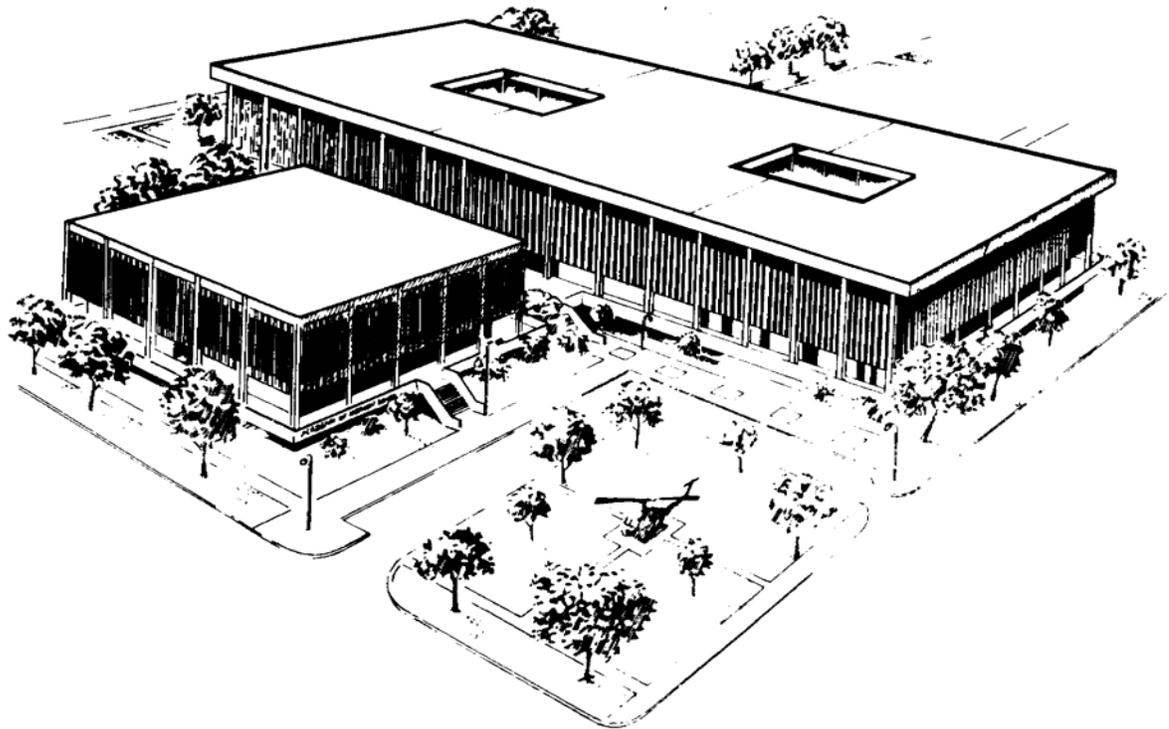

**U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
FORT SAM HOUSTON, TEXAS 78234-6100**



TREATING FRACTURES IN THE FIELD

SUBCOURSE MD0533

EDITION 100

DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

ADMINISTRATION

For comments or questions regarding enrollment, student records, or shipments, contact the Nonresident Instruction Section at DSN 471-5877, commercial (210) 221-5877, toll-free 1-800-344-2380; fax: 210-221-4012 or DSN 471-4012, e-mail accp@amedd.army.mil, or write to:

COMMANDER
AMEDDC&S
ATTN MCCS HSN
2105 11TH STREET SUITE 4192
FORT SAM HOUSTON TX 78234-5064

Approved students whose enrollments remain in good standing may apply to the Nonresident Instruction Section for subsequent courses by telephone, letter, or e-mail.

Be sure your social security number is on all correspondence sent to the Academy of Health Sciences.

CLARIFICATION OF TRAINING LITERATURE TERMINOLOGY

When used in this publication, words such as "he," "him," "his," and "men" are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.

USE OF PROPRIETARY NAMES

The initial letters of the names of some products are capitalized in this subcourse. Such names are proprietary names, that is, brandnames or trademarks. Proprietary names have been used in this subcourse only to make it a more effective learning aid. The use of any name, proprietary or otherwise, should not be interpreted as an endorsement, deprecation, or criticism of a product. Nor should such use be considered to interpret the validity of proprietary rights in a name, whether it is registered or not.

TABLE OF CONTENTS

| <u>Lesson</u> | | <u>Paragraphs</u> |
|---------------|----------------------------------------------------|-------------------|
| | INTRODUCTION | |
| 1 | FRACTURES AND RELATED INJURIES | |
| | Section I. Anatomy | 1-1--1-3 |
| | Section II. Fractures | 1-4--1-10 |
| | Section III. Related Injuries | 1-11--1-14 |
| | Exercises | |
| 2 | SPINAL INJURIES | |
| | Section I. General | 2-1 2-4 |
| | Section II. Immobilizing a Suspected Spinal Injury | 2-5--2-11 |
| | Exercises | |
| 3 | TRACTION SPLINTS | |
| | Section I. General | 3-1--3-2 |
| | Section II. Applying Traction Splints | 3-3--3-6 |
| | Exercises | |
| 4 | FRACTURES OF THE LOWER EXTREMITIES | 4-1--4-8 |
| | Exercises | |
| 5 | FRACTURES OF THE UPPER EXTREMITIES | 5-1--5-10 |
| | Exercises | |
| 6 | ROLLER BANDAGES | 6-1--6-10 |
| | Exercises | |

**CORRESPONDENCE COURSE OF THE
U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL**

SUBCOURSE MD0547

TREATING FRACTURES IN THE FIELD

INTRODUCTION

One of the more common injuries on a battlefield or in everyday life is a fracture. Although usually not immediately life-threatening, serious fractures can be fatal if not properly treated. This subcourse discusses the procedures for immobilizing fractures and dislocations of the extremities using traction splints, wire ladder splints, SAM splints, pneumatic splints, and improvised splints. The subcourse also covers immobilizing a casualty with a suspected fracture of the spine.

Subcourse Components:

This subcourse consists of six lessons. The lessons are as follows:

- Lesson 1, Fractures and Related Injuries.
- Lesson 2, Spinal Injuries
- Lesson 3, Traction Splints.
- Lesson 4, Fractures of the Lower Extremities.
- Lesson 5, Fractures of the Upper Extremities.
- Lesson 6, Roller Bandages

Credit Awarded:

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Section at Fort Sam Houston, Texas. Upon successful completion of the examination for this subcourse, you will be awarded 8 credit hours.

You can enroll by going to the web site <http://atrrs.army.mil> and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: <http://www.usapa.army.mil/pdffiles/p350-59.pdf>.

LESSON ASSIGNMENT

LESSON 1

Fractures and Related Injuries.

TEXT ASSIGNMENT

Paragraph 1-1 through 1-14.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 1-1. Identify the signs and symptoms of a fracture.
- 1-2. Identify the general procedures for treating a fracture.
- 1-3. Identify the signs and symptoms of a dislocation.
- 1-4. Identify the signs and symptoms of a sprain.
- 1-5. Identify the signs and symptoms of a strain.
- 1-6. Identify the general procedures for treating a dislocation, sprain, or strain.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

FRACTURES AND RELATED INJURIES

Section I. ANATOMY

1-1. THE SKELETAL SYSTEM

The human skeletal system (see figure 1-1) consists of about 206 bones. The skeleton gives shape and support to the human body. Together with the skeletal muscles, it performs movement of the body. The skeleton, especially the skull and rib cage, provides protection to vital internal organs such as the brain, lungs, and heart. The red marrow in the center of bones produces red blood cells that carry oxygen and nutrients to all parts of the body.

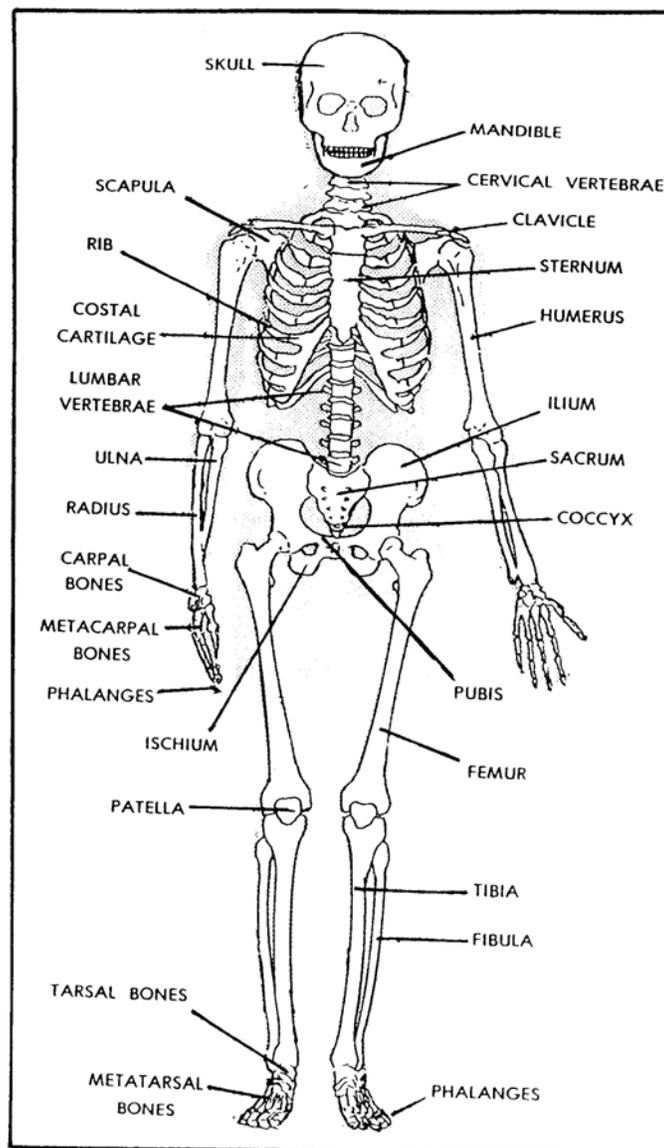


Figure 1-1. The human skeleton (anterior view).

1-2. JOINTS

A joint (articulation) is formed when two bones make contact with each other. Some joints, such as the knee and shoulder, allow a good deal of movement. Other joints, such as the joints of the skull, allow little or no movement. The bones of movable joints do not actually touch each other. They are separated by fibrous tissue, which prevent the bones from rubbing against each other. Ligaments, which are composed of very strong fibrous material, hold the ends of the two bones in place (see figure 1-2).

