

CHAPTER 13

**FIELD MEDICAL CARE/
MEDICAL EMERGENCIES****Section I. INTRODUCTION****13-1. General**

Field medical care is best defined as the provision of helpful and needful things to a sick or injured person to restore him to the best possible state of physical and mental health in a field environment. Whether assigned to a field unit, TMC, or hospital facility, the medical specialist must perform many aspects of field medical care to the sick and wounded. This chapter outlines and discusses various field medical procedures that the medical specialist will be expected to perform. Some of these procedures will have to be modified due to special circumstances such as equipment shortage, the tactical situation, or the personnel available.

13-2. Qualities of the Medical Specialist

In order to provide effective field medical care to sick and wounded personnel, the medical specialist must possess certain personal qualities. Many of them are inherent while others must be cultivated and improved upon.

a. Aptitude is the ability to anticipate the needs of patients, make appropriate decisions, and to adapt to various working conditions. Intelligence and a reasonable degree of manual dexterity indicate an aptitude for field medical care procedures.

b. Attitude is the manner of acting, feeling, or thinking that shows an individual's disposition or opinion. A desirable opinion is one that generates—

- Cooperation and understanding with fellow workers.
- Concern and consideration for the patients' welfare.
- A sense of individual job satisfaction.

c. Interest is a strong motivating force to provide satisfactory duty performance. Interest in a duty assignment can lead an individual to improve upon abilities and job knowledge.

d. Personal hygiene is the quality that includes both physical cleanliness and mental hygiene.

Section II. MANAGEMENT OF BURNS**13-3. General**

a. Causes. Burns are commonly caused by direct contact with flames, hot liquids, chemicals, hot metals, hot air, steam, or electric current. Burns can cause a substantial loss of body fluids which results in shock. There is danger

of infection in all burns, especially if there are blisters or a loss of skin. Hot gas and flame burns of the neck, nose, and mouth are associated with airway swelling. Even minor burns, incurred in enclosed areas, may cause respiratory damage.

b. Severity. The severity of burns is measured by the degree or depth to which tissues are injured and by the extent or percent of body surface burned.

(1) *Degree of burns.*

(a) First degree. A first degree burn is superficial and involves only the outer layers of the epidermis. An example is minor sunburn in which the skin is red and painful, but with no blisters or fluid loss. It is not an open wound and does not become infected.

(b) Second degree. The second degree (partial thickness) burn extends into, but not completely through, the dermis. This type of burn destroys or damages skin cells, glands, and blood vessels. It is characterized by redness, pain, blisters, and "weeping" of serum. Body fluids are lost through the damaged skin. The second degree burn is an open wound and is susceptible to infection.

(c) Third degree. A third degree (full thickness) burn destroys all layers of the dermis and may extend through the subcutaneous tissues into the muscle layer and underlying bone. There may be amputation of parts. This burn is characterized by *insensitivity* to pain (nerve branches in the area are destroyed) and a hard dry surface which is either charred or pearly white. The surface is usually depressed below that of the surrounding second degree burn. Large amounts of body fluids are lost into the damaged tissues and through the destroyed skin layer. A third degree burn is an open wound highly susceptible to infection.

(2) *Percent of body surface area burned.*

(a) An early estimate of the percent of body surface area (BSA) burned is of great importance in determining the amount of fluid replacement necessary to prevent shock and in the management of mass casualties. Usually, first degree burns are not included in this estimate. For practical purposes (especially in an emergency situation), second and third degree burns are considered to have the same effect when estimating the percent of body surface burned (for fluid replacement purposes).

(b) The percent of BSA is estimated by using the "Rule of Nines" shown in Figure 13-1. The total body surface is divided into the major anatomic parts, each part representing approximately 9 percent or multiples of 9 except for the perineal area. The head and neck represent 9 percent; each arm including the hand, 9 percent; the anterior trunk, 18 percent; the posterior trunk, 18 percent; each leg including the foot, 18 percent; and the perineum and external genitalia, 1 percent. Proportionate areas of these parts may be estimated.

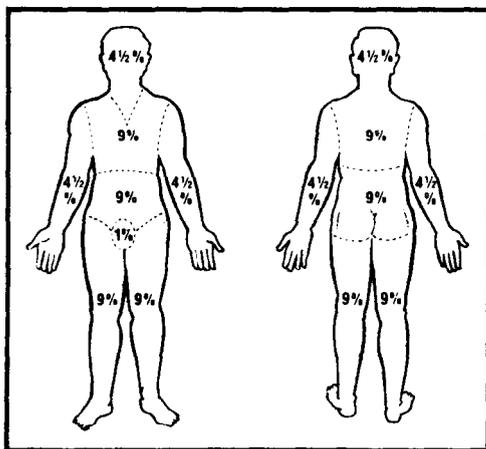


Figure 13-1. "Rule of Nines" BSA estimate.

13-4. Pathology of Second and Third Degree Burns

The pathologic process involved in second and third degree burns consists of three phases:

a. Phase 1. In the first phase there is always some destruction of the skin, which results in a loss of plasma. In second degree burns, there is a temporary loss of plasma in the form of edema fluid and a permanent loss through blister fluid or through "weeping" burned surfaces. Plasma rapidly seeps into burned tissues and produces widespread edema (swelling). Edema begins to develop at the time of burning and is evident within a few hours; it continues for 2 or 3 days. In second and third degree burns (particularly in third degree), there is destruction of red blood cells.

b. Phase 2. The second phase generally begins on the third day after injury. The coagulum which forms on the surface of second degree burns and eschar (scab) on third degree burns reduces fluid losses from the surface of the burn.

c. Phase 3. In the third phase, infection develops. Second and third degree burns are open wounds and are subject to contamination from the time they occur.

13-5. Classification of Burns

For emergency treatment purposes, second and third degree burns are classified by severity as minimal, moderate, or extensive, depending upon the percent of body surface burned.

- Minimal burn
 1. Third degree burns of less than 2 percent and no critical areas burned.
 2. Second degree burns of less than 15 percent BSA.
- Moderate burn
 1. Third degree burns of 2-10 percent BSA not involving face, hands, feet, or perineum.
 2. Second degree burns involving 15-25 percent BSA.
 3. First degree burns involving 50-75 percent BSA.
- Extensive burn

Burns of any degree that are complicated by respiratory injury or other major injury or fracture, or that involve hands, feet, face, or perineum.

13-6. Mortality Among Burned Patients

a. As a practical matter, *a second or third degree burn of more than 20 percent of the body surface endangers life.* In addition, the patient's age influences the outcome of a burn; the old and the very young do not withstand burn injuries well. *Without adequate treatment, a second or third degree burn of more than 30 percent is generally fatal to adults.* The outlook also varies according to the location of the injury.

b. Facial burns are often accompanied by complications involving the eyes or the respiratory passages; a serious risk of infection accompanies burns of the perineum. Most deaths among burn patients during the first few hours or days after injury can be attributed to shock. Some form of respiratory obstruction accounts for most other deaths during this early period. Pulmonary edema from burns about the face and neck or from inhalation of noxious agents, superheated air, or superheated vapor are prominent forms of respiratory obstruction. Gastrointestinal bleeding from a stress ulcer may account for some early deaths. Later mortality is almost always due to infection.

13-7. Procedure for Administering Initial Treatment for Burns

a. Survey the Patient.

(1) Respiratory functions of burn patients must be assessed frequently due to swelling and reduced respiratory function.

(2) Examine for singed nasal hairs, carbon-like material in the nose or mouth, or black or carbon-flecked sputum. These signs indicate inhalation burns.

CAUTION

Administer narcotics cautiously to burn patients because they may compromise respiration.

b. Determine the Cause of the Burn. If the cause is not evident, ask the patient or any bystanders for information.

c. Prevent Further Injury to the Patient.

(1) *Thermal burns.*

(a) Move patient away from any contact with the burn source.

(b) Remove all clothing and any metal items, such as jewelry. Do not remove clothing that is stuck to the burn, cut around the stuck clothing.

(c) Do not immerse the patient's whole body in water for more than 2 minutes.

NOTE

Ice or cold compresses may be applied locally to minor (first and second degree) burns. This will have a local anesthetic effect and relieve some pain. It causes vasoconstriction in the area, helping decrease edema. Ice should not be applied directly to the burn. Prepare a container of iced water and immerse the affected part for 10-15 minutes every 30-60 minutes for the first 6 hours. Care must be taken to avoid causing cold injury to the casualty.

(2) *Electrical burns.*

(a) Turn off the source of electrical current.

(b) If unable to do so, remove the patient by—

- Standing on a dry surface.
- Using a dry, nonconductive material such as a wooden pole or rope to physically move him from the source of the current.

NOTE

Electrical burns may cause deep, severe tissue destruction with only small skin burns at the point of current entry and exit.

CAUTION

1. Patients exposed to electrical currents may suffer cardiac arrest due to disturbances in their cardiac rhythm. Apply the ABC's of treatment and administer CPR if indicated.
2. Do not directly touch a patient receiving an electrical shock. Such contact will extend the current to you.
3. Examine the patient for exit as well as entrance burns (exit burns may be on soles of feet).

(3) *Chemical burns.*

- (a) Remove and dispose of contaminated clothing.
- (b) Brush off solid chemical particles.

CAUTION

Do not touch the chemicals or get them on your clothing.

(c) Flush the skin with large amounts of water for 20-30 minutes if possible. If the chemical is white phosphorus, flush the burn area thoroughly and cover it with a wet dressing.

d. *Expose the Burn Injury.* Expose the entire burned area by removing the clothing surrounding the affected area. Do not remove any clothing that is stuck to the burn to avoid increasing tissue damage.

e. *Determine the Percent of Body Area Burned.* Calculate the percent of BSA burned (using the "Rule of Nines") by adding the percentages of the affected areas (Figure 13-1).

NOTE

The actual percentage of body surface area burned is used to calculate fluid requirements. Incorrect estimates will distort the fluid requirements.

f. *Assess and Determine the Depth of the Burns.*

- (1) **FIRST DEGREE**—First layer of skin is red and painful (sunburn).
- (2) **SECOND DEGREE**—Skin reddened and blistered.
- (3) **THIRD DEGREE**—Full thickness of skin destroyed (burns down to the fat, muscles, and/or bones).

g. Treat for Shock.

(1) All patients with second and third degree burns of 20 percent or more body surface area must be treated for shock.

NOTES

1. Burn patients are extremely susceptible to shock due to loss of large amounts of fluids through the burned area.
2. The head and neck should be elevated if those areas are burned.
3. Place the patient in a high semi-Fowler position to assist in respiration. Monitor closely for respiratory difficulty.
4. Elevate burned extremities above the level of the heart. Assess for the presence of peripheral pulses and record presence or absence on FMC. Excessive edema can impede circulation.

(2) Start an IV with lactated Ringer's solution through a large bore needle (14-16 ga).

NOTE

Start the IV in an unburned area, if possible. Starting it in a burned area increases the chances of infections.

(a) Calculate the patient's body weight in kilograms by dividing his weight in pounds by 2.2 (see Table 13-1). This will yield the patient's approximate kilogram weight.

(b) A simple method of fluid replacement for field management involves patients who have sustained *greater* than 20 percent BSA second or third degree burns. A large bore IV is started and the patient receives 1 liter of lactated Ringer's solution per hour for the first 2 hours. If the patient cannot be evacuated during that time and must remain in the field environment, the following calculations will be utilized for fluid replacement:

1. Multiply 1 milliliter of fluid (1.00 cc) times the percentage of body surface area burned times the kilograms of the body weight. This will give the total amount of fluids (in cc's) to be administered during the first 8 hours. **EXAMPLE.** The patient weighs 165 pounds (75 kgs) and 30 percent of his body surface area is burned. This equals to $1.00 \text{ cc} \times 30 \times 75 = 2250 \text{ cc's}$ for the first 8 hours. In the first 24 hours the patient will require 1-4 cc's of electrolytes times the percentage of burns times the body weight in kilograms. This is required to maintain an adequate urine output (30-50 cc's/hr). (This fluid requirement may be as much as 9000 cc's in the first 24 hours in the above example.)

2. Measure the urine output as small, medium, or large volume and record it on the FMC (indicate the times(s) of output if possible).

3. Patients with extensive burns should have a Foley catheter inserted to monitor urine output (See Chapter 14). Urine output should be maintained at 30-50 cc/hr. If the patient is vomiting, distended, nauseated, or has burns over 25 percent BSA, a nasogastric tube should be inserted.

Table 13-1. Pounds/Kilograms and Conversion Table.

Kgs	5	10	15	20	25	30	35	40	45
Lbs	11	22	33	44	55	66	77	88	99
Kgs	50	55	60	65	70	75	80	85	90
Lbs	110	121	132	143	154	165	176	187	198
Kgs	95	100	105	110	115	120	125	130	135
Lbs	209	220	231	242	253	264	275	286	297
Kgs	140	145	150	155	160	165	170		
Lbs	308	319	330	341	352	363	375		

NOTES

1. The percentage of body surface area burned is used as a whole number, not as a decimal.
2. In the first 24 hours the patient may need fluids up to, or in excess of 4 ml/kilogram/percentage of burns. This fluid requirement could actually be in excess of 20,000 cc's for a large person (200 pounds) with extensive burns (75 percent BSA).
3. Fluid rates adjusted to maintain a drop rate of approximately 94 per minute insures the administration of 2250 cc's in 8 hours.

h. Dress the Burns. Do not apply dressings to the patient's face, hands, feet, or perineum.

CAUTION

Do not apply ointment or grease because they cause retention of heat in burns. If available, Silvadene or Sulfamylon cream can be applied.

Give the patient nothing by mouth unless an IV cannot be started; then only give *small sips* of water to a patient who will not reach the MTF within 3 hours. Do not give excessive amounts of water because kidney function may be impaired due to severe burns.

