### **Fractures**

Fractures may be classified as follows:

- Simple fractures, where there is a single, clean, bony break.
- Comminuted fractures, where the bone is broken into more than two fragments.
- Open or closed fractures, depending on whether the skin is breached.
- Complicated fractures, if other tissues are involved.

### *Diagnosis of fracture*

A fracture is suggested by pain and tenderness at the site of injury, swelling, bruising or discoloration, deformity and grating (crepitus). The last sign usually confirms a fracture. Pain, tenderness, bruising and swelling can also be seen in sprains and other soft-tissue injuries. However, loss of limb function usually, but not always, suggests a fracture. In an expedition setting where X-ray facilities are not available, treat as a fracture if uncertain. Evacuation can sometimes be delayed until the exact nature of the injury becomes more obvious.

### *Treatment of fractures*

Alignment of the bone ends at a fracture site to enable healing requires *immobilisation*, which prevents further damage, reduces pain and decreases the risk of shock. This cannot always be obtained in the field.

Many things can be used to improvise splints for immobilisation:

- Karrimat
- Sleeping bags
- Inflatable splints
- Trekking poles
- Skis
- Triangular bandages
- Canoe paddles
- Purpose-built splints such as Frakstraps.

When splinting any fracture, bony prominences must be padded and the joints above and below the fracture immobilised. It may be necessary to straighten the limb

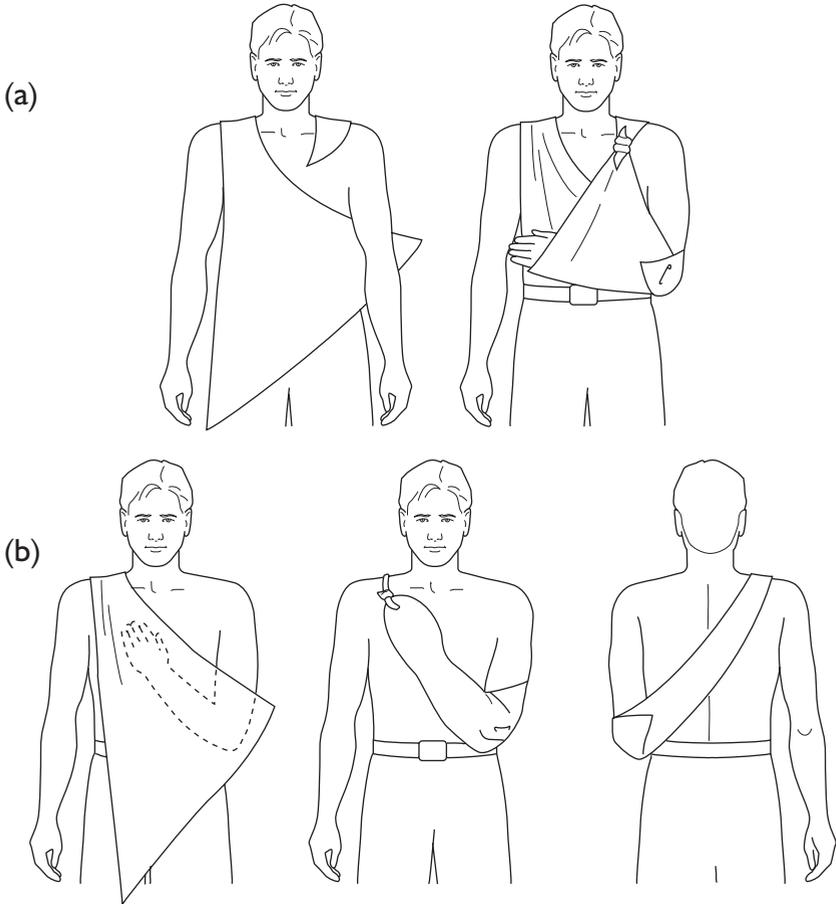


Figure 13.4 (a) The broad arm sling for arm and forearm injuries. (b) The high arm sling for hand injuries, infections and dislocated shoulders