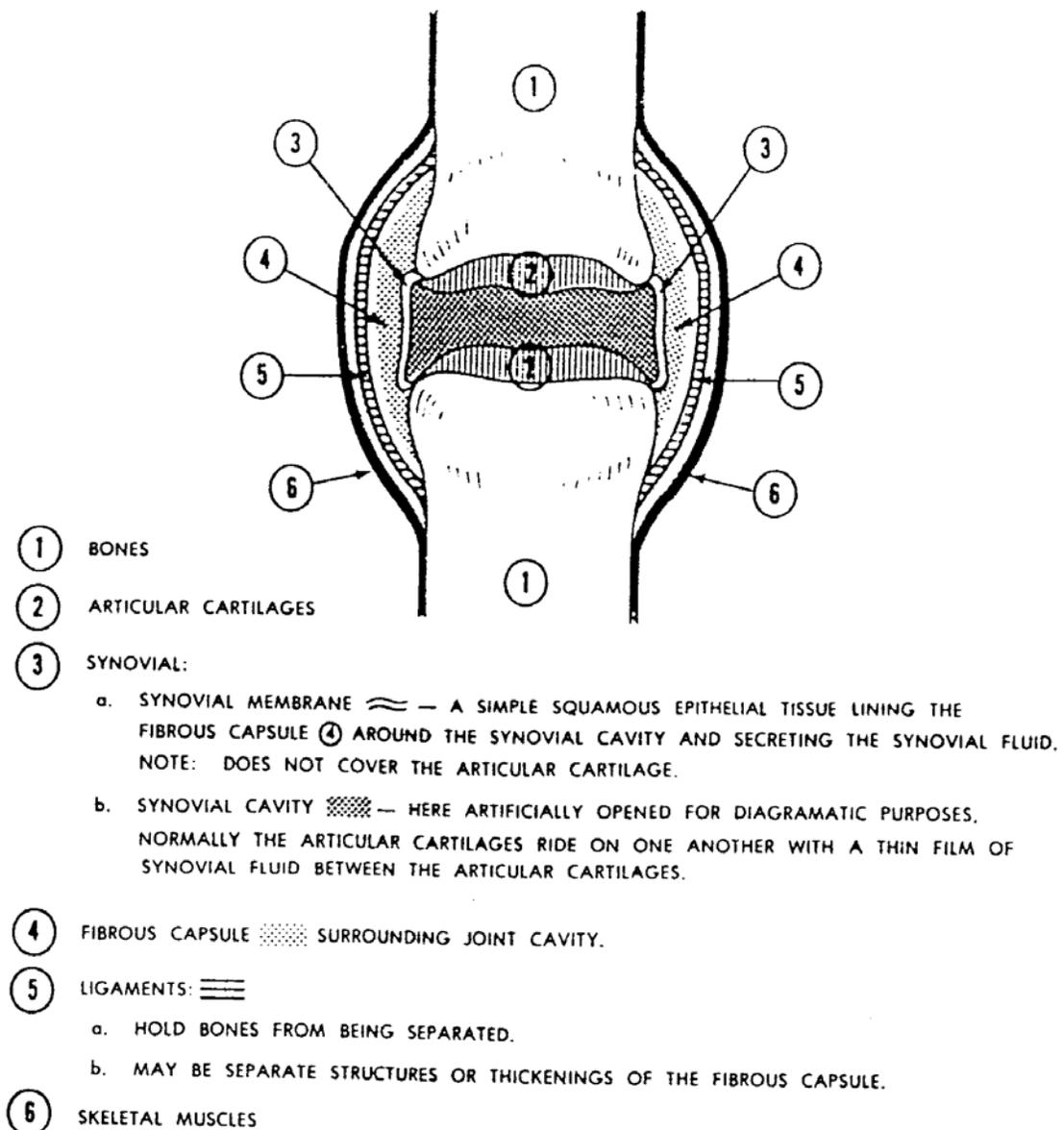


Figure 1-2. Example of a joint.

1-3. SKELETAL MUSCLES

The muscles that move bones are commonly called the skeletal muscles. They are also called striated (striped) muscles due to their physical appearance. Since these muscles are normally controlled by conscious thought (you "command" your arm to rise, for example), they are also called "voluntary" muscles. (Involuntary muscles, such as the muscles found in the blood circulatory system and digestive system, perform their function with no need of conscious control.) Muscles are connected to the bone by connective tissue called tendons.

Section II. FRACTURES

1-4. COMPLETE AND INCOMPLETE FRACTURES

A fracture occurs when a bone is broken. The break may only be a crack in the bone (incomplete fracture) or the bone may be broken into two separate parts (complete fracture). Any fracture can be serious. A fracture of a large bone like the femur can result in a significant loss of blood that, in turn, can result in hypovolemic shock. Complete fractures are also dangerous because the sharp ends of the fractured bone can injure muscle tissues, nerves, and blood vessels. If a rib is fractured in two places, the bone segment between the two fractures may "float" and damage an organ (such as the heart or a lung) or a major blood vessel (such as the aorta).

1-5. CLOSED AND OPEN FRACTURES

a. **Closed Fracture.** A closed fracture (see figure 1-3A) is a fracture in which the skin is not broken. A closed fracture may result in significant loss of blood due to internal bleeding (bleeding into surrounding body tissues or into a body cavity).

b. **Open Fracture.** An open fracture is one in which the skin is broken (penetrated). The source of the penetration may have been the end of a fractured bone (see figure 1-3B) or a foreign object, such as a bullet, which penetrated the skin and fractured the bone (see figure 1-3C). If an open wound is caused by a fractured bone, the bone may remain visible or it may slip back below the skin and muscle tissues. An open fracture results in more blood loss than does a closed fracture since the blood can escape through the open wound. In addition, infection is a major concern.

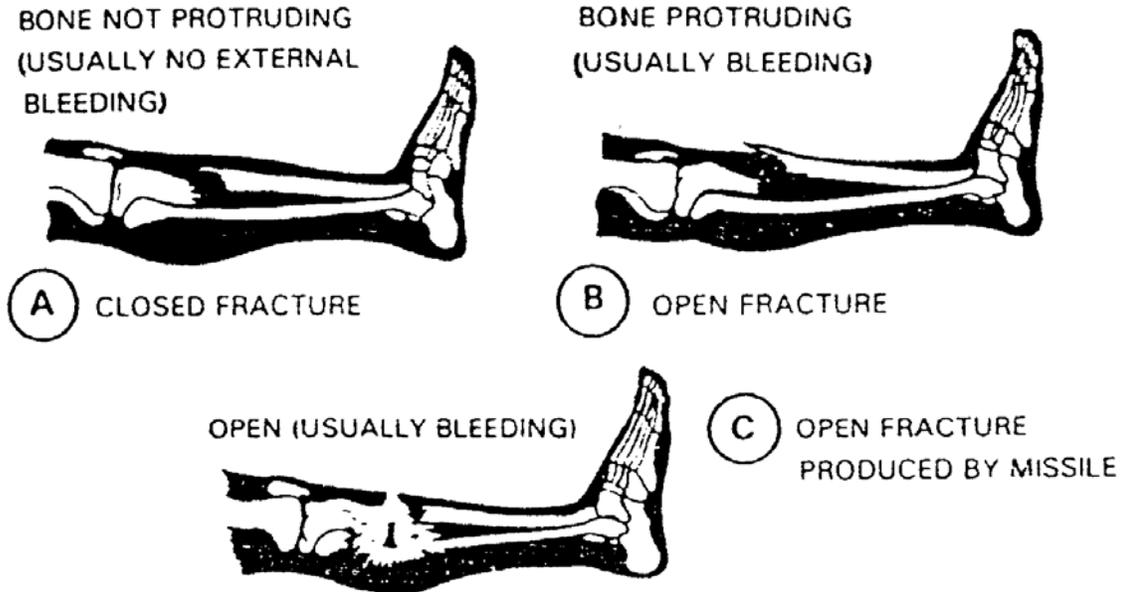


Figure 1-3. Examples of fractures.

1-6. COMMON CAUSES OF FRACTURES

Fractures may be caused by a direct blow to the body (such as being hit by a vehicle) or by indirect force that results in a fracture away from the point of impact (such as a hip fracture resulting from a person landing on his knee after a hard fall). A fracture can also result from a limb being twisted (fracture and dislocation may result) or from powerful muscle contractions (may occur during a seizure). Fatigue (stress) fractures can result by repeated stress, such as a stress fracture of the foot during a long march. Certain diseases, such as cancer, can weaken bones and make them easier to break. High-energy impacts, such as being hit by a speeding vehicle or by a bullet, may produce multiple fractures and cause severe damage to surrounding tissues.

1-7. TYPES OF FRACTURES

A fracture may be displaced (bone moved out of normal alignment) or nondisplaced (bone remains in normal alignment). A nondisplaced fracture may be difficult to identify without an x-ray. Therefore, anytime you suspect that a fracture may be present, treat the injury as though you knew the fracture existed. Some types of fractures are briefly described in the following paragraphs.

a. **Greenstick.** A greenstick fracture is an incomplete fracture in which one side of the bone is broken and the bone is bent.

b. **Comminuted.** A comminuted fracture is one in which the bone is crushed or splintered into many pieces.

c. **Transverse.** A transverse fracture is a straight crosswise fracture (break is at a right angle to the axis of the bone).

d. **Oblique.** An oblique fracture is a diagonal or slanted fracture (not at a right angle to the axis of the bone).

e. **Spiral.** A spiral fracture coils around the bone and is caused by twisting.

f. **Impacted.** An impacted fracture results when one bone is driven into another resulting in one or both bones being fractured and the bones being wedged together.

g. **Pathologic.** A pathologic fracture results when a bone that has been weakened by disease breaks under a force, which would not fracture a normal bone.

h. **Epiphyseal.** An epiphyseal fracture is a fracture located between the expanded end of a long bone (epiphysis) and the shaft of the bone.

1-8. SIGNS AND SYMPTOMS OF FRACTURES

A fracture may be found during the primary or secondary survey of the casualty. Life-threatening injuries (lack of breathing, massive bleeding, and shock) should be treated first since they immediately threaten a casualty's life. A serious fracture, however, can also be life threatening. A fracture can be identified by the following signs and symptoms.