NOTE

Dressings will reduce fluid loss and aid in preventing the progress of shock. If sterile dressings are not available, apply the cleanest cover possible (a clean blanket or sheet).

13-8. Treatment of the Patient with Extensive Burns

With the best of care and treatment conditions, only about 50 percent of patients with extensive burns survive more than a few days. With the limited medical capability envisioned during the first 72 hours after onset of a mass burn situation, survival rate among these patients is expected to be much lower. Diversion of medical resources to these individuals when their chance for survival is so limited adds tragedy to disaster because it deprives other patients less gravely injured of the treatment, care, and supplies which, if applied early and correctly, can help them back to health. The extensively burned patient, therefore, has no priority for replacement fluid, dressings, antibiotics, or time of personnel except for those few moments needed to give analgesics or other medications available for the relief of pain. Those who survive the emergency phase are then given treatment and care to the extent possible that is not detrimental to the welfare of patients in higher priority treatment categories.

Section III. IMPALEMENT INJURIES**13-9. General**

When treating an impalement injury, immediate and positive action is required by the medical specialist. An understanding of the principles of emergency care combined with proper application of these principles will greatly reduce the possibility of post-injury complications including hemorrhage and shock.

13-10. Initial Treatment for Impalement Injuries

a. Always treat for life threatening conditions first. Check the patient for consciousness. If he is unconscious, the cardiac and/or respiratory functions may be impaired.

(1) If respiration is impaired, check the airway for obstruction and ventilate the patient, if necessary.

(2) Check the patient for presence of a pulse. If none can be detected, follow established procedure for performing cardiopulmonary resuscitation.

b. DO NOT remove the object. Its removal may cause severe hemorrhage or damage of nerves or muscles lying close to the object. Try to stop any bleeding from the entrance wound by direct pressure on the surrounding tissue; avoid exerting any force on the impaled object itself.

c. Remove clothing covering the wound. Use a bulky dressing to stabilize the object. The impaled foreign body should be incorporated within the dressing so that its motion is reduced after the bandage is applied.

d. Transport patient to more definitive care with the object still in place.

13-11. Impalement Injuries of the Head

a. When evaluating a patient with an impalement head wound, you should—

(1) Assess the level of consciousness—conscious, confused, semiconscious, unconscious.

(2) Evaluate eye movements and pupil response—dilated, constricted, responsive to light, equal or unequal pupil size.

(3) Assess posture and movement (motor system) including reflexes.

b. Treatment.

(1) Check for life threatening conditions.

(2) Cut through sterile dressings to the halfway point and place them around the impaled object. The number and placement of the dressing will depend upon the size and position of the object.

(3) Use additional bulky materials/dressings to build up the area around the object.

(4) Apply supporting bandage over bulky materials to hold them in place. Gauze with adhesive tape, cravats, and strips of clothing may be used as bandaging material. Exercise caution when using elastic bandages since they can be difficult to apply by one person and may be applied too tightly.

(5) Record the treatment given on the FMC.

(6) Evacuate the patient immediately to the nearest medical treatment facility.

c. Treatment of impalement injury to the eye.

(1) Place padding around the protruding object, but do not touch or remove the object (Figure 13-2).



Figure 13-2. Padding placed around protruding object.

(2) Caution the patient not to squeeze his eyelids together.

(3) Cut partially through a first aid dressing so that it will fit around the object (Figure 13-3). This will keep the object from being pushed further into the eye.

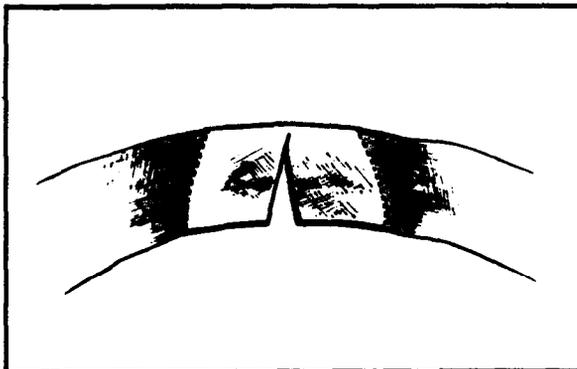


Figure 13-3. Cut first aid dressing.

NOTE

Padding must not put pressure on the object. It should also be built up so that it prevents the object from moving. The padding may be cloth material folded to fit the eye area. Tape may be used to hold the padding in place.

(4) Place the first aid dressing over the injured eye. If necessary, apply a second dressing so that both eyes are covered.

13-12. Impalement Injuries of the Chest

a. An object that has penetrated the chest wall may also penetrate and sever or come near a large blood vessel. This can cause a pneumothorax, tension pneumothorax, or hemothorax. In these conditions, normal lung expansion cannot occur and the lung is compressed so that volume of air is lost. Less air can be inhaled and there may be significantly less blood to carry the reduced amount of oxygen available to the patient.

b. Treatment. Use the same treatment procedures as outlined for treatment of an impalement head wound.

13-13. Treatment of Impalement Injuries of the Extremities

a. Check patient for immediate life threatening conditions first. Caution patient to remain still and not remove the impaled object. Expose the injury by cutting away clothing, shoes, or equipment (Figure 13-4). Check the pulse in the extremity involved, distal to the injury site.

b. Immobilize the impaled object by cutting through sterile dressings to the halfway point and placing them around the impaled object. This will help control bleeding and stabilize the object (Figure 13-5).

c. Use additional dressings or bulky materials to build up the area around the object. Two persons should be used to perform this procedure. One to immobilize the object and prevent any motion and the second to apply the bulky dressing (Figure 13-6) and bandaging (Figure 13-7).

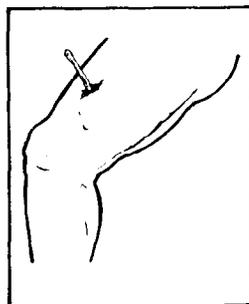


Figure 13-4. Exposed impalement.

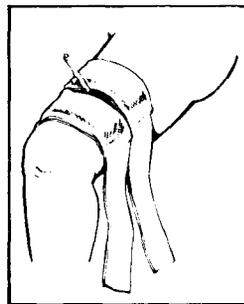


Figure 13-5. Dressing around impalement.



Figure 13-6. Bulky materials used.

d. Apply the bandage as tightly as possible to stabilize the object, but not to the point where it will interfere with circulation. Gauze with adhesive tape, cravats, and strips of clothing may be used as bandaging material.

e. Secure support bandage with adhesive strips or safety pins (Figure 13-8).

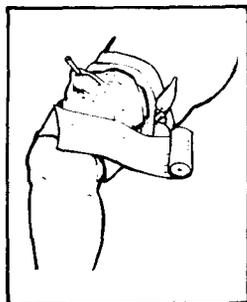


Figure 13-7. Applying bandage over bulky support materials.

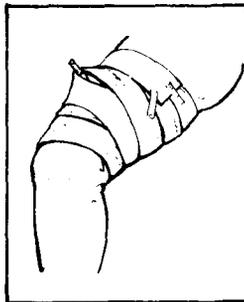


Figure 13-8. Securing bandage.

13-14. Immobilize the Affected Area

Immobilize the injured area by a—

a. *Splint.* Objects impaled in limbs require that the limb be splinted in the same manner as a fracture to prevent movement.

b. *Sling.* When an object is impaled in the upper chest and an arm is affected, the arm should be placed in a sling and swathe (see paragraph 13-52) to prevent movement and further damage.

CAUTION

1. The splint or sling should not be anchored to the impaled object.
2. Avoid undue motion of the impaled object when applying splints.

NOTE

In some instances, it may be necessary to shorten the length of the impaling object prior to evacuating the patient. Due to possible damage to underlying tissues, any manipulation of the object should be done with minimal movement.

13-15. Evacuate the Patient.

- a. Check the patient's pulse distal to the injury site.

NOTE

If indications of shock are noted, follow the procedure for treating hypovolemic shock. This procedure may be used for all impalement injuries.

- b. Record the treatment given.
- c. Evacuate the patient immediately.

Section IV. HEAD, FACE, NECK, AND SPINE INJURIES**13-16. General**

a. With the exception of fractures of the arms or legs, injuries to the head, face, neck, and spine are among the most common you will see. There is a wide range of injuries that can occur in these areas, from minor maxillofacial abrasions to massive trauma injuries. This section describes these injuries in detail and provides definitive treatment procedures.

b. The head consists of two major structures: the skull and the brain.

(1) *Skull.* The skull is essentially a hollow structure. On the outside are the musculature (muscle structures), skin, and appendages of the face and scalp. The scalp and facial structures are attached to the bones of the skull by means of a thin, tough, fibrous sheath, the periosteum. Within the face are the structures of the mouth, nose, and pharynx. The largest hollow of the skull, the cranium, contains the brain. The cranium completely envelops the brain except for a hole at the base of the skull through which the spinal cord connects with the brain. Cranial nerves and blood vessels pass through small holes in the cranium that are sealed by the cranial lining.

(2) *Brain.* The brain is the primary organ of life and the chief component of the central nervous system (CNS) (see Chapter 7). It is protected from injury by three separate mechanisms: the skull, the meninges, and the cerebrospinal fluid (CSF). The CNS consists of the brain, the spinal cord, and peripheral nerves that control all activities of the body. The brain directly controls the functions of the eyes, ears, face, heart, and respiratory apparatus by means of electrical charges that pass between these structures and the control centers in the brain by the cranial nerves. Interference with these control centers results in erratic behavior or cessation of function in the organs and structures they control. Brain cells do not regenerate. Once a brain cell is destroyed, it cannot be replaced by a new brain cell. Scar tissue takes its place, but not its function, which is lost forever. The brain lies very close to but not directly against the bones of the cranium. It is separated from the cranium by the meninges and fluid. The outer surface of the brain is intimately covered by one of the meningeal membranes, the pia mater, which contains many small blood vessels. The cranium is lined intimately with the dura mater (a tough, fibrous, relatively thick meningeal membrane). Between the dura and the pia is a thin subdural space, which contains a little fluid, the delicate net-like arachnoid membrane, and the subarachnoid space filled with cerebrospinal fluid. This fluid, which is clear, salty, and very watery, bathes the outer and certain inner surfaces of the brain and the spinal cord.

13-17. Classification of Head Injuries

Head injuries discussed in this section are limited to those involving the scalp, cranium, and its contents. Head injuries are divided into two main classes, open and closed. (Facial and pharyngeal injuries are discussed in paragraphs 13-22 through 13-25).

a. Closed Injuries. No obvious external damage except for a possible bruise or contusion is present. Injury may be to the brain itself, the pia, or the arachnoid meninges (Figure 13-9). Ruptured blood vessels of the pia are particularly important in closed injuries. Blood spilled onto brain cells is a foreign substance and disturbs the functions of these tissues. Blood collecting within the cranium exerts pressure against the brain when there is no fracture to the skull, or the skull fracture is such that the integrity of the dura is not disturbed. If the skull is depressed (displaced inwardly), it may exert direct pressure on the brain even without formation of a hematoma (blood pool).

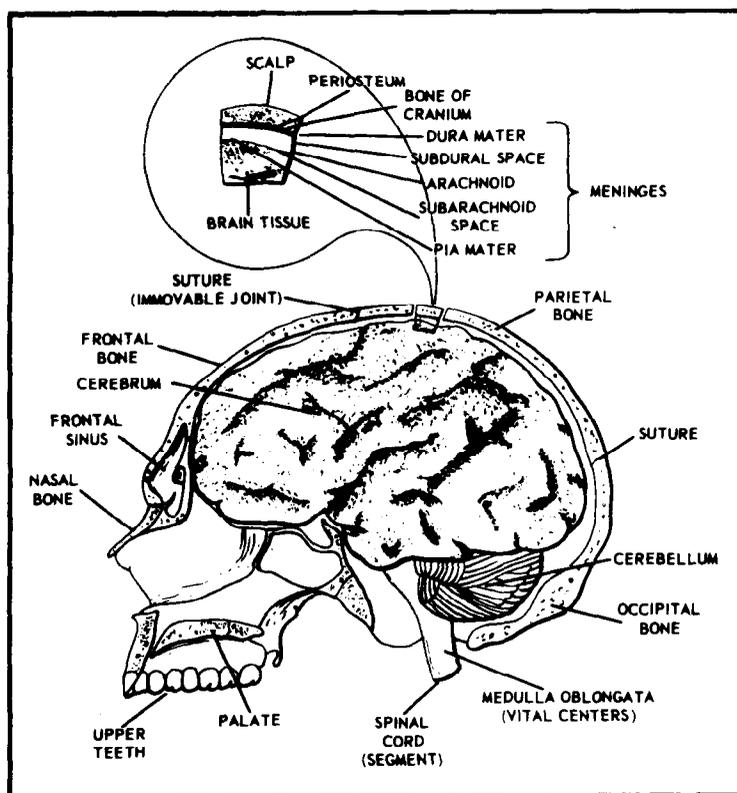


Figure 13-9. View of left side of brain with left side of skull and the mandible removed.

b. *Open Wound.* In an open wound there is obvious external damage. Open wounds of the head are subclassified according to whether or not the integrity of the dura is disturbed.

(1) *Nonperforated dura mater.* The wound may only be a laceration of the scalp which, although not to be taken lightly, may not be serious. Also, there may be one or more fractures of the skull without the dura being perforated. In either case, internal damage is likely to be or become more serious than that of the scalp and skull. If the skull is fractured, it will hold in the same manner as a closed injury against pressure of any hemorrhage that occurs within the cranium.

(2) *Perforated dura mater.* The skull is fractured in such a way that it is no longer a closed vault (part of it may be torn away) and the dura is open with the meninges exposed to the open air. In some cases, the delicate meninges are opened with the brain itself exposed or extruding through the opening.