in order to apply a splint, to relieve pressure on a blood vessel or to allow transfer on to a stretcher. Straightening the limb (reduction) is painful but rarely causes increased damage. Reduction requires strong traction/counter-traction in the long axis of the limb and is more readily done soon after the injury, before severe muscle spasm occurs. If there is no pulse beyond a fracture site the limb must be manipulated urgently into a position to restore the blood supply to the limb. Signs of an interrupted blood supply are absent pulses with pale, cold skin and severe pain. Movement, circulation and sensation should be checked both before and after any manipulation or movement.

### *Bleeding*

Bleeding occurs with all fractures and may result in shock or even death, particularly in fractures of the thigh or pelvis. Shock should be anticipated and treated appropriately.

### *Open fractures*

In an open fracture the skin is breached and therefore there is a risk of infection. Infection involving the bone is called osteomyelitis. This can be difficult to treat and can lead to crippling deformity and even amputation. Open fractures should always be treated as for contaminated soft-tissue injuries, by cleaning the wound to remove grit and foreign material and covering with sterile dressings. Co-amoxiclav (Augmentin) or erythromycin should be commenced to prevent infection and urgent evacuation should be arranged.

### *Pain relief*

Pain caused by fractures is decreased by effective immobilisation. Painkillers should be given before attempting reduction and during evacuation.

### *Transportation*

Fractures should be immobilised and other injuries attended to before evacuation, unless there are hazards in the immediate area. Always consider spinal injury, particularly if there is any injury above the level of the collarbones. Casualties with fractures of the upper limbs and ribs may be able to walk. Those with head injuries, back, neck or lower limb injuries must be carried by stretcher.

### **Spinal injuries**

Damage to the spinal cord can result in permanent paralysis and even death. The higher the level of spinal injury the greater the degree of disability. In about 10% of head injuries leading to unconsciousness there is an associated neck injury so all casualties with significant head injuries should be treated as if they have an unstable neck fracture. Spinal injury should be suspected if there is neck or back pain or pain radiating around to the front of the body. On examining the casualty there may be a “step” or swelling along the vertebral column, or loss of sensation, weakness or paralysis. In males erection of the penis may occur (priapism). Remember the spinal cord may not be damaged initially even with a spinal fracture; however, moving an unstable spine may damage the spinal cord and result in permanent paralysis. All casualties at risk of spinal injury should therefore be moved with the spine “in line” as if they have an unstable spine. Movement, circulation and sensation should be assessed before moving the victim, unless the danger of further injury necessitates a scoop-and-run approach. For details on stabilising neck injuries and log-rolling patients see Chapter 14.

Patients with a suspected spinal injury should be evacuated by helicopter; how-

**TABLE 13.3 MANAGEMENT OF SPECIFIC FRACTURES**

Hand and fingers	Bandage in a fist around a rolled-up sock and elevate in a sling (i.e. splint the hand in the position of function)
Forearm	Splint the wrist straight and the elbow at 90°
Elbow/upper arm/ shoulder	Use a broad arm sling with a swathe around the body to reduce movement
Collar bone	Use a broad arm sling
Foot and toes	Often well-splinted in a boot. Watch for numbness and swelling. It may be necessary to cut the boot off if swelling occurs
Ankles	Immobilise the foot and knee. Assisted walking may be possible
Lower leg/knee	Immobilise foot, ankle and knee
Thigh/hip	Traction is desirable as the bone ends often override damaging the surrounding tissues. Splint both legs together or use a traction splint. In hip fractures there is characteristic shortening and external rotation on the affected side
Pelvis	Treat as for a fractured thigh. <b><i>Pelvic fractures are associated with severe bleeding and damage to internal organs. Suspect if pressure on the pelvis leads to pain.</i></b> Bind the legs together to prevent further movement of pelvic fragments

ever, if this is not possible every effort should be made to immobilise the neck and back completely. Patients who do not have normal sensation can quickly develop pressure sores so stretchers should be well padded. The patient will require regular and careful changes of position.