NOTE: A sign is something that can be observed by someone other than the casualty. Bleeding, bruises, and pulse rates are examples of signs. A symptom is something which the casualty senses, but which cannot be observed directly by another person. Pain is an example of a symptom.

a. **Visible Fracture.** In an open fracture, the fractured bone or bone fragments may be visible.

b. **Deformity.** The body part may appear deformed due to the displacement of the bone, the unnatural position of the casualty, or angulation where there is no joint (for example, the casualty's forearm is "bent" instead of straight).

c. **Pain.** The casualty will probably experience pain at a particular location. The pain (point tenderness) usually identifies the location of the fracture. The casualty may be able to "feel" the fractured bones.

d. **Swelling.** There may be swelling (edema) at the suspected fracture site.

e. **Discoloration.** The area around the suspected fracture site may be bruised or have hemorrhagic spots (ecchymosis).

f. **Crepitation.** The fracture bones may make a crackling sound (crepitation) if they rub together when the casualty moves.

CAUTION: Do not ask the casualty to move the injured body part in order to test for crepitation.

g. **Loss of Motion.** The casualty may not be able to move the injured limb. If a spinal injury is present, paralysis may exist, especially paralysis of the legs.

h. **Loss of Pulse.** If the fractured bone is interfering with blood circulation, there may be no pulse distal to (below) the site of the fracture.

i. **False Motion.** There may be motion at a point where there is normally no motion. This movement at the fracture site is called false motion.

1-9. GENERAL PRINCIPLES FOR TREATING FRACTURES

Fractures may be discovered either during the primary or secondary survey of the casualty. Take measures to maintain or restore breathing and heartbeat, control major bleeding, and control shock before treating a fracture. [Procedures for restoring breathing and heartbeat are given in Subcourse MD0532, Cardiopulmonary Resuscitation. Procedures for controlling external and internal bleeding and controlling shock are given in Subcourse MD0554, Treating Wounds in the Field. Procedures for treating a spinal fracture are given in Lesson 2 of this subcourse. The general procedures for treating a fracture of an extremity (arm or leg) are given below.

CAUTION: Do not move the casualty before splinting the fracture unless you must remove the casualty (and yourself) from immediate danger (escape from a burning vehicle, move out of the line of fire, and so forth).

a. **Reassure Casualty.** Tell the casualty that you will take care of him.

b. **Expose the Limb.** If you suspect the casualty has a fractured limb, gently remove the casualty's clothing from the injured limb and check for signs of a fracture. Loosen any clothing that is tight or which binds the casualty. **DO NOT** remove the casualty's boots.

CAUTION: Do not expose the limb if you are in a chemical environment (chemical agents are present and the "all clear" signal has not been given).

c. **Locate Site of Fracture.** The site of the fracture is normally found by identifying the site of the deformity, false motion, bruise, wound, and/or point tenderness. To determine point tenderness in a conscious casualty, gently palpate the area with your fingers to determine the location of maximum discomfort.

d. **Remove Jewelry, If Appropriate.** If the casualty has a suspected fracture of the arm, remove any jewelry on the injured arm and put the jewelry in the casualty's pocket. If the limb swells, the jewelry may interfere with blood circulation. The jewelry may then have to be cut off to restore adequate blood circulation.

e. **Assess Distal Neurovascular Function.** Check for impairment of the nerves and/or circulatory system below the site of the suspected fracture. Some of the methods used to identify impairment are given below.

(1) Check pulse. Palpate a pulse site below the fracture site. If no pulse or a weak pulse is found, the fracture may be putting pressure on the artery or may have damaged the artery. A weak pulse can be determined by comparing the pulse felt below the fracture with the pulse felt at the same location on the uninjured limb. A casualty with no pulse below the fracture site should be evacuated as soon as the limb is splinted.

(2) Check capillary refill. If the fractured limb is an arm, press on the casualty's fingernail, then release. If normal color does not return within two seconds, the limb may have impaired circulation. This is also called the blanch test.

(3) Check skin temperature. Touch the casualty's skin below the fracture. Coolness may indicate decreased or inadequate circulation. Compare the temperature of the injured limb to the temperature of the same area on the uninjured limb.

(4) Check sensation. Ask a conscious casualty if he can feel your touch. Then lightly touch an area below the fracture. [If his arm is fractured, for example, touch the tip of the index and little fingers on the injured arm.] Ask the casualty if the injured limb feels numb or has a tingling sensation.

(5) Check motor function. Ask a conscious casualty to try opening and closing the hand of an injured arm or moving the foot of an injured leg. If the attempt produces pain, have the casualty stop his efforts.

f. **Dress Wounds.** If the fracture is open, apply a field dressing or improvised dressing the wound before splinting the limb. Do not attempt to push exposed bone back beneath the skin. If the bone slips back spontaneously, make a notation of the fact on the casualty's United States (US) Field Medical Card (FMC). The card is initiated after treatment is completed.

g. **Immobilize Fracture.** Immobilize the fracture to relieve pain and to prevent additional damage to tissues at the fracture site due to movement of the fractured bone(s). If an extremity is fractured, apply a splint using the following general rules.

CAUTION: The general principle is "splint the fracture as it lies." Do not reposition the fracture limb unless it is severely angulated and it is necessary to straighten the limb so it can be incorporated into the splint. If needed, straighten the limb with a gentle pull.

(1) If the fracture site is not on a joint, immobilize the joint above the fracture site and the joint below the fracture site.

(2) If a joint is fractured, apply the splint to the bone above the joint and to the bone below the joint so the joint is immobilized.

(3) Pad the splint at the joints and at sensitive areas to prevent local pressure.

(4) Minimize movement of the limb until it has been splinted.

(a) If the shaft of a long bone is fractured and severely deformed, apply gentle manual traction to attempt to align the limb so it can be splinted.

(b) If resistance is encountered when manual traction is applied, stop your efforts and splint the limb in the position of deformity.

NOTE: If the femur is fractured, a traction splint is available, and sufficient personnel are available, apply the traction splint to the leg using the procedures given in Lesson 3 of this subcourse.

(5) Secure the splint above and below the fracture site.

(a) Recheck the pulse below the securing device (cravat, strap, or other material) each time a securing device is applied. If the device interferes with blood circulation, loosen and retie the securing material.

(b) Never apply a cravat or other securing material directly over the fracture site.

(6) If you are in doubt as to whether an extremity has a fracture or not, splint the extremity.

h. **Check Distal Neurovascular Function.** Check again for impairment of the nerves and/or circulatory system below the site of the fracture using the procedures listed in paragraph e on the previous page.

i. **Evacuate the Casualty.** Evacuate the casualty to a medical treatment facility. If you cannot detect a pulse below the fracture site, evacuate the casualty as soon as possible in an attempt to save the limb.

1-10. SPLINTS

A splint is a device that immobilizes part of the casualty's body. Applying a splint to the injury helps to relieve pain and prevent further damage by minimizing movement. Splints are used to immobilize fractured bones, but they are also used to immobilize

limbs with dislocations, sprains, and serious soft tissue injury. A splint may be a special device or a splint may be improvised. Some types of splints are briefly discussed below.

a. **Traction Splint.** A traction splint holds a fracture or dislocation of an extremity (usually a fracture of the femur) immobile and provides a steady pull (traction) to the extremity. The traction acts to align the fractured bone and protect the tissues surrounding the fracture site.

b. **Pneumatic Splint.** A pneumatic (air) splint is a cylinder made of double-walled, heavy-duty, clear plastic. The injured limb is placed inside the cylinder; then the cylinder is inflated to make the splint rigid. The splint immobilizes the fracture and provides pressure to the injured limb that helps control external and internal bleeding.

c. **Wire Ladder Splint.** A wire ladder splint is made of strong, lightweight wire that can be bent by hand to fit various shapes.

d. **SAM Splint.** The SAM (universal) splint is a variation of the wire ladder splint. The SAM splint consists of a sheet of aluminum with a foam covering. The splint can be bent by hand to fit various shapes.

e. **Anatomical Splint.** An anatomical splint exists when one part of the casualty's body is used to immobilize an injured part of the body. For example, a casualty's injured leg can be tied (secured) to his uninjured leg.

f. **Improvised Splint.** An improvised splint is made of one or more rigid objects that are secured to the injured limb with available materials. Boards, poles, tree limbs, rolled newspaper, and unloaded rifles are examples of materials, which can be used as rigid objects. Bandages, strips of cloth torn from a shirt, and belts are some examples of securing materials.

Section III. RELATED INJURIES

1-11. DISLOCATIONS, SPRAINS, AND STRAINS

Dislocations, sprains, and strains are injuries to the musculoskeletal system. Although these injuries may not involve actual fractures, the causes, effects, and treatment of these injuries are closely related to those of fractures. Methods used to immobilize fractures are also used to immobilize dislocations and sprains.

1-12. DISLOCATIONS

A dislocation results when the end of a bone is moved from its normal articular position. The ligaments that hold the ends of the bones together may be torn. Other tissues surrounding the joint (the joint capsule) may also be injured (refer back to figure 1-2). Joints frequently affected include the shoulder, elbow, fingers, hips, and ankles.

a. **Signs and Symptoms.** A dislocation results in a deformed appearance due to the bone being out of its normal position. A dislocation also causes pain and/or a feeling of pressure over the joint. The region around the joint usually swells and is tender. The casualty may not be able to move the joint (the joint is "locked"). If the end of the dislocated bone is pressing on a nerve or blood vessel, the casualty may experience numbness or paralysis distal to (below) the injury.

CAUTION: Do not ask the casualty to move the injured body part in order to test for a locked joint or pain.

b. **Treatment.** Treat a dislocation as though it were a closed fracture.

(1) Immobilize the joint in the position in which the joint was found. Do not attempt to straighten or realign the bones.

(2) Reduce the swelling by elevating the joint and applying cold (a cold pack or ice compress, if available) to the joint for the first 24 hours after the musculoskeletal injury. After 24 hours, heat or warm soaks should be used to facilitate circulatory perfusion to the injured area.

(3) Check for pulse, strength, and sensation distal to the injury. If there is no pulse distal to the injury, attempt to restore blood circulation by gentle manipulation. If there is still no pulse, evacuate the casualty to a medical treatment facility as quickly as possible.

1-13. SPRAINS

A sprain results when the ligaments connecting two bones are stretched or torn. The other tissues that surround the joint may also be damaged. A sprain usually results when a joint is suddenly twisted beyond its normal range of motion. Skiing accidents often result in sprains. Sprains are most common in the knees and ankles. A sprain can result from a partial or temporary dislocation in which the bones resume their normal position following the injury. A sprain may produce as much damage as a dislocation.

a. **Signs and Symptoms.** A sprain does not cause a deformed appearance since the bones are not out of their normal positions. A sprain causes pain (tenderness), swelling, and discoloration (bruise) at the injured joint. The casualty may be unable to move the joint due to pain. [Do not ask the casualty to move the body part in order to test for this symptom.]

b. **Treatment.** Treat the sprain as though it were a closed fracture.