13-18. Assessment of Head Injuries

All head injuries are potentially dangerous, not only because of the immediate tissue damage and increased susceptibility to infection, but also because of the probability that some vital area or special sense is or will become involved. For these reasons, all signs and symptoms referable to the nervous system must be carefully noted including the time of their occurrence or observation.

a. *State of Consciousness.* A notation of the state or states of consciousness observed in the patient will greatly assist the physician who treats the patient later. The following descriptive terms should be used, as appropriate, to define the state of consciousness observed.

- *Conscious.* Patient is alert and oriented in time and space.
- *Confused.* Patient is alert but disoriented and excited; he can take fluids by mouth. The disorientation and excitement may be temporary and have a psychological basis in addition to, or instead of, brain injury.
- *Semicomatose (semiconscious).* Patient responds to any applied stimulus; he cannot be given fluids by mouth. The patient displays unnatural drowsiness (sommolence)
- *Comatose (unconscious).* Patient does not respond to any applied stimulus; he cannot be given fluids by mouth.

b. *Pupil Size.* Normally, pupils of the eyes become very small in the presence of strong light and dilate (become larger) as the light fades. Dilation in the presence of strong light indicates central nervous system impairment. Normally, the pupils are also matched in size. When neither eye is obviously injured and the pupils are of unequal size, brain impairment is assumed.

c. *Muscles.* The musculature on one or both sides of the face may droop due to a lack of brain stimulation. There may be a loss of speech or an impairment to speech. Paralysis and a lack of firmness in the muscle mass of any part of the body without damage in that part, or no evidence of spinal cord damage, is an indication of impairment in the brain area that controls those muscles.

d. Vital Signs. The vital signs (temperature, pulse, blood pressure, and respiration) are important when treating head injuries. Changes in the vital signs frequently indicate the onset of complications. It is important to recheck and record vital signs frequently. Be especially alert for changes in pulse and blood pressure. Rising blood pressure with a slow pulse indicates increased intracranial pressure. Falling blood pressure with a rapid pulse indicates shock.

13-19. Symptoms of Closed Head Injuries

a. Headache, nausea, dizziness, and loss of consciousness (which may be brief, intermittent, or extended) may accompany a closed head injury. If the injury is from an impact with a blunt surface, an elevated contusion (bruise) forms when blood and other fluids collect in the subcutaneous tissue between the dermis and the skull; there may be a fracture of the skull if the skull is displaced inwardly. Many skull fractures can only be diagnosed by x-ray. However, there are several important signs to look for if a skull fracture is suspected. These signs are—

- Deformity, a depression or instability in a part of the skull.
- CSF leakage from the nose, an ear, or a scalp wound.
- Blood oozing from the nose or an ear.
- Ecchymosis (bruising) behind the ear(s) (Battle's sign).
- Ecchymosis in the soft tissue under the eyes ("Raccoon" or black eyes).

b. In more severe injuries, vomiting and paralysis of muscle groups may occur. The patient may bleed from the nose, mouth, or ears in the absence of obvious injury to these parts. CSF coming from the nose or ears indicates a serious injury. The CSF becomes cloudy when mixed with blood. Signs of increasing intracranial pressure include—

- Elevated blood pressure.
- Elevated pulse pressure (distance between diastolic and systolic blood pressure).
- Slow pulse.
- Restlessness.
- Dilation of one or both pupils.
- Decreased respiration.
- Cyanosis.
- Delirium or irritability.
- Paralysis.

13-20. Symptoms of Open Head Wounds

The patient may be either conscious or unconscious. Signs of intracranial pressure and internal damage, if any, are the same as for a closed injury.

a. Lacerations. Lacerations of the scalp bleed profusely because the blood vessels, which are quite numerous, do not constrict and retract as do those of other body areas. Scalp lacerations tend to remain open because the scalp, when intact, envelops the skull very tightly.

b. Skull Fracture. The skull may be misshapen, yielding, or minus parts or pieces. The most severe open head wound is a skull fracture in which the brain tissue is exposed through the skull or extruded through the bone fragments and lacerated scalp. Another type of skull fracture is caused by penetrating objects. If the object is protruding, no attempt should be made to remove it. The protruding end of an impaled object may have to be cut off to transport the casualty.

13-21. Treatment for Head Wounds

a. Open the Airway. Clear the air passage of any vomitus, mucus, or debris as necessary; place the patient in the coma position (Figure 13-10); turn the semicomatose or comatose patient from one side to the other every 20 minutes. As the patient's condition stabilizes, turning him every hour may be sufficient. Always protect the cervical spine. Patients with injuries above the clavicle are considered to have a cervical spine injury until proven otherwise.

NOTE

Maintaining an open airway is usually not a problem for patients who have only scalp lacerations; the first consideration with these patients is to control the profuse bleeding.

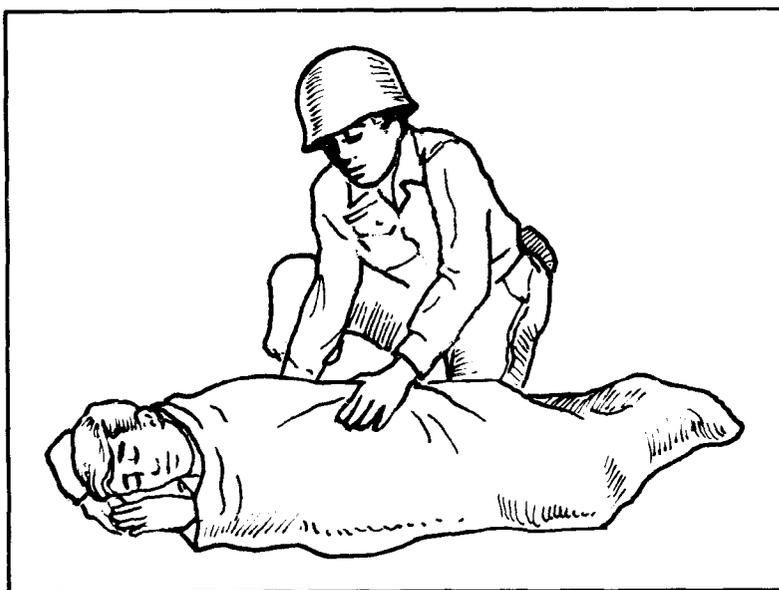


Figure 13-10. Coma position.

b. *Control Bleeding and Protect the Wound.* Do not remove or disturb any foreign material which may be in the wound; leave any protruding brain tissue as it is. Apply the dressing over this tissue.

(1) *Use a sterile pressure dressing.*

- Place the dressing over the wound (Figure 13-11), allowing the tails to fully unfold and hang along the side of the patient's cheeks.

- Grasp one tail, wrap it under the chin, up over the head covering the dressing, and down the opposite side of the head to the level of the patient's eyes (Figure 13-12).



Figure 13-11. Sterile dressing over the wound.

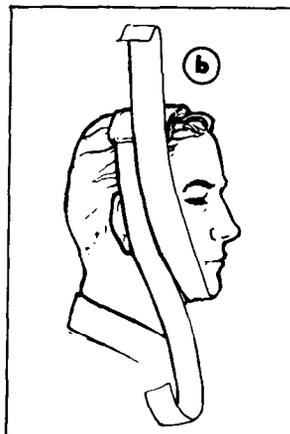


Figure 13-12. Tails wrapped around chin and head.

- Grasp the other tail, wrap it under the chin in the opposite direction and bring it up the side of the head, meeting the first tail at the level of the patient's eye.

- Cross the tails, wrap one tail around the back of the patient's head to the opposite ear. Wrap the other tail around the patient's forehead until it meets the first tail (Figure 13-13).

- Tie the tails over the crossings of the two directional wrappings (Figure 13-14).

NOTE

If blood seeps through the initial dressing, do not disturb the dressing. Apply a second dressing over it. This will help reinforce the primary dressing as well as aid in the clotting process for controlling the bleeding.

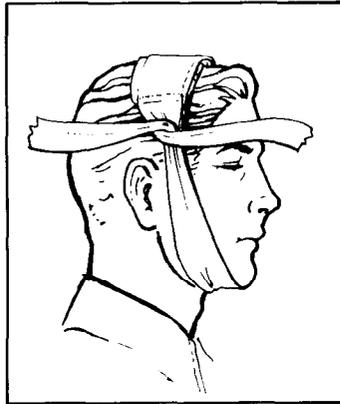


Figure 13-13. Tails crossed around the patient's head.

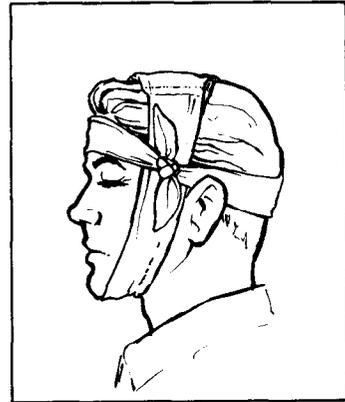


Figure 13-14. Tied dressing.

(2) Use a cravat and 4 by 4 inch gauze pads.

- If a field dressing is not available, place several 4 by 4 inch gauze pads over the wound site.
- Unfold one cravat (triangular bandage) completely.
- Place the cravat over the patient's head with the base (longest side) hanging over his eyes, and the tips hanging over the back of the neck (Figure 13-15).
- Fold the base upward along the creases by grasping both ends of the base and turning them upward until the patient's eyes and ears are uncovered.
- Wrap both tails around the head in opposite directions (Figure 13-16).
- Tie the tails at the side of the head (Figure 13-17).
- Tuck the third tip of the cravat under the band formed by the long tails at the back of the head. This is to hold the cravat snugly over the top of the head (Figure 13-18).

NOTE

If there is an injury or suspected injury to the cervical spine, the head must be immobilized before the patient is turned. The head must be maintained in a stable position.

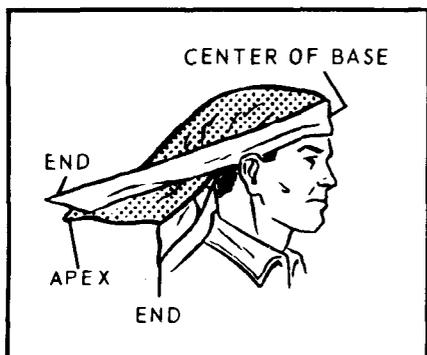


Figure 13-15. Cravat placed over head.

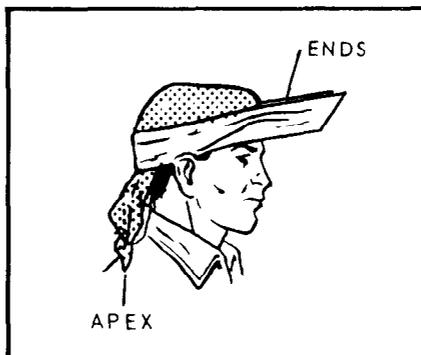


Figure 13-16. Cravat wrapped around the head.

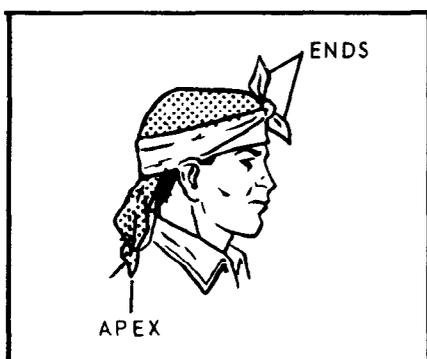


Figure 13-17. Cravat tied around the head.



Figure 13-18. Cravat tucked in on back of head.

c. *Prevent or Treat for Shock.* Apply measures for prevention or treatment of shock with the following exceptions:

- (1) Do not use the head-down position.
- (2) **DO NOT GIVE MORPHINE.** Morphine (a depressant) affects respiration, increases intracranial pressure, and decreases the patient's level of consciousness.
- (3) Do not give fluids by mouth. Initiate a large bore IV at a "keep open" rate, using dextrose, 5 percent, in water (D5W).

CAUTION

Administering an IV at faster than keep open rate risks over-hydration that increases intracranial pressure.

- d. *Record Treatment Given.*
- e. *Evacuate the Patient.*

13-22. Face Wounds

The face is very richly supplied with blood vessels. Therefore, injuries to the face are likely to have profuse bleeding or bruising. Hemorrhage is difficult to control. Because facial injuries may tend to be quite disfiguring, the medical specialist may apply dressings to these wounds first, forgetting the priorities of treatment. Facial wounds are life-threatening only when the airway is obstructed or there is massive bleeding.

13-23. Treatment for Facial Wounds

a. The most immediate concern in treating a person with facial wounds is to insure an adequate airway. Clear the mouth of blood, mucous, broken teeth, detached bone fragments, removable dentures, and other foreign material. If the patient is unconscious, the base of the tongue may rest against the back of the throat and block off the pharynx. This type of obstruction is easily relieved by using manual maneuvers to open the airway. Any force strong enough to produce severe facial injuries may have produced cervical spine injuries as well. Thus, when opening the airway, avoid hyperextension of the neck. The jaw thrust is the preferred technique when there is any suspicion of a cervical spine injury. If necessary, apply digital pressure to control bleeding while clearing the airway.

b. Place the patient in a comfortable sitting position. Tilt his head slightly forward to drain blood or mucous out of the mouth. Do not use the sitting position if—

- It would be harmful to the patient because of other injuries.
- The patient is unconscious, in which case, place him in the coma position. If there is a suspected injury to the cervical spine, immobilize the head before turning the patient on his side.

c. Apply a sterile dressing to the wound.

(1) Apply a sterile dressing using local pressure to help control the bleeding (Figure 13-19). The conscious patient or an assistant can hold the dressing in place.