### **Dislocations and other injuries**

A dislocation interrupts the normal relationships of a joint. The bone may be forced out of its socket (for example, shoulder, hip and elbow dislocations) or the joint surfaces may simply be displaced (for example, finger dislocations). Fractures, nerve and blood vessel injuries may be associated with dislocations.

Dislocations cause pain which is aggravated by movement, tenderness, swelling, discoloration, limitation of movement and deformity. The injured limb should be compared with the non-injured limb. Correction of dislocations can be technically

**TABLE 13.4 SPECIFIC DISLOCATIONS**

Fingers	Finger dislocations can usually be reduced easily Splint to the next finger, i.e. “buddy strapping”, after reduction
Thumb	Often associated with a fracture, best management is immobilisation in the position of function
Elbow	Reduce elbow dislocations as quickly as possible As with all fractures and dislocations, check the pulse and sensation before and after reduction as nerves and blood vessels can easily be damaged. Considerable force may be required and, if the pulse is not restored, try again. Splint the elbow at 90°
Shoulder	Diagnosis is suggested by squaring of the shoulder joint, the arm is often rotated outwards and held away from the trunk. To reduce: – Bend the elbow to 90°. – Hold the elbow at the patient’s side very gently and slowly move the arm outwards Immobilise the arm in a sling for 2 weeks
Knee	Major dislocations of the knee realign readily – because of severe damage to the ligaments Kneecap dislocations can be reduced by straightening the leg and pushing the kneecap back into position Immobilise as for a fracture
Jaw	If the jaw is locked open, it is dislocated Wear gloves and pad the thumbs to avoid injury as the person will bite involuntarily Place the thumbs over the victim’s lower molars and press directly downwards Considerable force may be required

difficult as nerves and blood vessels can be damaged during reduction. However, attempts to correct the deformity are justified in certain circumstances, particularly in remote areas. For example, if the blood supply to the distal part of the limb is compromised by a dislocation, reduction must be attempted. This should be done as soon as possible after the injury because of increasing muscle spasm.

- Steady, firm traction along the limb’s long axis should be applied to attempt to correct the deformity and to improve the blood supply. After reduction the limb should be splinted as for a fracture.

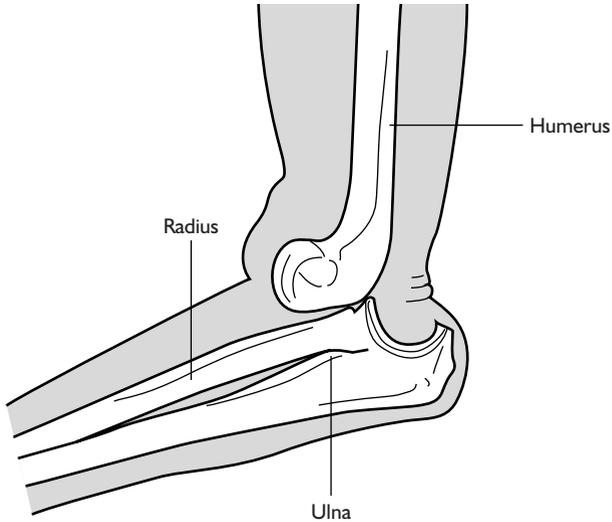


Figure 13.5 *Dislocation of the elbow*

### **Other injuries of bone and related injuries**

#### *Subperiosteal haematoma*

A direct blow to a bone may damage the tissue, the periosteum, covering the bone. Bleeding underneath the periosteum produces a subperiosteal haematoma. This is a very painful injury, commonly seen on the shin; the area is often exquisitely tender with some swelling. Treatment consists of elevation, cold packs and anti-inflammatory drugs. If a fracture cannot be confidently excluded, treat the injury as a fracture.