(1) Immobilize the joint.

(2) Reduce swelling by elevating the joint and applying cold, if available.

NOTE: Apply cold during the first 24 hours following the injury. After this time, apply warmth to the injured area.

1-14. STRAINS

A strain is a stretching or tearing of the muscle tissues around a joint. It is usually caused by excessive effort such as overstretching or overexertion. It is commonly called a "muscle pull."

a. **Signs and Symptoms.** A strain does not result in a deformed appearance. Swelling may or may not be present. Muscle spasms may be present. A strain can cause pain when the joint is moved.

b. **Treatment.** Have the casualty avoid putting weight on the injured joint. If you are unsure whether the injury is a strain or sprain, treat it as a sprain.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise. For true/false exercises, indicate if the statement is true or false.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. The fibrous tissues which hold the bones of a joint in place are called _____.
2. The tissues which connect muscles to bones are called _____.
3. A fracture in which the skin above the fracture is broken is called a(n)
_____ fracture.
4. A fracture in which the skin near the fracture is not broken is called a(n)
_____ fracture.
5. In a closed fracture, there is no risk of shock since there is no bleeding.
 - a. True.
 - b. False.
6. In an open fracture, there is a significant risk of infection.
 - a. True.
 - b. False.

7. Signs of a fracture include which of the following?
- a. Discoloration around the fracture site.
 - b. Swelling around the fracture site.
 - c. Deformed appearance, such as an unnatural bend in a straight part of the limb.
 - d. All of the above.
8. When performing the blanch test to check for circulation impairment, the color should return to the nail bed about _____ seconds after releasing the pressure.
9. When would you attempt to straighten a forearm before applying a splint?
-
10. You are applying a splint to a casualty's fractured limb. Should you check the casualty's pulse each time you apply and tie a cravat?
- a. Yes.
 - b. No.
11. Which one of the following usually causes the joint to appear deformed?
- a. Dislocation.
 - b. Sprain.
 - c. Strain.
12. In general, a dislocation is treated as though it were a(n) _____.

13. A fracture in which only one side of the bone is broken and the bone is bent is called a(n) _____ fracture.
- a. Comminuted.
 - b. Greenstick.
 - c. Pathologic.
 - d. Transverse.
14. A traction splint is usually applied to a fractured:
- a. Femur.
 - b. Rib.
 - c. Scapula.
 - d. Ulna.
15. An injury to a joint resulting in a torn ligament is a _____ while an injury to a joint resulting in a torn muscle is a _____.

Check Your Answers on Next Page

SOLUTION TO EXERCISES: LESSON 1

1. Ligaments (para 1-2)
2. Tendons (para 1-3)
3. Open (para 1-5b)
4. Closed (para 1-5a)
5. b (para 1-5a)
6. a (para 1-5b)
7. d (para 1-8b, d, e)
8. Two (para 1-9e(2))
9. The fractured limb is severely angulated and you must straighten the limb so it can be incorporated into the splint. (para 1-9g Caution)
10. a (para 1-9g(5)(a))
11. a (para 1-12a)
12. Closed fracture (para 1-12b).
13. b (para 1-7a)
14. a (para 1-10a)
15. Sprain; strain (paras 1-13, 1-14)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2

Spinal Injuries.

LESSON TEXT

Paragraphs 2-1 through 2-11.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 2-1. Identify the signs and symptoms of a spinal fracture.
- 2-2. Identify the general procedures for treating a spinal fracture.
- 2-3. Identify the procedures for placing a casualty with a spinal fracture onto a spine board.
- 2-4. Identify the procedures for evacuating a casualty with a spinal injury.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

SPINAL INJURIES

Section I. GENERAL

2-1. ANATOMY

a. **Spinal Column.** The spinal column (also called the backbone, spine, or vertebrae column) consists of a series of bones called vertebrae (see figure 2-1) and fibrocartilage layers (intervertebral disks), which separate adjacent vertebrae. The vertebrae are held together by ligaments. The top seven vertebrae (cervical vertebrae) are the bones of the neck. The next twelve vertebrae (thoracic vertebrae) form the upper part of the back and have the ribs attached. The next five vertebrae (lumbar vertebrae) form the lower part of the back. The next five vertebrae (sacral vertebrae) are located between the hip bones. They are fused together and form the sacrum, a structure, which looks like a broad triangle. The final four vertebrae (coccygeal vertebrae) are fused rudimentary vertebrae located at the end of the sacrum. These rudimentary vertebrae form the coccyx.

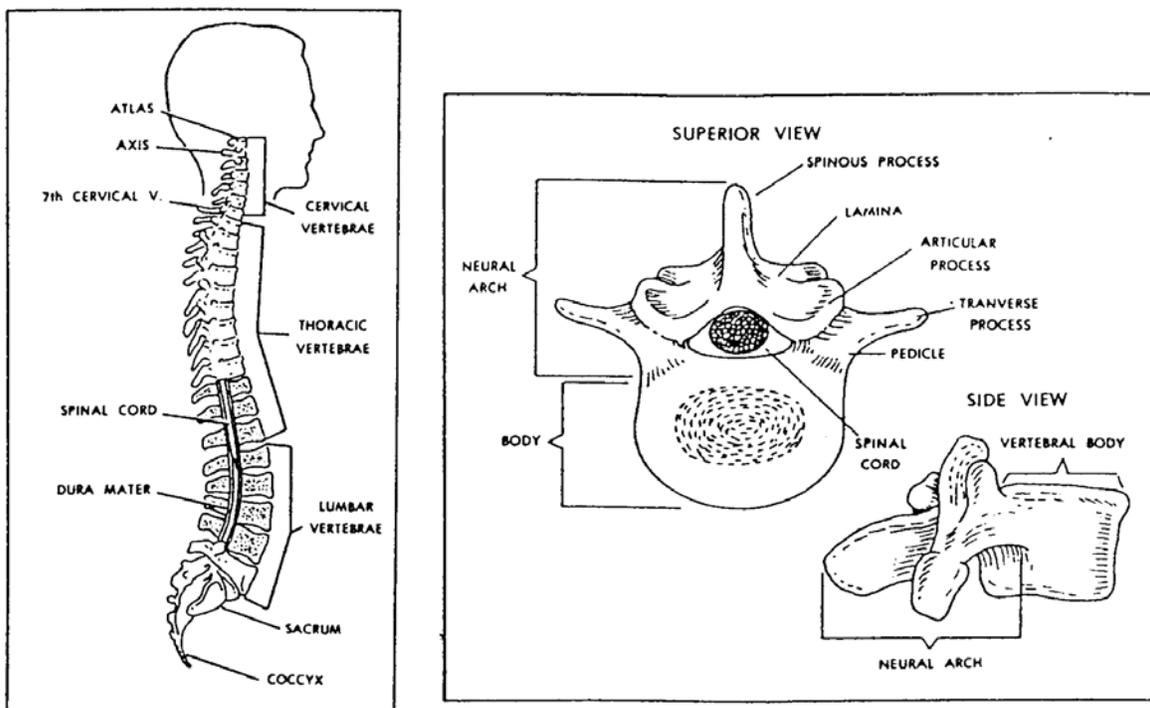


Figure 2-1. The spinal column and a typical thoracic vertebra.

b. **Spinal Canal.** The spinal canal is created by holes in the posterior parts of the vertebrae. The spinal canal contains the spinal cord.

c. **Intervertebral Disks.** The vertebrae that are not fused together are separated by intervertebral disks. These disks act as a cushion between the vertebrae.

d. **Spinal Cord.** The spinal cord is composed of nerves that carry impulses between the brain and the rest of the body. The spinal cord is protected by the spinal column. The spinal cord begins at the base of the brain and extends through the cervical vertebrae and thoracic vertebrae. The cord itself usually stops between the second and third lumbar vertebrae. If the spinal cord is severed (cut completely), the muscles controlled by the portion of the spinal cord below the cut will not function. Muscle control may be lost even if the spinal cord is not severed. Pressure on the spinal cord from a fractured vertebra or pressure due to swelling of the spinal cord can also produce paralysis.

e. **Cerebrospinal Fluid.** The cerebrospinal fluid (CSF) is produced in the brain and acts as a protective cushion by surrounding the brain and spinal cord. Leaking cerebrospinal fluid (usually from the ears, nose, or site of a head injury) indicates a serious head or spinal injury.

2-2. SURVEYING THE SCENE

When you arrive upon the scene, the first thing you should do is to perform a general survey. This information will help you to determine if a spinal injury is probable. A spinal injury should automatically be suspected if the casualty fell from a height, was involved in a vehicle accident or cave-in, or had a heavy object fall across his body.

a. Always assume that a spinal injury is present until your survey of the casualty indicates otherwise.

b. If other soldiers are present, ask them how the casualty was injured.

c. Do not move a casualty with a suspected spinal injury unless it is necessary to move him to a place of safety (his life is in immediate danger due to a burning vehicle, etc.) or it is necessary to position him for rescue breathing (respiratory arrest is present). Moving a casualty with a fractured spine can result in permanent paralysis or death.

(1) If the casualty must be moved to safety, keep the head and back in alignment while moving him.

(2) If the casualty must be in position for rescue breathing (mouth-to-mouth or mouth-to-nose resuscitation), open the casualty's airway using the jaw-thrust method. The jaw-thrust reduces movement and prevents hyperextension of the neck. Procedures for performing the jaw-thrust and other methods for restoring breathing are contained in Subcourse MD0532, Cardiopulmonary Resuscitation.

2-3. SIGNS AND SYMPTOMS OF A SPINAL INJURY

When you begin your primary survey, check for signs and symptoms of a spinal injury. If you suspect the casualty has a spinal injury, treat him as though you know he has a spinal injury. Some signs and symptoms of a spinal injury are:

a. **Spinal Deformity.** If the casualty is lying with his back, neck, or head in an abnormal position, suspect a severe spinal injury.

b. **Severe Head Injury.** If the casualty has a severe head injury (depressed area in the skull or brain matter visible), assume the casualty also has a spinal injury.

c. **Pain in the Spinal Region.** If the casualty is conscious, ask him about the presence of pain or tingling in his neck or back. The pain may be localized or defused. The presence of any pain in the spinal region is sufficient reason to suspect a spinal injury.