NOTE

A laceration may extend through the cheek into the mouth with an object protruding from the injury. Remove the object before attempting to control the bleeding. This is the only time that an impaled object can be removed outside an MTF.

(2) If the patient or an assistant cannot hold the dressing in place, use one hand to maintain pressure on the dressing over the wound. Wrap the upper tail over the head and under the chin and hold in place over the wound.

(3) Wrap the other tail under the chin and over the head in the opposite direction from the first tail (Figure 13-20).

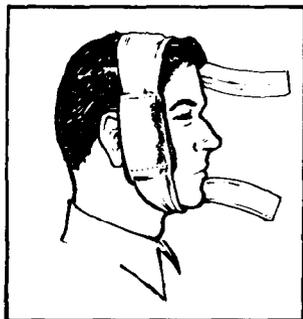


Figure 13-19. Dressing over the face injury.

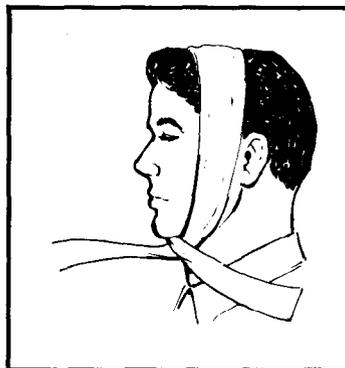


Figure 13-20. Wrapping the tails.

(4) Cross the tails over the ear on the dressing side of the head (Figure 13-21).

(5) Wrap the tails in opposite directions around the forehead and the back of the head.

(6) Tie the tails over the temple area above the ear on the uninjured side (Figure 13-22).



Figure 13-21. Crossing the tails.



Figure 13-22. Tails tied opposite the injury.

CAUTION

Do not tie the dressing so tight that it prevents drainage from the mouth.

d. Secure the dressing with a cravat bandage.

- (1) Fold the cravat to 3 inches in width.
- (2) Place the cravat over the dressing. Wrap one end over the head and the other end under the chin.
- (3) Cross the end above the ear on the opposite side from the wound.
- (4) Wrap one end around the back of the head and the other end around the forehead.
- (5) Tie the ends above the ear on the injured side.

13-24. Neck Injuries

The neck is the most vital and vulnerable part of the body anatomy. The airway, the blood supply to the brain, and the nerve supply to the whole body below the head passes through the neck. Injuries to the neck have enormous potential for lasting damage. Hemorrhage from a neck wound, unless attended to immediately, can rapidly become fatal. Major concern in emergency treatment of patients with neck wounds, other than those involving the spinal column, is keeping the airway open. The airway may be obstructed by blood, mucous, edema fluid, plasma (if the throat is burned), and broken parts of the trachea and larynx. Clearing the mouth (not the pharynx) with the fingers, together with postural drainage in the coma position may be successful. If not, an emergency surgical airway must be performed promptly by the most experienced medical person available.

13-25. Treatment for Neck Injuries

- a. Place a sterile dressing over the injury.
 - Pass the tails upward over the head on opposite sides and tie the knot on top of the head, OR
 - Pass the tails around the chest and back downward under the opposite armpit and tie the tails under the arm.
 - NEVER pass the tails around the neck, to avoid pressure on the trachea.
- b. Prevent or treat for shock with the following exceptions:
 - DO NOT use the head-down position.
 - DO NOT give morphine.

- c. Check for signs of closed head injuries.
- d. Record treatment given.
- e. Evacuate the patient.

13-26. Neck Fractures

a. The cervical vertebrae (skeleton) of the neck consists of the upper seven vertebrae of the spine. The greatest danger in a neck fracture is damage to the spinal cord, which can cause permanent paralysis. The nerves that control the diaphragm are located in the cervical spine. Injury to this area can cause respiratory difficulty and/or arrest.

b. Extreme care must be taken when moving an individual with a neck fracture. The injured vertebrae must be immobilized and maintained in its normal alignment parallel to the spine. Movement of the injured vertebrae can cause spinal cord damage (compression of the spinal cord) or the spinal cord may be severed by the movement, causing disastrous results.

13-27. Signs and Symptoms of Neck Fractures

- a. Ask the patient about his injury:
 - Does he have tingling or numbness in his upper extremities?
 - How did he receive the injury (auto accident, fall from a high place, dive into shallow water)?
 - If the patient is unconscious, question others that may have witnessed the accident.
 - Palpate for tenderness or deformities by inserting your hand under the patient's neck without moving his head. Gently feel the area of the back of the neck.
 - If the patient has pain or increased pain when pressure is applied to the back of his neck, treat him as having a neck injury. If he has pain in the shoulder region without signs of shoulder injury accompanied by pain in the neck, treat him as a neck injury patient.

b. Caution the patient not to move. Explain to the patient that movement may increase the severity of his injury. Do not frighten him, but insure that he understands the seriousness of his injury.

13-28. Treatment for Neck Fractures

- a. Immobilize the injury.
 - (1) If the patient is lying on his back, leave him in this position. If he is face down and has other injuries, or cannot breathe, request assistance in turning him over.

(2) To move the patient before splinting, grasp his head with your hands and apply gentle traction to maintain the head in alignment while others move or turn him (Figure 13-23).

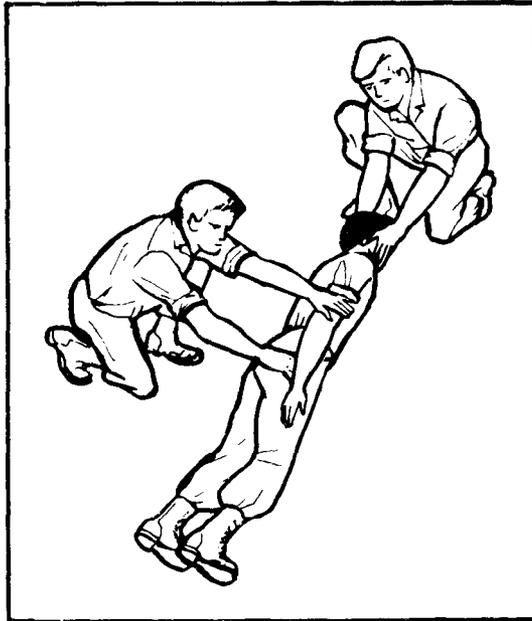


Figure 13-23. Turning patient on his back.

b. Apply a cervical collar to the neck.

NOTE

An improvised "collar" can be made from various materials (folded towel, T-shirt, field jacket, or other flexible material that will provide support).

- (1) Gently slide one end of the collar under the neck (Figure 13-24).
- (2) Wrap the collar around the neck. Be careful not to move the head or neck.
- (3) Fasten the collar in place with tape, safety pins, or a cravat (Figure 13-25).
- (4) Check the collar for tightness. If the skin at the temples shows signs of swelling, or if breathing is impaired, you must adjust the collar so that it is snug but does not fit too tightly.

c. With assistance, move the patient onto a spine board or another board that is at least 4 inches longer than the patient's height (Figure 13-26).

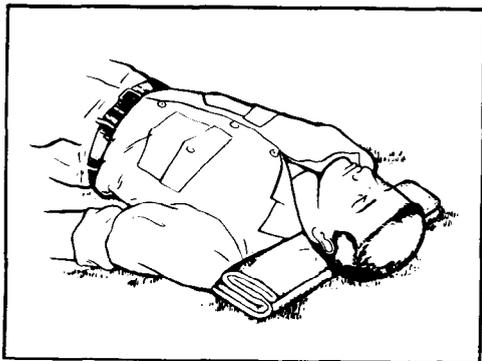


Figure 13-24. Collar under the patient's neck.

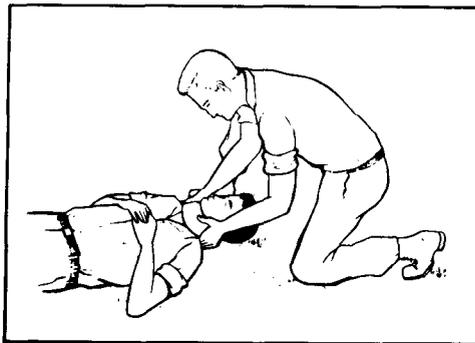


Figure 13-25. Collar fastened in place.

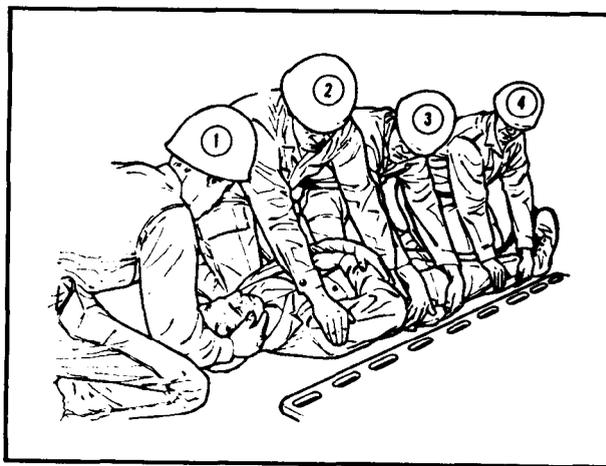


Figure 13-26. Placing patient on board.

CAUTION

Do not attempt to move the patient onto the board without assistance.

- d. Place a padded object on each side of the patient's head. To prevent movement, tie his head and the padding to the board.
- e. Place the patient and the board on a litter (Figure 13-27).

NOTE

If a board is not available, the patient's head can be immobilized by using padded material and tying his head to the litter.

- f. Record the treatment given.
- g. Evacuate the patient.

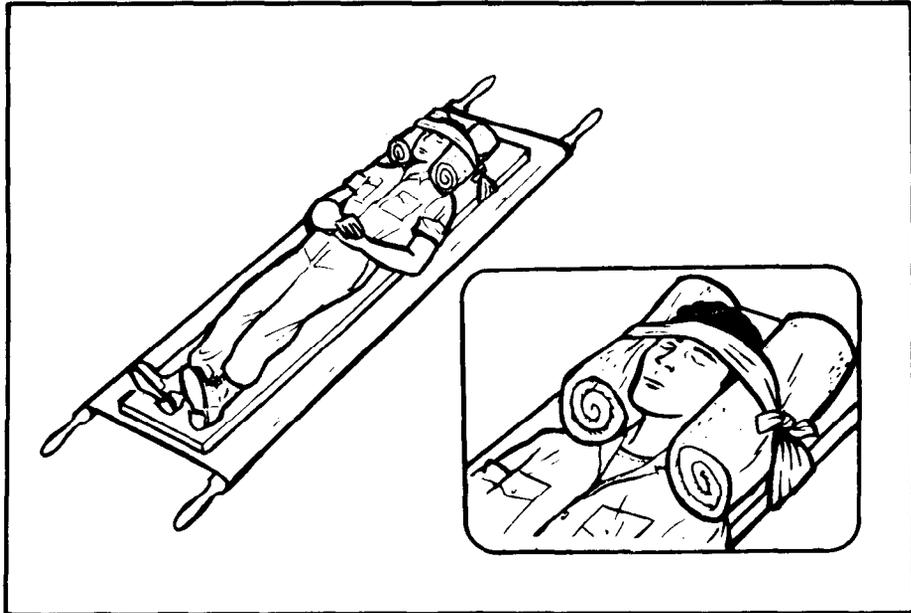


Figure 13-27. Patient with padded head on board and litter.

13-29. Spinal Injuries

a. The spinal column is composed of 33 bones or vertebrae. The upper 24 bones are separated by cartilage disks, the 5 bones of the sacrum form part of the pelvis, and the remaining 4 bones comprise the coccyx.

b. The spinal column encases the spinal cord. If a vertebrae or disk is fractured or dislocated, the spinal cord may be injured. Injuries to the spinal cord can cause paralysis below the point of injury. All patients with known or suspected spinal injuries must be immobilized before movement.

13-30. Signs and Symptoms of a Spinal Injury

a. Ask the patient if he has any pain, numbness, or tingling. Ask bystanders about the cause of the injury if the patient is unconscious. Determine numbness by gently pinching or pricking the injured area. The patient may not be able to move or may not experience sensation in parts of the body below the injury.

NOTE

An unconscious patient involved in a situation in which a spinal injury is suspected should be treated as if he has a spinal injury.

CAUTION

Do NOT permit any motion of the spine if a spinal injury is suspected.

b. Gently palpate along the spine for tenderness or deformity. Watch the patient's reaction for signs of tenderness. Local tenderness over a portion of the spine may indicate a spinal injury and the patient should be treated accordingly.

13-31. Treatment for Spinal Injuries

a. Caution the patient not to move. The patient must not move until the injury has been immobilized. The spinal cord must be protected from damage when the patient is moved. The head and neck must be maintained in a stable, neutral position; extension or flexion may cause the spinal cord to be compressed disastrously and paralysis can result. If the neck is hyperextended (the head falls backward), posterior compression of the spinal cord by fractured vertebrae can occur. If the neck is flexed (the head falls forward), anterior compression of the spinal cord by fractured vertebrae can occur.

NOTE

A patient with pain in his shoulder without any sign of injury and accompanied by pain of the neck indicates a spinal injury.

- (1) If the patient is lying face up, immobilize him in that position.
- (2) If he is face down and has no other serious injuries or cannot breathe properly, request assistance to turn him onto his back.
- (3) If the patient must be moved before splinting, you must maintain gentle traction of the head while moving him. To maintain traction, kneel at the patient's head, place your hands on each side of his head and jaws, and pull back slightly to immobilize his head and neck (Figure 13-28). Keep the direction of pull in a direct line with his spinal column.



Figure 13-28. Maintaining traction.

- (4) Gently slide the cervical collar under the neck. Wrap the collar around the neck and secure it in place.
 - (5) Place the patient on a spine board.
 - (6) Place the patient and spine board on a litter.
 - (7) Record treatment.
 - (8) Evacuate the patient.
- b. Apply a short spine board before extracting a patient from a vehicle.