#### *Sprains and strains*

These are tearing or stretching injuries of ligaments and tendons around a joint which can be associated with a great deal of swelling and bruising. The injury may impair function as seriously as a fracture or a dislocation. Treatment consists of **rest, ice, compression** and **elevation** (RICE – see Bruises, page 141). Immobilisation with a plaster of Paris backslab or splinting will improve pain.

#### *Muscle and tendon tears*

Muscles may be torn from their attachments by a sudden, strong force or by penetrating injuries. A complete tear will result in loss of muscle function and a partial tear will produce weakness.

Common sites of muscle/tendon tears are:

- Fingertip (mallet finger)

- Shoulder
- Achilles' tendon
- Thigh.

Treatment consists of rest, ice, compression, bandaging and immobilisation. Evacuation for surgical repair may be necessary.

### *Tenosynovitis*

Tenosynovitis is inflammation of the sheaths that surround tendons and is caused by overuse or penetrating injury. The diagnosis is made by eliciting pain on movement of the involved tendon. If the cause is overuse, treat with rest and anti-inflammatories (such as ibuprofen). If infection is suggested by a history of trauma and there is painful movement with redness and swelling, antibiotics and immediate evacuation may be necessary to save the function of the limb.

### *Joint effusion*

Swelling around joints, particularly the knee and elbow, occurs commonly following injury. Treatment consists of elevation, rest, support bandaging and anti-inflammatory drugs.

## **PAIN MANAGEMENT**

A person's response to pain is subjective and is influenced by factors such as fear, anxiety, fatigue, extreme cold or heat, and the responses of those nearby. Since these factors are important in the perception of pain, much can be done to make a patient in pain more comfortable, even if an expedition is carrying very few drugs. Reassurance, shelter, warmth, splinting of fractures, relief of skin pressure by careful turning, adequate food and fluids, and rest will all help to relieve pain.

Severe pain may be associated with nausea. The control of associated symptoms such as nausea and vomiting with antisickness drugs (such as prochlorperazine, Stemetil) will, in itself, promote rest and improve pain.

### **The treatment of pain**

The treatment of pain requires an assessment by taking a history and doing a physical examination to ascertain the likely cause of the pain. The best therapy for pain is to treat the underlying cause. Where this is not possible, a simple stepwise approach using a limited number of drugs should control pain in the majority of cases.

The following features of the pain may be helpful in reaching a diagnosis:

- When did the pain start? Was there an injury?
- Where is the main site of the pain and does it move anywhere else?

- What makes the pain worse or better?
- Is it constant or intermittent?
- What is the character of the pain, for example, burning, crushing, dull, sharp, etc?
- Are there any other associated symptoms, for example, nausea, diarrhoea or vomiting?

### **Painkilling drugs**

Painkillers can be divided into three groups: simple painkillers, moderate-strength painkillers and strong painkillers. Expedition groups should have with them one or two simple painkillers, such as paracetamol or aspirin, and one or two moderate painkillers, such as dihydrocodeine or ibuprofen. Many groups choose not to carry strong painkillers, such as nalbuphine, tramadol and morphine.

Pain caused by an accident or injury should initially be treated with a simple painkiller given regularly, i.e. given by the clock rather than waiting until the pain returns. However, for a headache, it is sufficient to take a dose of a painkiller and then wait and see if the pain returns. If pain caused by an injury is not controlled by a regular, simple painkiller, then a moderate painkiller should be taken, again regularly and at the recommended dose. Pain caused by severe injury may require strong painkillers. The same principles of regular administration apply, but the dose may also need to be increased until pain is controlled.

### **Simple painkillers**

#### *Paracetamol*

This can be taken for mild-to-moderate pain and fever. Side-effects are rare and the dose is two tablets (1g) 4–6 hourly (no more than eight tablets in 24 hours).