CAUTION: If your survey of the casualty does not indicate a spinal injury but the casualty has spinal pain when he attempts to move, assume a spinal injury is present.

d. **Lacerations and Contusions.** Look for lacerations (cuts) and contusions (bruises) over the spine.

e. **Tenderness in the Spinal Region.** If the casualty is conscious and does not report spinal pain, gently palpate the spine for tenderness (pain). If the casualty says an area of his spine is tender, assume that a spinal injury is present. As you check, also feel for deformity and look for lacerations and contusions. If the casualty is lying on his back, use the following procedures to check for spinal injury.

(1) Carefully insert your hand under the casualty's neck and feel along the cervical spine as far as can be done without disturbing the casualty's spine.

(2) Carefully insert your hand into the cavity formed by the small of the back and feel along the thoracic spine and down to the lumbar spine as far as possible without disturbing the casualty's spine.

f. **Numbness or Paralysis.** If the casualty is conscious, ask him if his extremities (especially his legs) feel numb (anesthesia), weak, or paralyzed. Numbness or paralysis of all four extremities usually indicates an injury to the cervical spine. Numbness or paralysis of only those areas below the waist usually indicates an injury to the lower part of the spine.

(1) Check for loss of function by having the casualty move his fingers and toes (or feet). Do not have the casualty lift an extremity since this could result in additional injury to the casualty.

(2) Touch the casualty's arms and legs with your fingers and ask if he feels your fingers.

g. **Unconsciousness.** Always treat an unconscious casualty as though he has a spinal injury.

2-4. SPINE BOARDS

After making sure the casualty is breathing and all severe bleeding has been controlled, you must immobilize the casualty's spine. This is normally accomplished using a long spine board or a short spine board (see figure 2-2). If spine boards are not available, use a door, wide plank, or other flat, rigid materials to immobilize the casualty's spine. A standard litter can be used, but a more rigid surface is preferred. Cravats or similar materials are used to secure the casualty to the spine board. The spine board allows the casualty to be evacuated with a minimum of spinal movement.

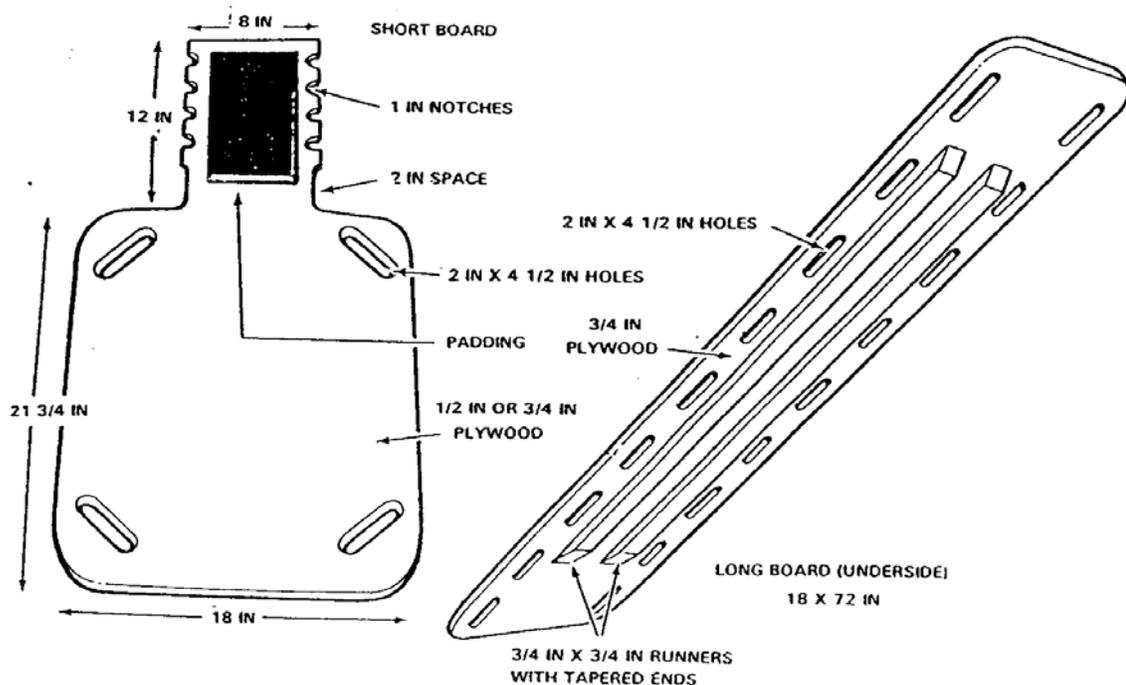


Figure 2-2. Short (left) and long (right) spine boards.

a. **Long Spine Board.** The long spine board is a combination litter, body splint, and rescue (extrication) device commonly used with casualties suspected of having spinal or pelvic injuries. A long spine board is usually made from 3/4-inch exterior plywood that has been sanded and varnished. The board usually measures about 18 inches in width and about 72 inches in length. Hand holes (which are also used for straps) are cut out along each side. Two parallel runners are attached lengthwise underneath the board. The runners permit easy sliding of the spine board and lift the board off the ground slightly to permit easy grasping of the hand holes. The ends of the

board are rounded, beveled, and tapered to make it easier to slide the board beneath the casualty. Accessories normally include four 6-foot patient securing straps, padding materials, and several cravats. The long spine board can also be placed beneath a casualty if cardiopulmonary resuscitation (CPR) is needed while the casualty is being transported on a litter. The board provides a firm surface for performing cardiac compressions.

b. **Short Spine Board.** The short spine board is used to immobilize the casualty's upper body. It is normally used when the casualty is extricated while in a sitting position or when a long spine board cannot be used. The short spine board is a splint and a rescue device but, unlike the long spine board, it is not a lifting device. The short spine board is normally made of 1/2-inch exterior plywood. The board is generally 18 inches wide and about 32 to 34 inches long. It is also sanded and varnished. Although it is a one-piece board, it is divided into two sections—the body and the headpiece. The headpiece is notched along its edges and normally measures 8 inches by 12 inches. The body has strap holes cut out at each corner and measures around 18 inches by 20 inches. Accessories normally include two 6-foot straps, one cervical collar, and cravats.

c. **Cravats.** A cravat is a piece of folded material. Cravats are usually made from muslin bandages, but can be made from other pliable material such as a shirt or sheet. The steps for making cravats are summarized below.

(1) Cut or tear a square about three feet on each side from pliable material if a muslin bandage is not available (see figure 2-3A).

(2) Fold the square diagonally so it is triangular in shape (see figure 2-3A).

(3) Cut or tear along the fold to form two triangles. Each triangle, commonly called a triangular bandage, is used to make a cravat. The longest side (the diagonal along which you cut the material) is called the base. The corner opposite the base is the apex (see figure 2-3B).

(4) Fold the apex of the triangle down until the tip of the triangle touches the base (see figure 2-3C).

(5) Continue to fold until the cravat is the correct size, usually about two more folds (see figures 2-3D and E).

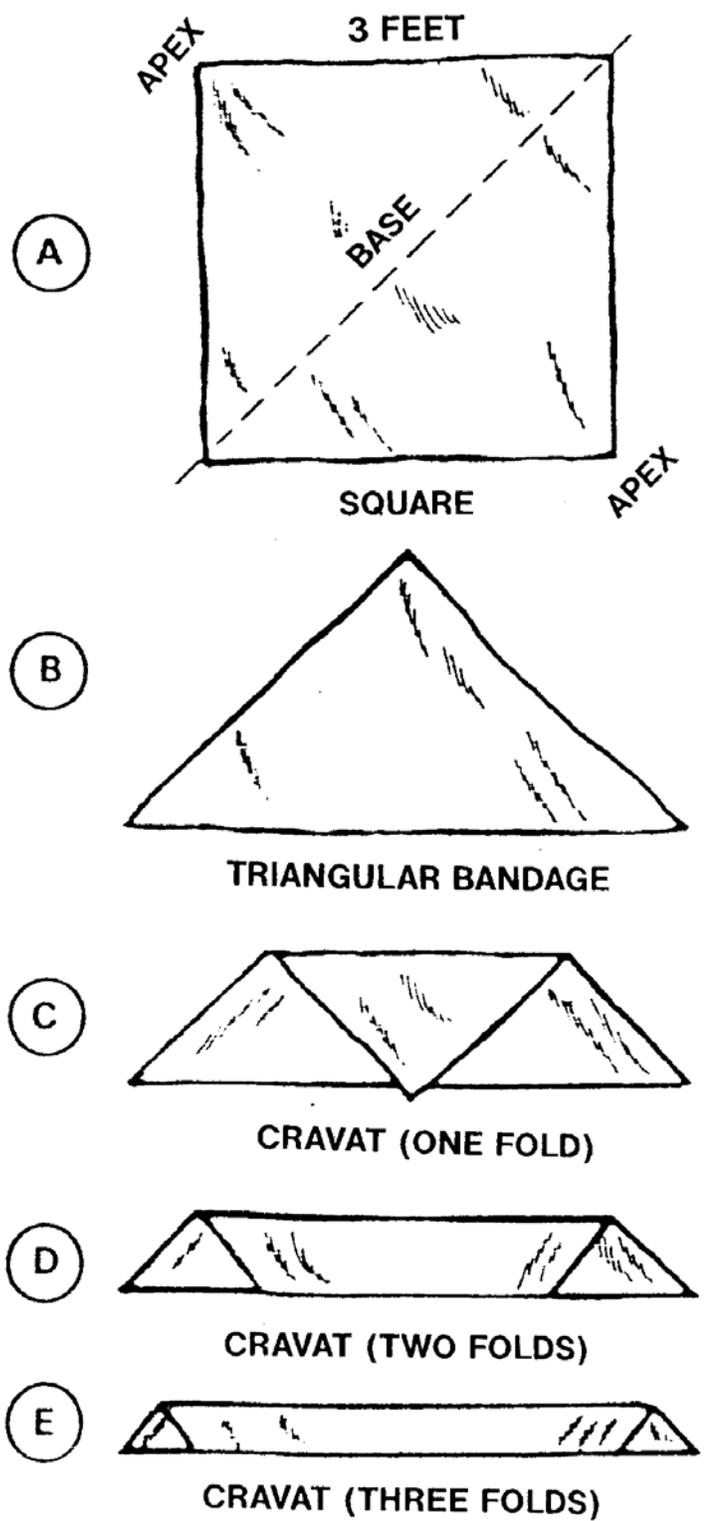


Figure 2-3. Making a cravat.