(1) Two rescuers are required. No. 2 man pushes the board as far down into the seat as possible behind the patient while No. 1 man maintains traction on the patient's head (Figure 13-29). It may be necessary to move the patient slightly forward if the back of the seat has a pronounced curve.

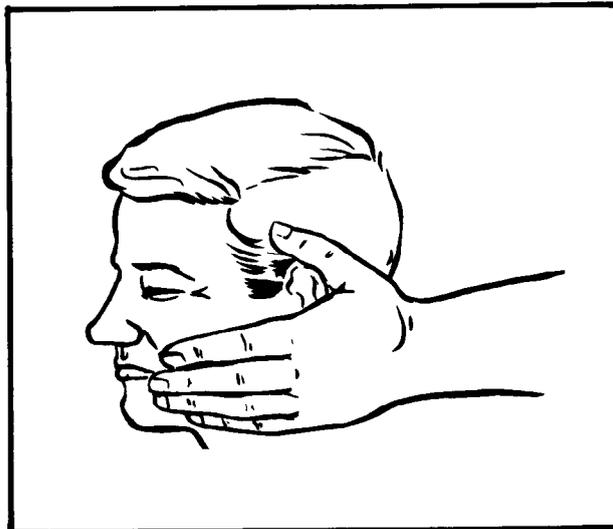


Figure 13-29. Maintaining traction on a sitting patient's cervical spine.

NOTE

It may be easier to insert the head end of the board into the vehicle first, especially if the vehicle has a low roof. This way, there will not be a need to maneuver the board around the patient.

(2) No. 2 man places a cervical collar or a neck roll in the hollow space between the patient's neck and the board. The collar or neck roll serves to fill the gap between the patient's neck and the board. The neck roll should only be large enough to fill the gap; not to exert pressure on the neck.

(3) No. 1 man maintains traction on the patient's head. No. 2 man secures the patient's head to the board by using a cravat, head straps, or other cloth strips. Pass the cravat downward diagonally across the patient's forehead, and tie it securely to the head portion of the board.

CAUTION

The patient's head must be firmly secured in place before the No. 1 man releases the traction.

(4) Secure the patient to the spine board (Figure 13-30) by—

- Placing the buckle of the first strap on the patient's lap.
- Passing the other end through the lower hole in the board; up the back of the board; through the top hole; under the armpit; over the shoulder; and across the back of the board at the neck.
- Buckling the second strap to the first one.
- Placing the buckle on the side of the spine board at the neck.
- Passing the other end of the strap across the shoulder; under the opposite armpit; through the top hole in the board; down the back of the board; through the lower hole; and across the lap.
- Securing the end to the first strap by buckling.

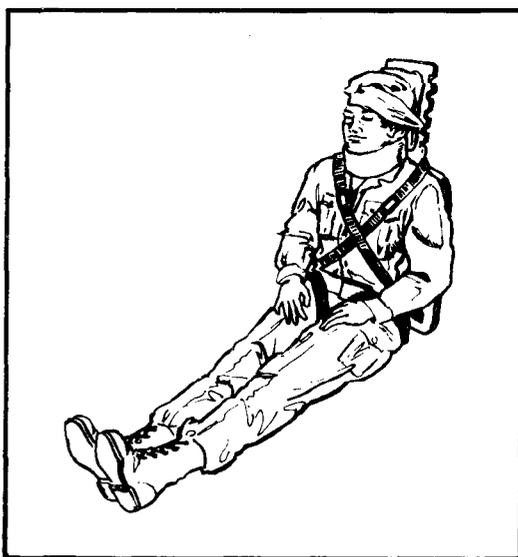


Figure 13-30. Patient secured to short spine board.

(5) Tie the patient's hands together and place them on his lap to keep the arms from moving.

(6) No. 1 man pivots the patient in the seat with his back facing the opened vehicle door, by grasping his upper body. No. 2 man remains in the vehicle, grasping the patient's legs, lifting them onto the seat and pivoting the patient in unison with the No. 1 man.

CAUTION

Do not grasp the short board to move the patient. Pressure of lifting should be applied under the patient's arms and legs. Using the short board to lift the patient will cause excessive pressure on his neck and spine.

(7) No. 1 man slides a long board in perpendicular to the patient's back, with the end against his buttocks.

(8) No. 2 man exits the vehicle and positions himself opposite the No. 1 man. Together, they lay the patient down horizontally on the long spine board.

(9) Move the patient from the vehicle by grasping the sides of the long board.

(10) Line up the holes of the short board with the holes of the long board and tie the boards together.

c. Place a patient that is not in a vehicle on a long spine board.

(1) Obtain a long board; seek the assistance of at least three other individuals and explain the procedure to them.

(2) Prepare the spine board.

- Place the spine board in position near the patient.
- Insure that all necessary equipment is ready.
- Have pads available for padding the spine board in the areas of the natural curve of the neck and small area of the back (Figure 13-31).

NOTE

If a spine board is not available, use a standard litter or improvise one from a board or door. A hard surface is more suitable than one that does not support the patient's weight. If the injured patient is in a face-down position, transport him in that position.

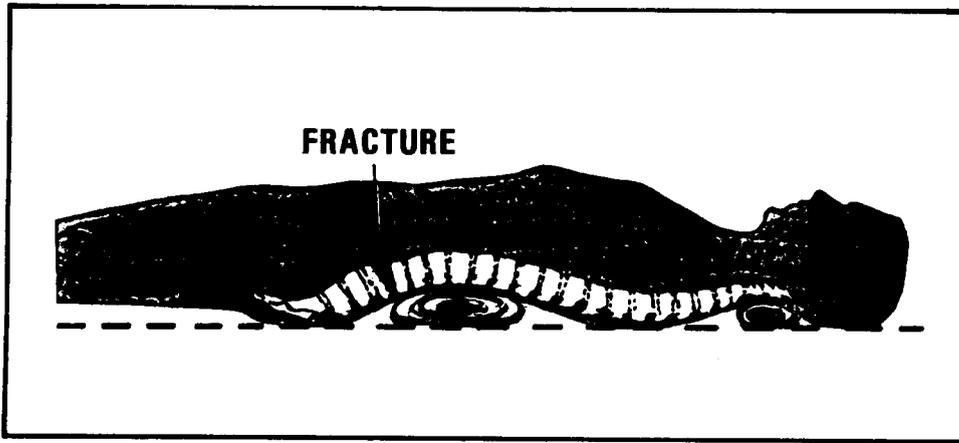


Figure 13-31. Padding of neck and small of back.

(3) Instruct the patient not to move or attempt to assist in placing his body on the spine board.

(4) Loosely tie the patient's wrists together at his waist. This prevents the arms from moving while he is being placed on the spine board.

(5) Use the log-roll technique to place the patient on the spine board.

(a) Place the spine board parallel to the patient's body.

(b) Kneel at the patient's head, place your hands on each side of his head and jaws, and pull back slightly to immobilize the head and neck.

(c) Instruct the three assistants to kneel on either side of the patient and place their hands on the opposite side at his shoulder and waist, hip and thigh, knee and ankle.

(d) On your command, have the assistants, in unison, roll the patient's body slightly toward them while you turn his head, keeping it parallel with the spine.

(e) Instruct assistant #3 to reach across the patient's body with one hand, grasp the board at the closest edge, and slide the board against the patient. With the same hand, assistant #3 then reaches across the board to the far edge and holds the board in place.

(f) Instruct all assistants to slowly roll the patient backwards onto the board, keeping his head and spine in a straight line.

NOTE

All assistants should kneel on the same knee and utilize their own thighs to help support the patient.

(g) If the patient is in the face-down position, the spine board is still placed on the opposite side of the patient away from the assistants. Roll the patient away from the assistants (toward the board) using the same technique as above.

OR

(6) Use the straddle-slide technique to place a patient on the spine board.

(a) Place the spine board at the patient's head in alignment (parallel) with his body.

(b) Stand at the patient's head with your feet on each side of the spine board. Place your hands on each side of his head and jaws. Apply slight traction to immobilize the head and neck.

(c) Instruct one assistant to straddle the patient while facing you and gently elevate the patient's shoulders just enough to permit the spine board to slide under them.

CAUTION

Do NOT bend or flex the spine or neck.

(d) Instruct assistant #2 to straddle the patient while facing you and carefully elevate his hips.

(e) Instruct assistant #3 to stand behind the spine board and gently slide it under the patient.

(f) Instruct assistant #3 to move the patient's feet and straddle his legs. Carefully elevate the legs and ankles while sliding the board completely under the patient.

(7) Secure the patient to the spine board.

(a) Secure the patient's forehead with a cravat.

(b) Secure the patient with straps across his chest (include the arms if the strap is long enough), hips, thighs, and lower legs (Figure 13-32).

d. Record the treatment given.

e. Evacuate the patient.

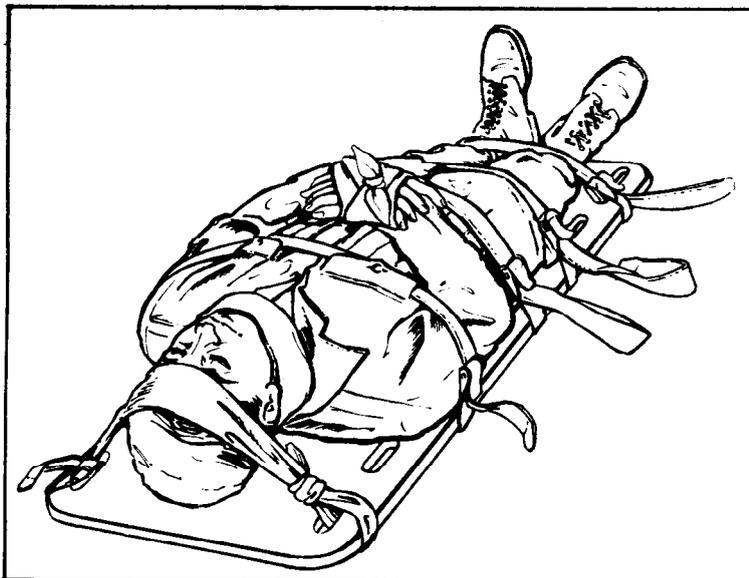


Figure 13-32. Patient secured to a spine board.

Section V. ORTHOPEDIC INJURIES

13-32. General

The evaluation of a patient with possible musculoskeletal damage requires determining the cause of the injury; obtaining an accurate patient history; and giving a thorough examination. Take note of the patient in relation to the environment (possible mechanisms of injury). Ask the patient to identify the areas of pain and to move each extremity.

a. *Types and Causes of Injuries.* Orthopedic injuries are the result of a variety of causes. Types of injuries and causes include—

- Direct injuries (a broken bone at the point of impact with a solid object, such as a jeep bumper).
- Indirect injuries (a fracture or a dislocation at some distance along the bone from the point of impact, such as a hip fracture caused by the knees slamming into a solid object).
- Twisting injuries (fractures, sprains, and dislocations that occur when there is torsion of the joint while the end of the limb remains fixed).
- Powerful muscle contractions (muscle torn from the bone or muscle breaking away a piece of the bone; occurs in seizures or tetanus).
- Fatigue fractures (caused by repeated stress). These most commonly occur in the feet after prolonged marching (stress fractures).

- **Pathologic fractures** (occur in patients with diseases such as cancer that weaken areas of bones). A fracture may occur with minimal force. The elderly have more brittle bones and are more prone to pathologic fractures.

b. Patient History. Most patients with musculoskeletal injuries will complain of pain. Usually the pain is well localized to the area of injury. Sometimes the patient with a fracture will report having felt something snap. Try to determine how the injury occurred. For example, for a twisted ankle, did the injury occur with the ankle bent outward (everted) or bent inward (inverted)? Does the patient have any serious illnesses, such as cancer, that might account for an otherwise unexplained fracture.

c. Examination. With rare exceptions, orthopedic injuries are not life threatening. In the patient with multiple injuries, fractures may be the most obvious and dramatic, but may not be the most serious. Therefore, you should do a primary survey and treat any life-threatening conditions first. Management of orthopedic injuries fit well in the secondary survey.

- *Look.* Swelling and black-and-blue marks indicate the escape of blood into the tissues (extravasation). Shortening or angulation between the joints, deformity or angulation in unusual direction around the joints, and internal or external rotation when compared with the opposite extremity indicate a bone defect. *Lacerations or puncture wounds near the site of a bone fracture are open fractures.*

- *Listen.* Crackling sounds (crepitation) can be heard with a stethoscope or felt with palpating fingers. The sounds are produced when the broken bone ends rub together. Do NOT attempt to move the injured area to evaluate this sign. Percussion over a bony protuberance while listening with a stethoscope on another bony prominence distal to a fracture will produce a sound different from the sound produced on an uninjured bone.

- *Feel.* Palpation along the length of the bone can help detect deformities, bony protuberances, or angulation that is not seen.

- *Check.* Pulse and neurological sensation should always be evaluated distal to the fracture before and after application of splints. In the arm, you should test the radial and ulnar arteries; in the leg, the dorsalis pedis and posterior tibial arteries (Figure 13-33). If there is not a distal pulse, two or three gentle manipulations of the extremity should be carried out to try to restore the blood flow. Do not make prolonged attempts; the loss of blood may be due to actual vascular injury or to preexisting hardening of the arteries (arteriosclerosis) rather than simple compressions.

- *Evaluate.* A neurological evaluation of both motor and sensory functions should be made. For example, when checking an arm, are the nerves intact and can the hand demonstrate intact sensory nerves by both sensation and finger movements?