#### *Aspirin*

Aspirin is good for mild-to-moderate pain and fever. It is a good painkiller and an anti-inflammatory drug, but some people are allergic to it and it may cause stomach irritation. The dose is one to three tablets (300–900mg) 4–6 hourly (no more than 4g in 24 hours).

#### *Ibuprofen (Nurofen, Brufen)*

Ibuprofen is an anti-inflammatory drug that is useful in the treatment of muscle and joint pains, period pains and where pain is associated with inflammation. It can be taken in combination with paracetamol or weak or strong painkillers. However, it should not be given with aspirin or to patients with an aspirin allergy or a history of peptic ulcers. Side-effects are indigestion, heartburn and nausea. In some individuals asthma may be made worse. It should be taken with food and the dose is 400mg every 8 hours.

*Minims Amethocaine (Amethocaine hydrochloride 0.5%)*

One drop gives about 20 minutes of pain relief, suitable for the examination and management of a painful eye e.g. ocular abrasion, snowblindness or a foreign body in the eye. It is available in 10ml bottle or 0.5ml Minims.

**Moderate-strength painkillers**

*Dihydrocodeine (DF118)*

This can be taken for moderate pain. Side-effects are constipation, nausea and drowsiness. The dose is one tablet (30mg) three to four times a day.

*Tramadol (Zydol)*

Tramadol is used for moderate-to-severe pain. It can cause nausea, vomiting, dry mouth, drowsiness and a rash. It should not be taken with alcohol and should not be given after head injuries or to people with epilepsy as it may precipitate fitting. The dose is one to two tablets (50–100mg) 4–6 hourly, maximum eight tablets a day. It can also be given as an injection (50–100mg, 4–6 hourly).

**Strong painkillers**

*Morphine*

Morphine, an opiate, is a strong painkiller with potent sedative side-effects. Together these effects relieve pain and may help relieve anxiety following an accident or in serious illness. Morphine is a controlled drug and is difficult, but not impossible, to obtain and export for expedition use. As it causes sedation, it should not be given to any patient with a significant head injury. Morphine also depresses respiratory function and should be used with great caution in patients with chest injuries. It may cause nausea and vomiting and it is wise to give morphine with an antisickness drug, such as prochlorperazine, which can be given by mouth, by suppository or by injection. Morphine is very constipating. It should be given every 4 hours and the dose depends on the patient and the severity of the pain; however, a range of 5–15mg intramuscularly is usual. All opiates can cause drug dependence given over a prolonged period. This is not a problem for short-term use to relieve the pain of an injury. Morphine may also be given by mouth and by slow intravenous injection.

*Nalbuphine (Nubain)*

Nalbuphine is a strong painkiller but is not subject to the legal restrictions covering drugs such as morphine or pethidine. It is therefore more appropriate for most expeditions. Its side-effects are similar to morphine. Nalbuphine is given by injection subcutaneously, intramuscularly or intravenously. The dose is 10–20mg for a 70-kg patient every 3–6 hours.

*Buprenorphine (Temgesic)*

This drug is similar to morphine, although less potent, but is administered by placing a tablet under the tongue. It is also a controlled drug but the mode of administration may be easier in some cases. Other precautions and side-effects are as for morphine. Buprenorphine makes many individuals very nauseated and a drug such as prochlorperazine may need to be given with it. The dose is one to two tablets (200–400 micrograms) under the tongue 6–8 hourly.

If strong painkillers are necessary to relieve pain in an injured casualty, the doses used and the time they were given should be recorded and this information handed on when the patient is evacuated. If a group decides not to carry strong painkillers, a severely injured casualty can still be managed with weak painkillers and the comfort measures noted above; information and the presence of a competent, reassuring companion will be particularly helpful.

**SUMMARY**

Minor accidents and injuries do occur on expeditions, but with knowledge and a reasonable medical kit most should be treatable in the field and should not impair the enjoyment of the expedition. The expedition medical officer has a responsibility to consider when an accident or injury requires more expert help and to arrange for the patient's evacuation to a place of safety and competent care.

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