Section II. IMMOBILIZING A SUSPECTED SPINAL INJURY

2-5. IMMOBILIZING A CASUALTY'S NECK WITH CASUALTY LYING DOWN

After making sure the casualty is breathing and all severe bleeding has been controlled, immobilize the casualty's spine. If possible, take measures to immobilize the casualty's neck before placing the casualty on a spine board. The following procedures assume the casualty is lying on his back and you have at least one other person to assist you. If you are the only medical person available, you should apply traction and supervise the application of the cervical collar to the casualty's neck.

a. **Apply Manual Traction.** Immobilize the casualty's head and neck by applying gentle manual traction.

- (1) Kneel behind the casualty's head, facing the casualty.
- (2) Gently remove the casualty's helmet if the helmet is still on his head.
- (3) Place your hands on the sides of the casualty's head with your palms over the casualty's ears and your fingers supporting the casualty's mandible (jaw) as shown in figure 2-4.
- (4) Pull back slightly to apply gentle traction. Maintain the traction until the casualty has been secured to the spine board.



Figure 2-4. Applying manual traction to a casualty's head (casualty on his back).

b. **Apply Cervical Collar.** A cervical collar is a rigid device which, when properly placed around the casualty's neck, prevents the casualty from bending his neck. It also provides support to the jaw, thus helping to immobilize the casualty's head. If a cervical collar is available, have your assistant apply the collar to the casualty's neck. If a cervical collar is not available, improvise a collar from a SAM splint or from material such as a folded towel, T-shirt, or field jacket. The following procedures can be used to improvise a cervical collar from a towel or other materials at hand.

- (1) Fold the material so it can be slipped under the casualty's neck.
- (2) Slide one end of the folded material under the casualty's neck.
- (3) Wrap the material around the casualty's neck without moving his head or neck.
- (4) Fasten the material in place using pins, tape, or a cravat.
- (5) Check the collar for tightness. It should support the neck without interfering with the casualty's breathing.

c. **Place Casualty on Long Spine Board.** Place and secure the casualty to a long spine board using the procedures given in paragraph 2-6 or paragraph 2-7.

2-6. IMMOBILIZING A CASUALTY USING A LONG SPINE BOARD AND LOG ROLL

The log roll technique is the preferred method of placing a casualty with a spinal injury onto a long spine board. The technique requires four people (yourself and three assistants). You should maintain manual traction of the casualty's head while supervising your assistants.

a. **Position Long Spine Board.** Have an assistant obtain a long spine board and place it next to and parallel with the casualty.

b. **Secure Wrists.** Have an assistant place the casualty's wrists together at his waist and tie them together loosely without compromising circulation. A cravat is normally used to secure the wrists. Securing the casualty's wrists will make it easier to position him on the long spine board and will keep his arms from moving off the spine board.

c. **Brief the Casualty.** Tell the casualty that you are going to place him onto the spine board. Tell the casualty that he should not try to move; the assistants and yourself will move him without any effort on his part.

d. **Position Assistants.** Have the three assistants kneel on the same side of the casualty (the side away from the spine board) as shown in figure 2-5. If one of the assistants is more experienced than others, place him at the casualty's chest.

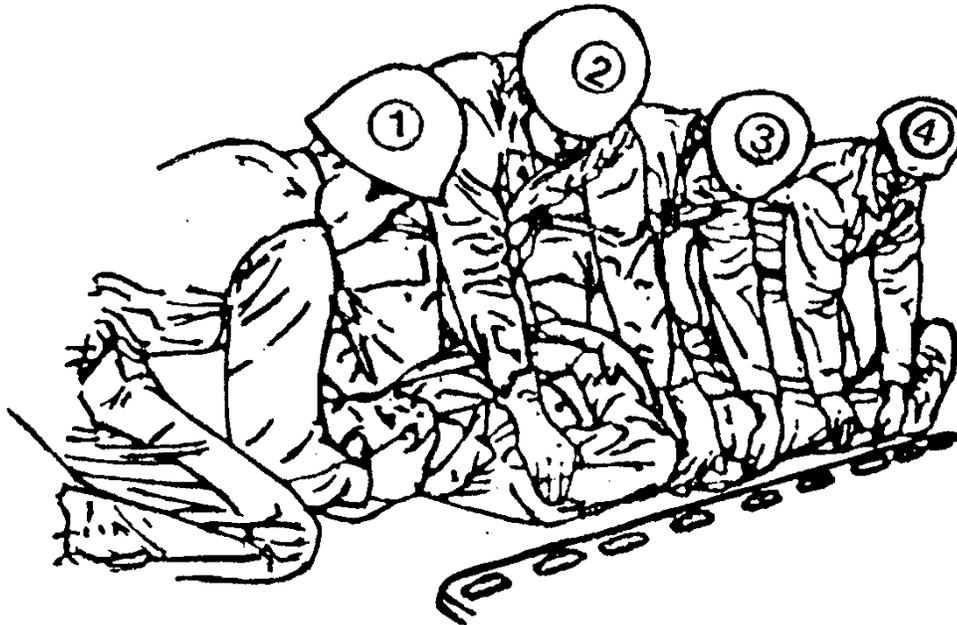


Figure 2-5. Placing a casualty on a long spine board using the log roll technique.

(1) Have the first assistant kneel near the casualty's chest and reach across the casualty. Have him place one hand at the casualty's far shoulder and the other at the casualty's waist.

(2) Have the second assistant kneel near the casualty's hips and reach across the casualty. Have him place one hand at the casualty's far hip and the other at the casualty's far thigh.

(3) Have the third assistant kneel near the casualty's lower legs and reach across the casualty. Have him place one hand at the casualty's far knee and the other at the casualty's far ankle.

e. **Roll Casualty.** Upon your command, have the three assistants roll the casualty slightly toward them in unison. As they roll the casualty, turn his head slightly to keep it in alignment with his spine.

f. **Slide Board.**

(1) If a fourth assistant is available, have him slip the spine board under the casualty.

(2) If a fourth assistant is not available, have the middle (second) assistant release his hold on the casualty's hip, grasp the closest edge of the spine board, and slide it against the casualty. Then have him release the board, reach across the board, grasp the far edge, and hold the board in place so it will not slip as the casualty is placed on the board.

NOTE: If needed, all three assistants can release one of their holds on the casualty to help move the spine board beneath the casualty. If this is done, the first and third assistants return to supporting the casualty with both hands while the second assistant uses one hand to prevent the spine board from slipping.

g. **Position Casualty on Board.** Have the assistants slowly lower the casualty in unison, allowing the casualty's back to rest on the spine board. As they lower the casualty, turn his head slightly to keep it in alignment with his spine. Position the casualty with his body in the middle of the spine board.

h. **Place Padding Beneath the Casualty.** Have the assistants slip padding (folded towels, jackets, and so forth) at the natural curves beneath the small of the casualty's back, beneath his knees, and beneath his ankles. Have an assistant place additional padding beneath the casualty's neck.

i. **Secure Casualty to Board.** Have the assistants secure the casualty to the long spine board using patient securing straps and cravats as shown in figure 2-6.

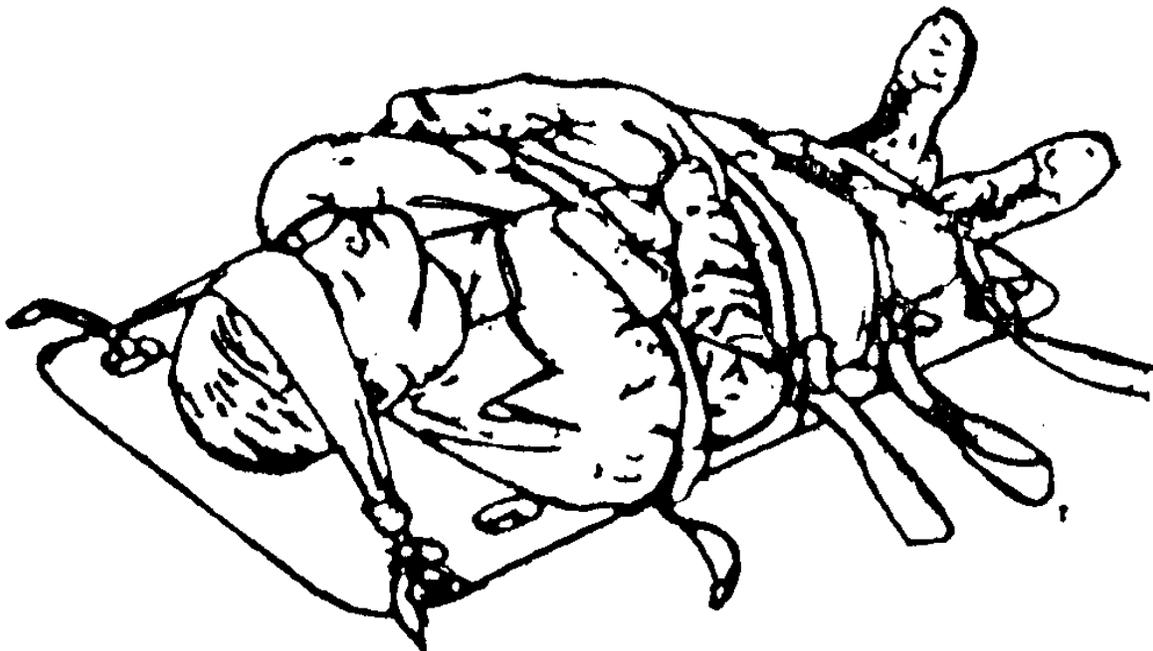


Figure 2-6. Casualty secured to a long spine board.

(1) Secure the casualty's head to the spine board with a cravat. Folded material or socks filled with sand may be placed at each side of the casualty's head before the cravat is applied to provide additional stability.

(2) Secure the casualty's chest (and upper arms if straps are long enough), hips, thighs, and lower legs to the spine board using the patient securing straps. Cravats or strips of cloth can be used if securing straps are not available.

2-7. IMMOBILIZING A CASUALTY USING A LONG SPINE BOARD AND STRADDLE-SLIDE

The straddle-slide technique is used to place a casualty with a spinal injury on a long spine board when limited space makes it impossible to use the log roll technique. The straddle-slide technique requires five people (yourself and four assistants). You should maintain manual traction of the casualty's head while supervising your assistants.

a. **Obtain Long Spine Board.** Have the fourth assistant obtain a long spine board.

b. **Secure Wrists.** Have an assistant place the casualty's wrists together at his waist and tie them together loosely with a cravat. The casualty's circulation should not be impaired.

c. **Brief the Casualty.** Tell the casualty that you are going to place him onto the spine board. Tell the casualty that he should not try to move; the assistants and yourself will move him without any effort on his part.

d. **Position Yourself and Assistants.** Squat so that you can maintain traction and have your feet spread wide apart. Position the assistants as follows.