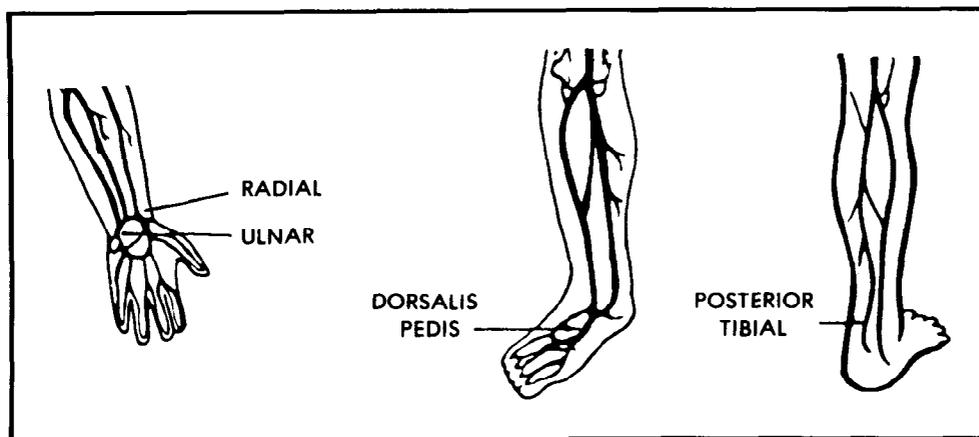


Figure 13-33. Distal pulses locations.

- *Palpate all bones.* When doing the secondary survey, palpate and manipulate every bone in the body to determine the extent of the injury. The only exception to the manipulation is with possible spinal column injuries. Some bones, such as the ribs and the pelvis, can be palpated by applying direct pressure. **EXAMPLE:** For pelvis injuries, apply bilateral pressure on the anterior iliac spines to elicit pain. Pressure over the symphysis pubis will also flex the pelvic ring to detect any existing fractures.

- *Treat as fracture.* It is difficult to distinguish between fractures and sprains without x-ray. If there is a question, immobilize and treat the injury as if it were a fracture. The pain produced by a fracture will cause muscle spasms. The patient will guard or not move the fractured bone at all. Fractures do not produce paralysis. Only nerve damage produces paralysis. The pain may be so great, however, that the patient does not voluntarily move the bone or its muscular attachment.

13-33. Management of Orthopedic Injuries

a. The signs and symptoms of orthopedic injuries—fractures, dislocations, and sprains are given in Table 13-2.

Table 13-2. Orthopedic Injuries: Signs and Symptoms.

Fracture	Dislocation	Sprain
Pain, tenderness.	Pain.	Pain, tenderness.
Deformity or shortening.	Deformity.	No deformity.
Loss of use.	Loss of movement.	Painful movement.
Swelling.	Swelling.	Swelling.
Ecchymosis.	Ecchymosis.	Redness.
Grating.	Located at joint.	
Guarding.		
Exposed bone ends.		

● *Fractures.*

○ A fracture is a break in a bone. It may either be closed (skin is intact) or open (there is a wound over the fracture site). In an open fracture, the bone may or may not be protruding through the wound. Open fractures are more serious than closed fractures because the risks of contamination and infection are greater. A transverse fracture cuts across the bone at right angles to its long axis and is often caused by direct injury. The greenstick fracture is an incomplete fracture that commonly occurs in young individuals whose bones (like green sticks) are still pliable. Spiral fractures result from twisting injuries; the fracture line has the appearance of a spring. The fracture line of an oblique fracture crosses the bone at an oblique angle, or in a slanting direction. In impacted fractures, the broken ends of the bone are jammed together and may function as if no fracture is present. A comminuted fracture is one in which the bone is fragmented into more than two pieces (splintered or crushed) (Figure 13-34).

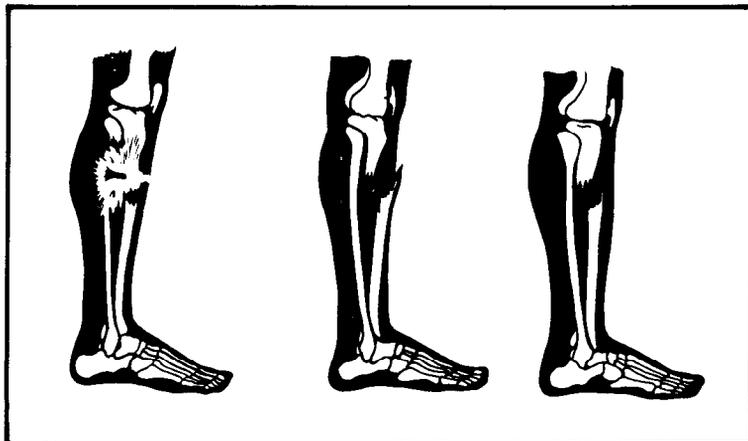


Figure 13-34. Common fractures.

o Fractures, even open fractures, seldom present an immediate threat to life. Their treatment should be deferred until life-threatening conditions have been treated, such as establishing an airway and controlling hemorrhage. A tourniquet is seldom necessary in treating an open fracture, even when a limb has been mangled beyond all possibility of salvage. Only after treating all life-threatening conditions should you identify and immobilize fractures.

o Immobilization is accomplished by splinting which—

■ Prevents a closed fracture from becoming an open one.

■ Prevents damage to surrounding nerves, blood vessels, and other tissues by the broken bone ends.

■ Lessens bleeding and swelling.

■ Decreases pain.

● *Dislocations.*

o A dislocation is the displacement of a bone end from its articular surface. Sometimes ligaments that hold the bone end in place are also torn. The shoulder, elbow, fingers, hips, and ankles are the joints most frequently affected.

o Symptoms of a dislocation are either pain or a feeling of pressure over the involved joint and a loss of motion. The sign of a dislocation is deformity. If the dislocated bone end is pressing on nerves or blood vessels, there may also be a compromise of other functions, such as numbness or paralysis below the dislocation. When dealing with a dislocation, always check the pulse, strength, and sensation distal to the injury. The treatment for a dislocation is to immobilize the involved part in the position in which it is found. Do not straighten or attempt reduction. If there is not a distal pulse in the involved extremity and it cannot be restored by gentle manipulation, transport the patient to an MTF promptly.

● *Sprains.* Sprains are injuries in which ligaments are partially torn. Sprains occur when a joint is suddenly twisted beyond its normal range of motion. Sprains most commonly affect the knees and ankles and are characterized by pain, swelling, and discoloration over the injured joint. Unlike fractures and dislocations, sprains usually do not show a deformity. However, treat the sprain as if it were a fracture and immobilize it. Elevate the sprained joint and apply an ice compress, if available.

● *Strains.* Strains are soft-tissue injuries or muscle spasms around a joint and are characterized by pain on movement. There is no deformity or swelling associated with a strain. Strains are best treated by avoiding weight-bearing on the injured area. If there is doubt as to the nature of the injury, immobilize the extremity.

13-34. General Principles of Splinting and Immobilization

In the treatment of musculoskeletal injuries, remember the following principles:

- Severely angulated fractures of long bones should be straightened before splinting. Explain to the patient that straightening the fracture may cause momentary pain, but that it will lessen significantly once the fracture is straightened and splinted. Any overlying clothing should be cut away.
- Do NOT straighten dislocations and fractures involving the spine, shoulder, elbow, wrist, or knee.
- The adage "splint them as they lie" should be changed to "immobilize them where they lie." Splinting may well be accomplished after extrication. If a pulse is absent, splinting may necessitate manipulation of the fracture to its normal position.
- In open (compound) fractures, do not attempt to push bone ends back beneath the skin surface. Simply cover them with a sterile dressing.
- Immobilize joints above and below the fracture (at the wrist and elbow for fractures of the radius and ulna).
- Splinting should be done firmly, but not so tightly as to occlude circulation. Check distal pulse after the splint is in place to be certain that the circulation is still adequate. If the pulse disappears, the splint should be loosened enough to permit its return. If used, air splints or MAST should be checked and rechecked to make certain that they are not overinflated. The ankle hitch on a traction splint should be inspected so that it is not applied too tightly across the foot; all areas of contact should be padded. The proximal end of a lower extremity splint should not press against the groin. Board splints should be long enough, well padded, and well secured to uninjured parts of the body.
- For fractures above the knee or about the hip, a traction splint is best (Thomas half ring or Hare traction). Such fractures can be managed by supporting the extremity with the hip and knee in slight flexion and the extremity stabilized by strapping it to the uninjured leg. MAST can splint both hips and knee joints.
- For massive trauma to the lower extremities, MAST can be used as a splint and will also help stop bleeding (see paragraph 13-59 for MAST application).
- All fractures should be immobilized before moving the patient.
- Fractures of the tibia or fibula can be managed with traction, wooden, or wire ladder splints. Whichever splint is used, the knee must also be immobilized. MAST should not be used for below-the-knee fractures.
- When other materials are not available, the long spine board can be used to manage almost any fracture.

- An upper extremity fracture can usually be immobilized against the chest.

- The fingers and toes should be exposed even though they are included within a splint.

13-35. Types of Splints

Any device used to immobilize a dislocation or fracture is considered a splint. There are several specific types: rigid, soft, and traction.

a. Rigid.

(1) A rigid splint consists of a firm material, either rigid or slightly flexible. It is applied along the sides, front, or back of the injured extremity. When applied, it will prevent motion of the extremity. Examples of rigid splints include padded wood, such as bass wood, tree limbs, or branches, metal or stiff plastic, wire ladder, and folded cardboard. The splint must immobilize both the joint above and below the fracture site.

(2) To apply a rigid splint, the extremity is grasped by one individual below the fracture site and gentle traction is applied. A second individual then places the padded splint on the injured extremity and secures it above and below the fracture site (Figure 13-35). Keep the toes and/or fingers exposed to insure distal circulation.

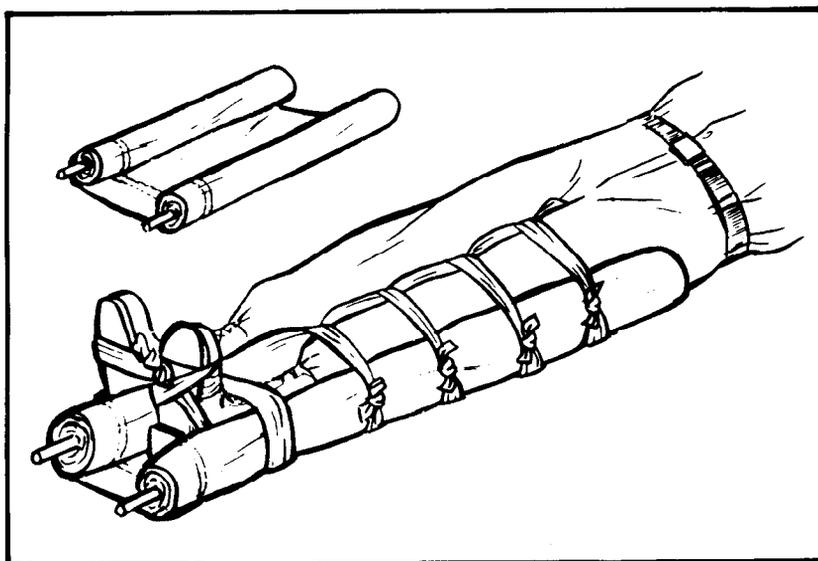


Figure 13-35. Rigid splint applied.

b. Soft Splints.

(1) An example of soft splints are the air splints (Figure 13-36), which are simple double-walled tubes made of heavy-duty clear plastic. These splints come in various shapes and sizes, some with zippers and some without.

The primary advantages of an air splint are comfort to the patient, uniform contact with the injured extremity, and gentle pressure on bleeding wounds. Other material suitable for soft splints are pillows and rolled blankets, which when wrapped and secured are very comfortable and provide effective immobilization. Slings with swathes and pistol belts are also considered soft splints and are excellent for immobilizing upper extremities.

(2) Application of air splints depends on whether or not the splint has a zipper. If there is a zipper, the open splint is gently placed around the extremity, zipped and inflated, insuring that a distal pulse is present. If a non-zipper type is used—

(a) Pull the splint onto your arm to hold the splint open; grasp the hand or foot of the injured extremity.

(b) Apply gentle traction and slide the splint from your arm to the injured extremity.

(c) Inflate the splint (by mouth), insuring the presence of a distal pulse.

NOTE

With an open wound or compound fracture, the air splint should be applied after the application of a sterile dressing.

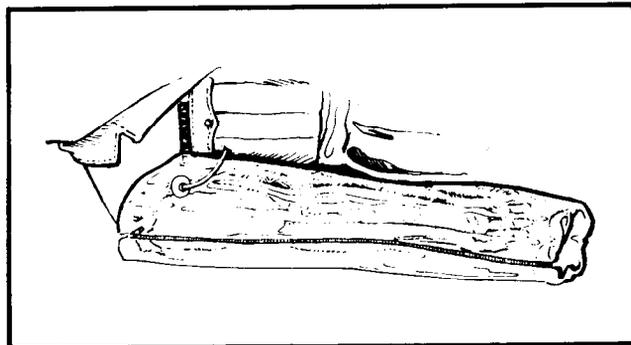


Figure 13-36. Air splint.

c. Traction Splints.

(1) A traction splint holds a fracture or dislocation immobile and maintains steady traction on the extremity. Because the axilla cannot tolerate the counter traction created by these splints, they are suitable for lower extremities only. There are two traction splints presently in use, the Thomas leg splint (Figure 13-37) and the Hare traction splint. For best results, a team of three individuals are needed to apply the Thomas leg splint.

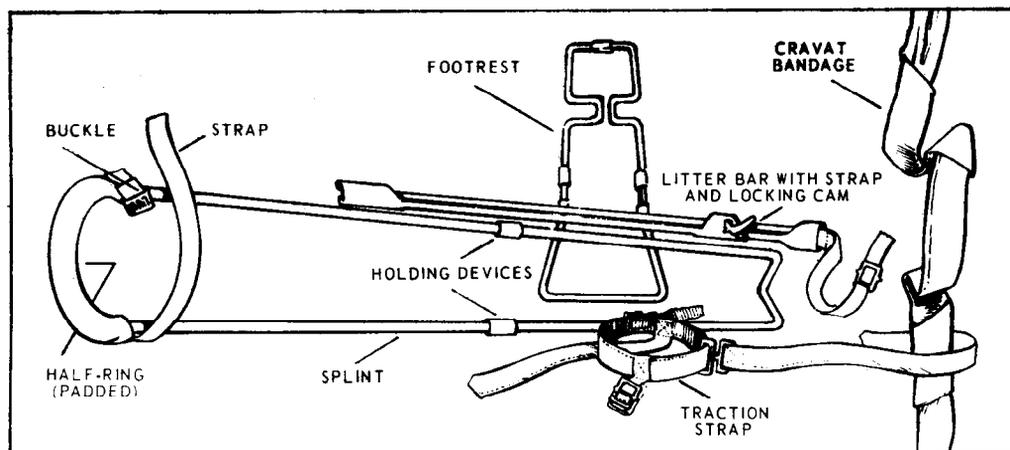


Figure 13-37. Thomas leg splint.

(2) Application of the Thomas leg splint—

(a) Adjust the splint to the length which best serves the patient. Too short a splint will not leave sufficient room to apply traction to the foot. Too long a splint will not permit use of the traction strap. Place the splint beside the uninjured leg with the ring portion parallel to the ischium (bone in the buttock) and extend the splint about 6 to 8 inches beyond the foot. Lock the holding devices.

(b) Place the adjusted splint, with the buckle on the outside, alongside the broken extremity.

(c) No. 1 member: apply the traction strap over the shoe on the patient's foot (Figure 13-38). If the patient is shoeless or only has low quarter shoes, place plenty of soft materials over the areas on which the traction strap will pass. Fasten the strap, position yourself facing the sole of the patient's foot, run one hand through the large opening in the footrest and under the outside rod of the splint, and grasp the back of the patient's heel. With the other hand, grasp the dorsum of the patient's foot. Apply and maintain traction throughout the remainder of the application procedure. Maintenance of traction is very important. Release may cause serious and unnecessary damage.

NOTE

No. 1 member does not release traction or change hand positions while the splint is being applied.

(d) No. 2 member: raise and support the extremity; maintain this support throughout the application.

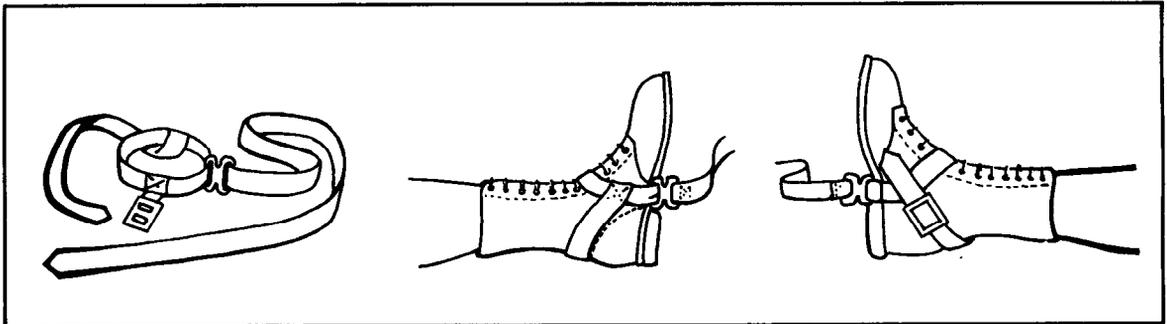


Figure 13-38. Application of traction strap.

(e) No. 3 member: apply the splint by attaching the supporting equipment as follows:

- With the buckle of the splint to the outside and the half-ring turned down at a right angle, ease the splint under the leg, setting the padded half-ring against the ischium (Figure 13-39).

- Place a pad over the thigh at the location of the splint strap and fasten the strap.

- Bring the long free end of the traction strap over and under the notched end of the splint; then pass it up through the link at the swivel (Figure 13-40A). Secure greater traction by pulling the strap toward the end of the splint. Fasten the strap securely (Figure 13-40B). No. 1 member must continue to support foot until the footrest is applied (Figure 13-40C).

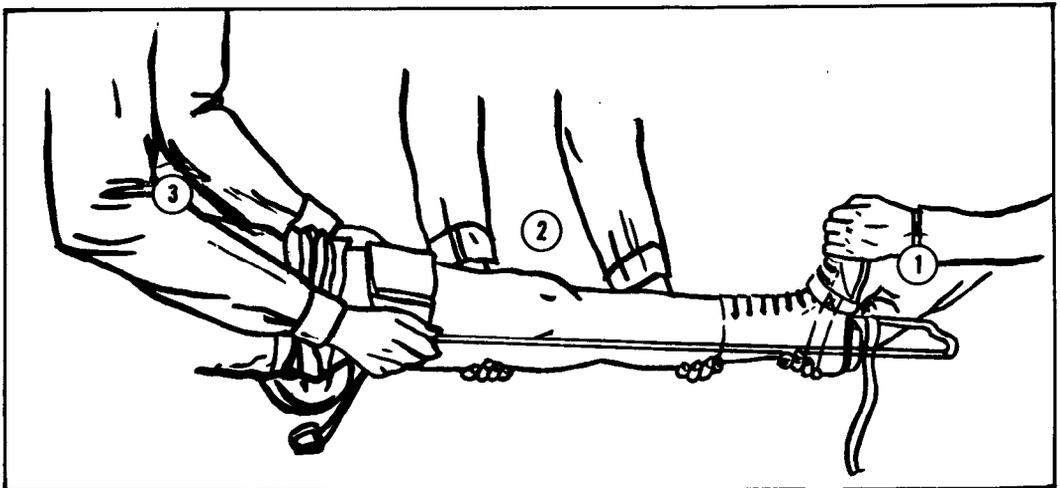


Figure 13-39. Applying the splint.

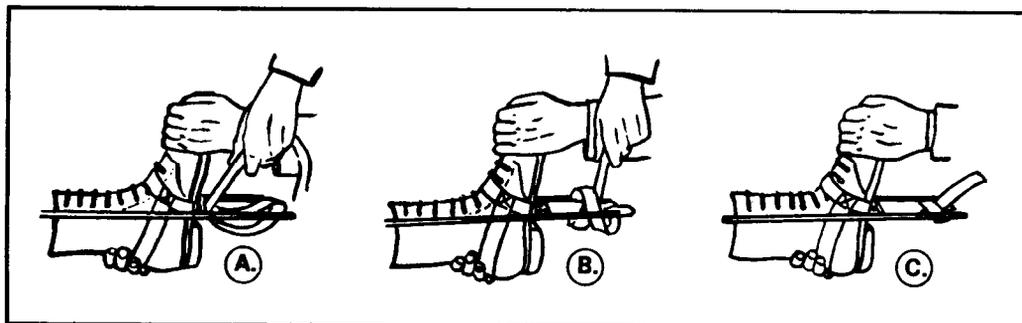


Figure 13-40. Securing the traction strap.

- Apply two cravat bandages to help support the leg. If triangular bandages are not available, use other strong cloth material that is at least 3 inches wide. Place each cravat across the rods of the splint (Figure 13-41A), with the long end of the bandage to the outside. Make sure that the cravats are not directly over the fracture. Bring the ends under the splint and loop them in opposite directions (Figure 13-41B). Bring the longer tail over the patient's leg and tie the two ends over the outside rod (Figure 13-41C). (No. 2 member must continue to support the leg.)

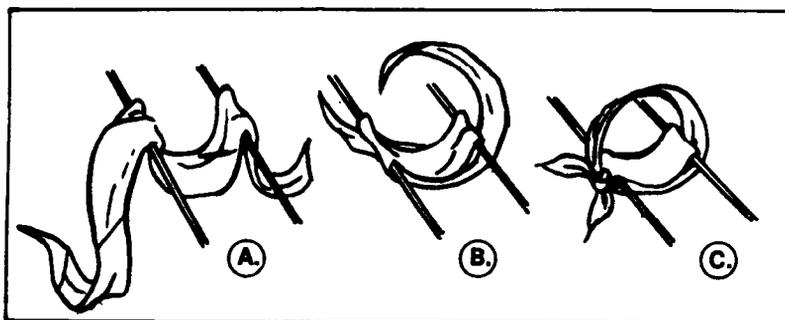


Figure 13-41. Placement of cravats on the Thomas splint.

- Slide the footrest over the end of splint and into place against the shoe or padding on the sole of foot (Figure 13-42). (No. 1 member continues to hold the patient's foot steady, adjusting the foot position slightly so that the heel and sole of the shoe or padded foot are in light contact with the footrest).

- Apply three or four cravat bandages as before to further support the extremity (Figure 13-43). Make sure that no bandage is placed directly over the fracture site. (No. 2 member shifts positions, then releases support as the bandages are tied.)

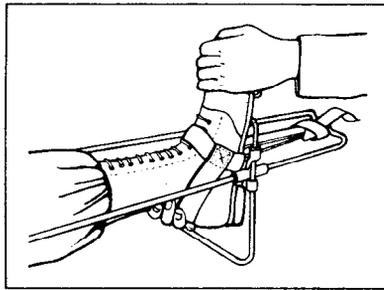


Figure 13-42. Footrest in place.

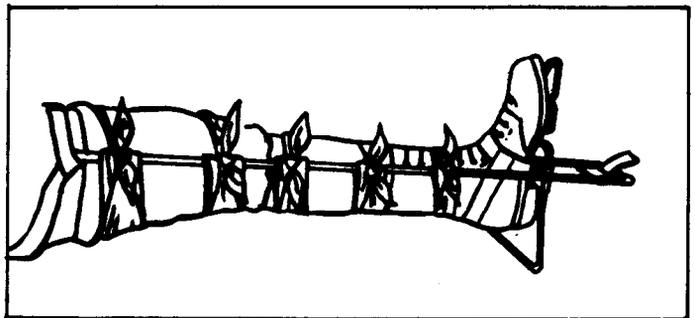


Figure 13-43. Support of extremity by splint, cravat bandages, and footrest.

● Finally, apply two cravat bandages to support the foot and ankle and secure the foot to the footrest (Figure 13-44). Place one cravat under the back of the shoe, bringing both ends up and crossing them on top of the shoe; then carry the ends toward the sole of the shoe and tie them on the outside of the footrest. Apply the second cravat around the toe of the shoe and footrest and tie. (No. 1 member releases as bandages are applied.)

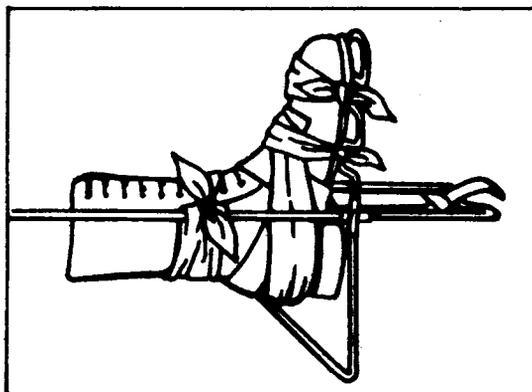


Figure 13-44. Foot supported and secured.

(3) Move the patient onto a litter.

(a) After the splint has been applied, move the patient onto a litter.

- No. 2 and 3 members kneel along side the patient on the side of the splinted limb. No. 1 member kneels on the opposite side. Each member kneels on the knee nearest to the patient's feet. No. 1 member places both hands under the patient's back and thighs, No. 2 member supports the legs, and No. 3 member the shoulders and back. All three then lift the patient onto the thighs of No. 2 and 3 members.

- No. 2 and 3 members support the patient on their thighs while No. 1 member places litter in position alongside their knees, which are touching the ground. No. 1 member then helps No. 2 and 3 members lower the patient gently onto the litter. As the patient is lowered, he is positioned so that the footrest on the splint is resting on the litter 2 inches from the border of and on the litter canvas.

(b) Secure the footrest to the litter with a grooved litter bar.

- No. 1 member: lift and hold the footrest steady a few inches above the litter canvas.

- No. 3 member: slide the litter bar under the footrest, guiding the bottom of the footrest into the groove in the litter bar. Start the bar from the direction of the fractured limb and slide it toward the other leg.

- Lock the litter bar to the footrest by turning the handle of the locking cam.

- No. 1 member: lower the footrest so that the litter bar is on the litter canvas.

- No. 3 member: buckle the litter bar strap tightly around the litter poles.

NOTE

If a traction strap and a litter bar are not available, roller bandage, cravat bandages, or similar strong material may be used as substitutes.

(c) Cover the patient with blankets or other materials as his condition and the situation warrant and place him in a position to prevent or lessen shock.

(4) Application of the Hare traction splint.

- Place the splint beside the patient's uninjured leg and adjust it to the proper length (Figure 13-45). Open and adjust the Velcro straps.

- Expose the entire injured limb.

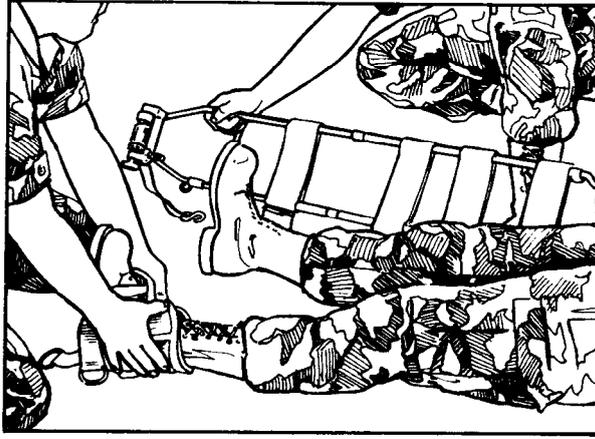


Figure 13-45. Adjusting the Hare splint.