(1) Have the first assistant face you, straddle the casualty's chest, and place his hands under the casualty's armpits.

(2) Have the second assistant face you, straddle the casualty's hips, and place his hands on the outsides of the casualty's hips.

(3) Have the third assistant face you, straddle the casualty's lower legs, and place his hands on the outside of the casualty's lower legs.

(4) Have the fourth assistant (the assistant with the spine board) stand behind you and face your back. Have him position the spine board so it can be slipped beneath the casualty.

e. **Lift Casualty.** Upon your command, have the first three assistants lift the casualty slightly in unison. As they lift the casualty, lift his head slightly to keep it in alignment with the spine.

f. **Slide Board.** Have the fourth assistant slide the long spine board between your feet and the feet of the other three assistants. The board should be positioned so the casualty will be in the middle of the board when he is lowered.

g. **Lower Casualty.** Have the first three assistants slowly lower the casualty in unison so the casualty is in the middle of the board. As they lower the casualty, lower his head to keep it in alignment with his spine.

h. **Place Padding Beneath the Casualty.** Next, have them slip padding beneath the natural curves at the small (arch) of the casualty's back, his knees, his ankles, and his neck.

i. **Secure Casualty to Board.** Finally, have them secure the casualty's head, chest, hips, thighs, and legs to the long spine board using straps, cravats, and/or strips of cloth while you maintain the cervical traction.

2-8. IMMOBILIZING A CASUALTY'S SPINE WITH CASUALTY SITTING UP

If the casualty was riding in a vehicle when it was involved in an accident, he may be in a sitting position. After making sure the casualty is breathing and all severe bleeding has been controlled, immobilize the casualty's spine by applying a cervical collar and a short spine board to the casualty before removing him from the vehicle. The following procedures assume the casualty is in a sitting position and you have at least one other person to assist you by applying a cervical collar and short spine board while you apply traction. Direct the assistant as needed.

a. **Apply Manual Traction.** Immobilize the casualty's head and neck by applying gentle manual traction.

(1) Position yourself behind the casualty and face the casualty.

(2) Place your hands on both sides of the casualty's head with your palms over the casualty's ears and your fingers supporting the casualty's mandible (jaw) as shown in figure 2-7.



Figure 2-7. Applying manual traction to a casualty's head (casualty sitting up).

(3) Apply and maintain manual traction until the casualty has been secured to the spine board. The casualty should be in an "eyes forward" position.

b. **Apply Cervical Collar.** If a cervical collar is available, have the assistant apply the collar to the casualty's neck. If a cervical collar is not available, have the assistant improvise a collar from a SAM splint or from material such as a folded towel, T-shirt, or field jacket. Apply an improvised material collar following the procedures given in paragraph 2-5b.

c. **Position Short Spine Board.** Have the assistant position the short spine board in the manner described below. If a short spine board is not available, improvise using a plank and cravats or other nearby materials.

(1) Position the spine board next to the casualty with the head (narrow) end of the board up.

(2) Slip the spine board between the casualty's back and the seat of the vehicle by pushing the board as far into the seat behind the casualty as possible.

(3) Tilt the upper end of the board toward the head.

d. **Secure Casualty's Head to Short Spine Board.**

(1) Position the back of the casualty's head against the spine board. Make sure you move the head and neck as a unit. The casualty will be in an upright position.

(2) If a cervical collar has not been applied to the casualty, have the assistant place a roll of material in the hollow space between the neck and the board to help keep the neck in its normal position when the casualty is removed. The roll should be large enough to fill the gap, but not large enough to exert pressure on the neck.

(3) If available, have the assistant place a support (rolled towel, blanket, sandbag, or similar material) next to each side of the casualty's head before securing the casualty's head. The additional material will help to prevent motion. The supports and the head are secured as a single unit.

(4) Have the assistant secure the casualty's head to the board using a head strap or cravat (see figure 2-8). Once the casualty's head is firmly secured, you can release your hold on the casualty's head.

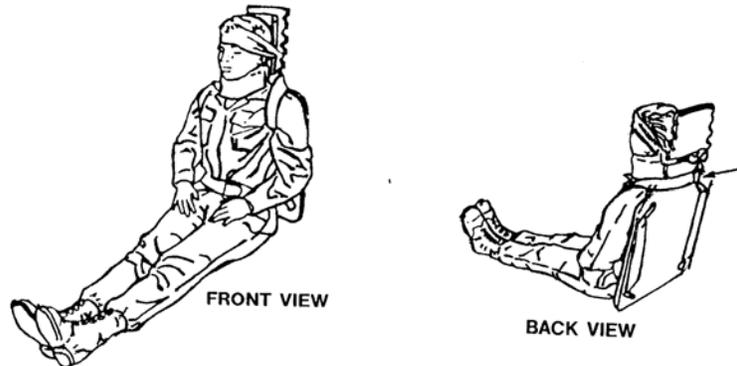


Figure 2-8. Short spine board and cervical collar applied to a sitting casualty.

e. **Secure Casualty's Back to Short Spine Board.** Secure the casualty's back to the spine board using two body straps or improvised straps (see figure 2-8).

- (1) Place the buckle of the first body strap in the casualty's lap.
- (2) Pass the other end of the strap through the lower hole in the board, up the back of the board, through the top hole, under the casualty's armpit, up over his shoulder (same side as armpit), and across the back of the board at the neck.
- (3) Take the second body strap and buckle it to the end of the first body strap (the end at the back of the board near the casualty's neck). The buckle should rest on the back of the spine board and not press on the casualty's neck.
- (4) Continue to secure the casualty by bringing the strap around the back of the board, over the casualty's unsecured shoulder, down and under his armpit, through the top hole on that side of the board, down the back of the board, through the lower hole, and across the casualty's lap.
- (5) Secure the end of the second body strap to the buckle of the first body strap. Both shoulders are secured to the top of the board's body and the bottom of the board is secured to the casualty's waist (see figure 2-8).

f. **Secure Casualty's Wrists.** Place the casualty's wrists together in his lap and tie them together loosely with a cravat. Make sure the cravat does not interfere with blood circulation.

g. **Position Long Spine Board.** Once the casualty has been partially immobilized with the short spine board, position him on a long spine board. If a long spine board is not available, use a wide plank or similar object.

- (1) Have the assistant obtain the long spine board and open the vehicle door on the opposite side of the casualty. If the casualty is located on the driver's side of the front seat, for example, the assistant will open the door on the passenger's side of the front seat.

(2) Have the assistant position the long spine board flat on the seat perpendicular to the casualty.

(3) Have the assistant slide the long spine board on the seat until the end of the board is against the casualty's buttocks.

(4) Tip the casualty slightly and have the assistant continue to move the board until the end of the long spine board is beneath the casualty's buttocks. This will make it easier to place the casualty on the long spine board.

h. Lay Casualty on Long Spine Board. Turn the casualty in the seat so his back is toward the opened door (back toward long spine board) and lay him on the long spine board.

(1) Check the casualty's feet. If they are tangled up in the pedals, move the feet until they are free.

(2) Turn the casualty by working in unison with the assistant.

(a) Grasp his upper body area (under his arms). Do not grasp the short spine board when moving the casualty.

(b) Have the assistant grasp the casualty's lower legs.

(c) Pivot the casualty's body as the assistant lifts the casualty's legs onto the seat. You and the assistant must work in unison to prevent additional injury to the casualty.

(3) Have the assistant help you lay the casualty on the long spine board in a slow and gentle manner. The casualty's trunk is now in a horizontal position.

(4) Have the assistant help you to lift the casualty's body and legs and slide the long spine board beneath the casualty's entire body. If the casualty is properly secured to a short spine board and there is not enough room to lift the casualty, slide the casualty onto the long spine board.

i. Remove Casualty From Vehicle. Once the casualty has been positioned on the long spine board, remove the casualty from the vehicle.

(1) Have the assistant join you at your door. You should be on one side of the long spine board (right or left) and the assistant should be on the other side.

(2) Lift the long spine board and remove the casualty from the vehicle.

j. Secure Casualty to Long Spine Board.

(1) Secure the short spine board to the long spine board. If possible, line up the strap holes of the short spine board with the holes of the long spine board and secure the two boards together. Do not remove the short spine board.

(2) Secure the casualty to the long spine board using available straps, cravats, or strips of cloth.

2-9. TRANSPORTING A CASUALTY WITH A SPINAL INJURY

Record the treatment given the casualty on a US Field Medical Card and attach the card to the casualty's jacket. Open a standard litter and place it on the ground near the casualty. Have at least four bearers lift the long spine board in unison, move the casualty over the litter, and gently lower the long spine board in the middle of the litter in unison. Keep the board and the casualty as level as possible during the procedure. Evacuate the casualty using an appropriate four-man litter carry as described in Subcourse MD0001, Evacuation in the Field. If a litter is not available, the casualty can be evacuated using the long spine board as the litter. If a short spine board has been applied, the casualty must be placed on a long spine board or litter before being evacuated.

2-10. IMMOBILIZING A CASUALTY'S SPINE USING THE GROUND AS SPLINT

If you suspect a casualty has a spinal injury, you can use the following steps to temporarily immobilize the casualty on the ground while you obtain a long spine board and assistance.

a. Tell the casualty to keep still.

b. If the casualty is lying on his back, place padding to help support and immobilize his spine (see figure 2-9).

(1) Roll or fold padding (such as a blanket) until it conforms to the shape of the arch of his back. Then carefully slide the padding under the arch of his back.

(2) Slide a roll of cloth under the casualty's neck to help support and immobilize his neck.

c. Place padded rocks, small padded logs, or filled boots on each side of the casualty's head to keep it from moving. The procedure for using filled boots is described below.

(1) Remove the casualty's boots.

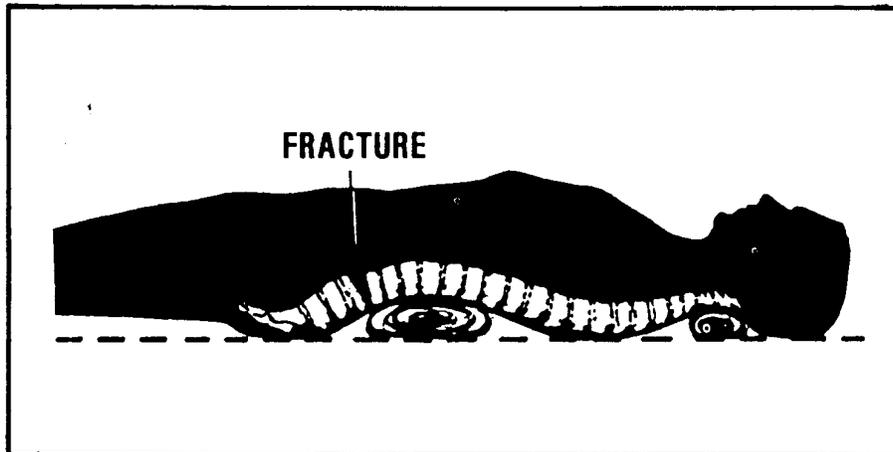


Figure 2-9. Padding placed under the casualty's neck and back.