- No. 1 member secures the leg from movement while No. 2 member applies the ankle hitch (Figure 13-46).

NOTE

The boot is usually left in place.

- No. 1 member lifts and supports the leg at the site of the suspected fracture while No. 2 member applies traction with his hands.

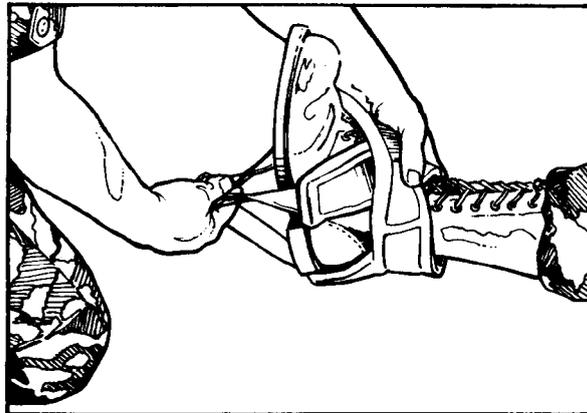


Figure 13-46. Applying the ankle hitch.

- No. 2 member maintains traction while No. 1 member slides the splint into position under the patient's leg and gently applies the ischial strap (Figure 13-47).

- No. 2 member maintains the traction with his hands while No. 1 member connects the ankle hitch to the splint (Figure 13-48).

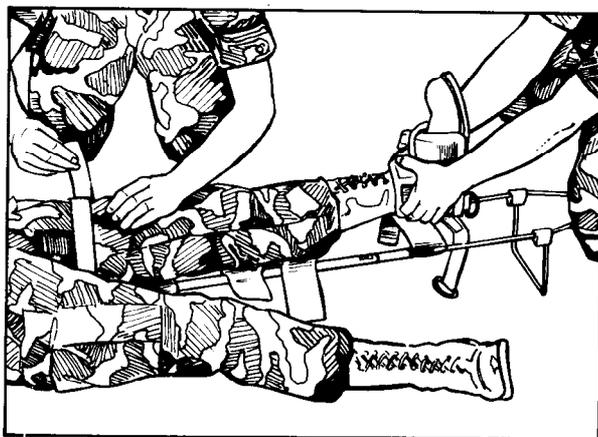


Figure 13-47. Securing ischial strap.

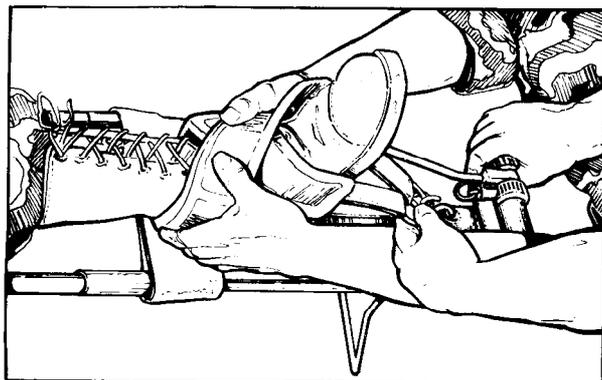


Figure 13-48. Connecting the ankle hitch to the splint.

- Apply traction with the splint (Figure 13-49).
- When proper traction has been applied with the splint, fasten the Velcro straps so that the limb is secured to the splint (Figure 13-50).

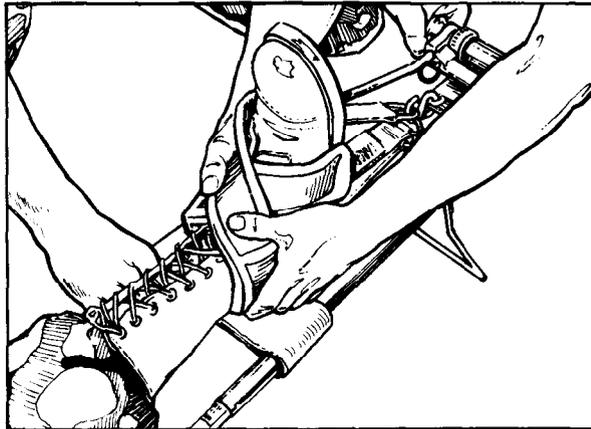


Figure 13-49. Applying splint traction.

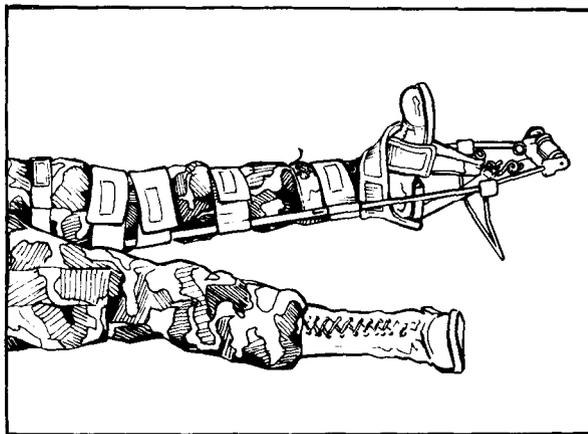


Figure 13-50. Fastening the Velcro straps.

13-36. Management of Fractures

a. Clavicle.

- Clavicular fractures can be detected by palpation and observation along the shaft of the clavicle.
- You can obtain immediate stabilization by using a sling and swathe to prevent shoulder motion.

b. Humerus.

- Proximal fractures of the humerus are usually sustained by falling on an outstretched arm. The diagnosis is sometimes difficult in such fractures because the broken parts are frequently impacted. Palpating the length of the humerus and gently rotating the humerus can identify the

presence or absence of most fractures. Fractures of the shaft usually cause gross deformity, swelling, and pain. In proximal head fractures, pain and tenderness beneath the deltoid muscle may be the only symptom, but in a fracture of the shaft, the patient will not be able to move the arm.

- The most effective method of stabilization is the sling and swathe which immobilize the fracture against the chest. Wood splints can be added for protection, but cannot be used alone because they do not immobilize the joint above the fracture. Initial stabilization can also be accomplished by using a long spine board and sandbags, keeping the patient's upper arm at his side with the forearm across the abdomen.

c. *Hand.*

- Fractures of the metacarpals and phalanges may be either impact or incomplete greenstick. Frequently diagnosis is based on pain alone. A typical "boxer's fracture" of the fifth metacarpal can result when the victim delivers a punch. This can be most easily detected by posterior palpation.

- Immobilize the injured hand by use of a splint and sling.

d. *Elbow (Distal Humerus and Proximal Radius and Ulna).*

- Pain and the inability to move the elbow indicates a fracture. These fractures are particularly serious because of the proximity of the fragments to nerves and blood vessels. Elbow fractures are the most frequent type of fracture associated with severe vascular compromise. Surgery is frequently necessary to reestablish blood flow to the extremity.

- Do NOT attempt to manipulate a fractured elbow. Immobilize the injury and evacuate the patient.

e. *Forearm (Shaft and Distal Radius and Ulna).*

- Fractures of the forearm are usually produced by a fall on the outstretched arm. Shaft fractures of the radius and ulna are diagnosed by palpation and rotational movements from the pronation (palms down) to supination (palms up). Even though midshaft fractures usually produce great deformity, it is not uncommon for fractures to be impacted and relatively stable. Therefore, x-ray is necessary to confirm that no fractures exist.

- The best method of managing this fracture is to apply a sling and swathe to stabilize the wrist. Complete immobilization must include the joint above the fracture, the elbow. This means, of course, that pneumatic splints or rigid splints must immobilize the arm in full extension. It is difficult to transport the patient in this position, and it is uncomfortable for the patient.

- A hemorrhage of 250 to 500 cc's of blood can occur in the area of the fracture.

- The fracture should be immobilized with 4 inch square gauze pads and a sling applied in the position of function. Straight splints such as tongue depressors or short pneumatic splints can also be used. Complications of these fractures are minimal.

f. Pelvis.

- A fractured pelvis commonly results from compression injuries and falls. Bilateral pressure applied to the anterior superior iliac spine can cause pain on movement of the pelvis, as can pressure over the symphysis pubis or bilateral pressure over the greater trochanter.

- Long spine boards or MASTs can immobilize such fractures. Intravenous fluid replacement must be carried out.

- Blood loss from pelvic fractures is probably the most extensive of any fractures. As much as two to two and a half liters of blood can be lost into the retroperitoneal space. Shock can develop from this fracture alone. Therefore, MASTs are especially beneficial in the management of these patients.

g. Hip.

- Fractures of the hip can either be of the surgical neck of the femur (acetabulum) or the shaft. These fractures are generally caused by a fall or other type of trauma, such as hitting the knees in a head-on vehicle crash. Shortening and external rotation of the leg with pain when moving the extremity are frequent physical findings.

- Traction splints are preferred for management of this type of fracture although a long spine board or the MAST can provide immobilization. Keep in mind that blood loss is usually minimal but can approach 250 to 500 cc's.

h. Femur.

- Tenderness or midshaft angulation of the femur are the most common physical findings. Rotation of the extremity can be helpful in the diagnosis of a femoral fracture.

- Management of this fracture is similar to management of hip fractures; traction splints are preferred. Pneumatic splints, other than the MAST, do not immobilize the joint above the fracture. They can be more harmful than no splint at all. Vascular obstruction or hemorrhage can occur, with blood loss from 750 to 1,250 cc's. Traction splinting of the leg should relieve most vascular obstruction. The simultaneous use of traction splinting and MAST is often necessary in severe hip or femur fractures when hypovolemic shock is present or is likely to develop. When this is necessary, *apply the MAST over the traction splint.*

i. Knee.

- Fractures of the knee are like those of the elbow. Impaction with minimal angulation may make these fractures difficult to identify, except by testing for tenderness.

- When treating a fracture of the knee, the knee must be immobilized. The hip and femur management techniques are used; however, pain and occasionally angulation of this fracture may prevent the use of traction splinting. Splinting the knee in the position most comfortable to the patient may require the use of wire ladder splints.

- The position of the fracture causes vascular complications similar to those in elbow fractures. An attempt to reestablish impaired circulation is necessary, but may not be successful. Only minimal pressure should be used to correct the deformity. Patients with knee fractures should receive treatment and transportation before those with fractures in the shaft of the femur without vascular impairment.

j. Tibia and Fibula.

- Fractures of the tibia and fibula, particularly those near the ankle, resemble a sprain or strain and can be difficult to identify. Although angulation may be present in the midshaft, pain and tenderness may be the only evidence of injury distally.

- Long leg pneumatic splints, traction splints, or rigid splints are all acceptable methods of immobilizing this fracture. The MAST does not immobilize the ankle and cannot be used for immobilization of fractures below the knee.

- Vascular complications, particularly around the ankle, are common. If vascular impairment is secondary to a fracture dislocation, reduction should be attempted in the field, even though the wound may be open, if evacuation will be delayed for more than 6 hours.

k. Foot.

- Like fractures of the hand, fractures of the metatarsals and phalanges are relatively benign and can be detected by palpation.

- Immobilization can be accomplished by the use of a pneumatic pillow or rigid splint. Complications rarely occur with these fractures; however, patients with heel fractures from falls should be examined for fractures of the hip or spine.

13-37. Management of Dislocations

Dislocations should be immobilized as they are found unless there is an absence of pulse distal to the injury. Dislocations are most easily treated shortly after they occur before severe muscle spasms develop.

a. Shoulder.

- Restricted motion will identify this dislocation.

- Immobilize the upper arm with a sling and swathe after padding the armpit. Frequently it may be necessary to use a pillow or blanket between the arm and the chest wall because the arm is fixed away from the chest.

b. Elbow.

- Dislocation of the elbow is diagnosed by painful movements of the elbow joint. The dislocation occurs when the full body weight is supported on an extended arm.

- Immobilize the elbow with a sling and swathe or with a padded long arm splint. Full extension or flexion of less than 90° should be avoided to decrease the chances of vascular complications.

c. Phalanges.

- Both metacarpal-phalangeal and interphalangeal joint dislocations are identified by obvious deformity of joints and painful movement. Dislocations of the metacarpal-phalangeal and interphalangeal joints are managed by splinting in a position of function.

- Stabilize the fracture and/or dislocation to an adjacent toe or finger with tape, with padding between the toes or fingers. Traction applied proximally and distally to the involved joint relaxes the muscular spasm, allowing movement of the articular surfaces into their normal position.

d. Ankle.

- Dislocations of the ankle are frequently associated with fractures. Generally, there is gross deformity of the ankle and often it is not possible to distinguish a fracture from a dislocation.

- Treat an ankle dislocation as if it were a fracture—immobilize the ankle with a splint.

Section VI. BANDAGES AND BINDERS

13-38. General

a. Bandages and binders are used to—

- Apply pressure to control bleeding.
- Provide for immobilization of an injured body part, such as a fractured arm.
- Hold dressings in place.
- Protect open wounds from contaminants.
- Provide support and aid in venous blood return, such as when bandaging the leg of a patient suffering from impaired circulation.

b. Bandages and binders are applied so that pressure is evenly distributed to the affected area. If a joint is involved in bandaging, it is supported in its normal position with a slight flexion of the joint. Both the bandage and binder are wrapped securely to avoid friction or rubbing of the underlying tissue, which can cause severe irritation. It must be tight enough to stay in place but not so tight as to cut off circulation.

c. Signs of impaired circulation are paleness or cyanosis, swelling, coolness, and pain. Leave the tips of the fingers and toes visible on a bandaged extremity so that you can check for circulation.