CAUTION: Do not remove the casualty's boots if you are in a chemical environment.

- (2) Fill the boots almost to the top with sand or small rocks.
- (3) Place material (strip of clothing, sock, and so forth) on top of the sand or rocks in each boot to keep the sand or rocks from falling out.
- (4) Tie the top of each boot to keep the material in place.
- (5) Place the boots around the casualty's head so the head will not turn (see figure 2-10).

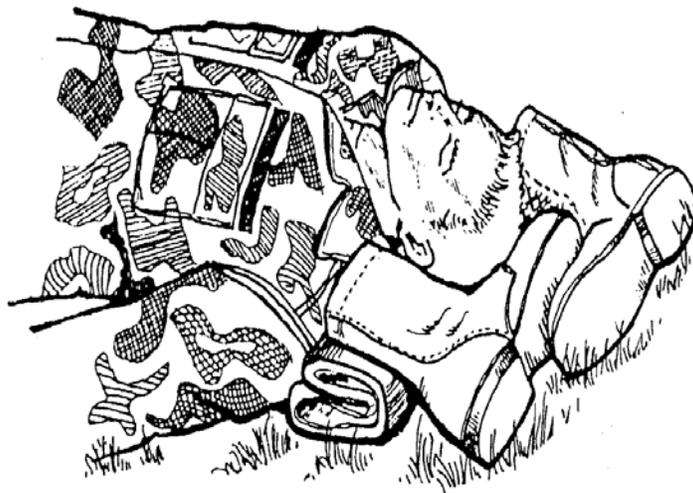


Figure 2-10. Casualty's head immobilized with boots.

2-11. TURNING A CASUALTY ONTO HIS BACK

The preceding paragraphs have dealt with a casualty in a supine or sitting position. If the casualty is lying on his abdomen, leave him in this position while you perform your survey of the casualty.

a. To turn the casualty onto his back, obtain the assistance of three or more people, if possible. The procedure for turning a casualty with a possible spinal injury onto his back is similar to those used for the log roll. Keep the casualty's head, neck, and back in alignment during the turn.

(1) Position yourself at the casualty's head and apply gentle manual traction to his head.

(2) Have the assistants kneel on the same side of the casualty at the casualty's chest, hips, and lower legs.

(3) Have the assistants reach across the casualty and secure holds on the casualty's far side at his shoulder, waist, hip, thigh, knee, and ankle.

(4) Upon your command, have the assistants gently roll the casualty onto his back. All members must work in unison and keep the casualty's spine in alignment. As the assistants turn the casualty, turn his head so his face is up when the turning is completed.

b. Do not attempt to turn the casualty by yourself unless you must risk injury to the casualty in order to save his life (administer rescue breathing to a nonbreathing casualty, remove the casualty from a burning building, and so forth). If you must turn the casualty and no other help is available, keep the casualty's head, neck, and back in alignment as much as possible when turning.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. You should assume the casualty has a spinal injury if the casualty:
 - a. Has a severe head injury.
 - b. Has a bruise over the spine and the casualty states that the area is painful.
 - c. Is unconscious.
 - d. Has any of the above conditions.

2. A casualty has fallen from a building. He is conscious and states that he cannot move his arms or legs. Your testing indicate that he has no feeling in his limbs. This casualty has probably suffered a spinal injury in the:
 - a. Sacral/coccygeal area.
 - b. Lower thoracic area.
 - c. Cervical area.
 - d. Lumbar area.

3. You were going to immobilize the casualty's neck, but no cervical collar is available. What should you do?
 - a. Do not evacuate the casualty until an approved cervical collar has been applied.
 - b. Apply an improvised cervical collar before evacuating the casualty.
 - c. Evacuate the casualty, but apply a cervical collar when one becomes available.

4. Can a casualty with a suspected spinal injury who is lying on his abdomen be moved before you begin applying a splint?
 - a. Yes, if he is not breathing or his life is in danger.
 - b. No, never move a casualty with a spinal injury before applying a splint to the casualty's spine.

 5. When is the straddle-slide method of placing a casualty on a long spine board used instead of the log roll method?
-

6. Which one of the following is the proper procedure for removing a sitting casualty with a suspected spinal injury from a vehicle?
 - a. Apply a short spine board to the casualty's head and back; remove the casualty from the vehicle; then place him on a long spine board.
 - b. Apply a short spine board to the casualty's head and back; turn the casualty and lay him on a long spine board; then remove him from the vehicle.
 - c. Remove the casualty from the vehicle; then place him on a combined short and long spine board.

7. While you and a friend are hiking in the woods, you hear a scream. You investigate and find a person who has fallen from a tree. The casualty is conscious, lying on his back, has no significant external bleeding, and may have a cervical spinal injury. What should you do to help keep the casualty's head and neck immobile while your friend summons medical help?
 - a. Tell the casualty to keep still.
 - b. Place padding beneath his neck.
 - c. Remove the casualty's boots, fill them with small rocks, and put them around the casualty's head.
 - d. All of the above are proper procedures.

8. A casualty has been placed on a long spine board. Should padding be placed between the small of the casualty's back and the spine board?
 - a. Yes.
 - b. No.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. d (paras 2-2a; 2-3b, c, d, e, g)
2. c (para 2-3f)
3. b (paras 2-5b, 2-8b)
4. a (para 2-2c)
5. When the casualty is in a narrow area that does not provide enough space to perform the log roll method. (para 2-7)
6. b (para 2-8)
7. d (paras 2-10a, b, c)
8. a (paras 2-6h, 2-7h)

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3

Traction Splints.

LESSON ASSIGNMENT

Paragraphs 3-1 through 3-6.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 3-1. Identify the purpose of a traction splint.
- 3-2. Identify the procedures for applying an Army Thomas leg splint.
- 3-3. Identify the procedures for applying a Hare traction splint.
- 3-4. Identify the procedures for securing a traction splint to a litter.

SUGGESTION

After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

TRACTION SPLINTS

Section I. GENERAL

3-1. FRACTURED FEMUR

When a casualty suffers a complete fracture of the femur, the strong thigh muscles can contract and pull the ends of the fractured bone out of alignment. Once the two fractured ends of the femur are out of alignment, muscle contractions can then cause the fractured bone segments to slip and be side by side. This causes the thigh to "shorten." These fractured ends can damage major blood vessels, nerves, and muscle tissues of the thigh.

3-2. PURPOSE OF A TRACTION SPLINT

The purpose of a traction splint is to immobilize and provide constant traction to the injured limb. The traction pulls the muscles of the thigh back to their normal length and allows the fractured femur to slip back into alignment.

a. The traction splint was developed by Sir Hugh Thomas, an orthopedic surgeon, who lived in Liverpool, England during the 19th century. Traction splints used in the field include the Army Thomas leg splint and the Hare traction splint.

b. Traction splints are used only on the lower extremity, usually for a fracture of the femur. The traction places counter traction on the body. When traction is applied to the leg, the counter traction is applied against the bones of the pelvis. If the splint were to be applied to an arm, the splint would press against the axilla (armpit) region. Pressure in the axilla could damage blood vessels and nerves located in the region and seriously impair blood circulation.

Section II. APPLYING TRACTION SPLINTS

3-3. APPLYING AN ARMY THOMAS LEG SPLINT

a. **Locate Fracture Site.** As you survey the casualty, cut or tear the pants leg to expose the injury and locate the site of the fracture. Dress any open wounds on the leg before applying the traction splint. Check the casualty's popliteal pulse (the pulse behind the knee).

b. Obtain Splint and Two Assistants.

(1) Obtain the Army Thomas leg splint set (see figure 3-1). You will need the metal telescoping splint with a padded half ring and strap at the top, a traction apparatus (straps), a footrest, a litter bar, six or more cravats (can be made from muslin bandages or other material), and padding.

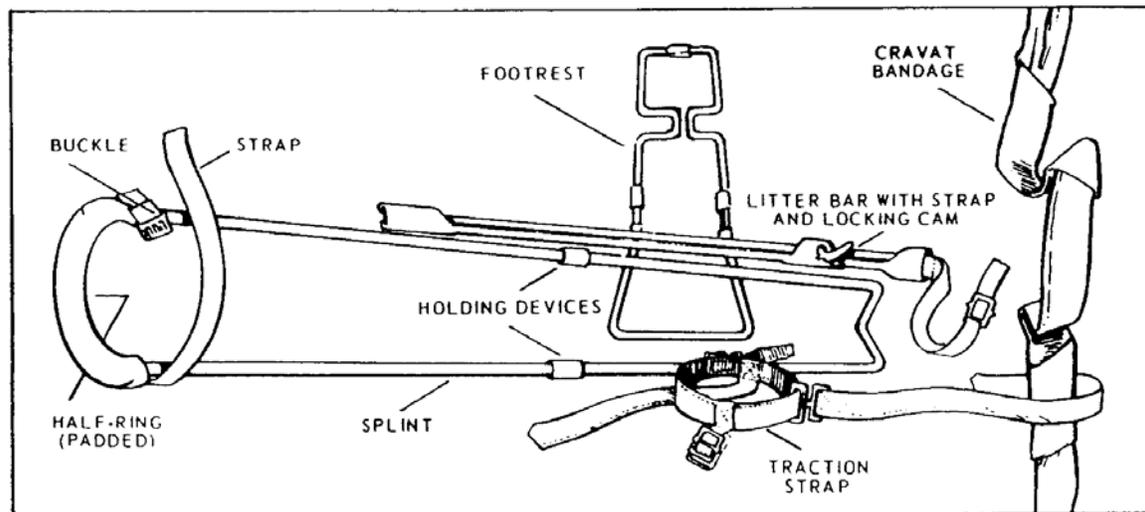


Figure 3-1. Thomas leg splint.

(2) The Army Thomas leg splint requires three people (you and two assistants) to apply the splint properly. In the following instructions, the assistants will be identified as the splint assistant and the traction assistant. You must instruct and help the assistants as needed.

c. Apply Traction Apparatus to Boot. Have the traction assistant apply the traction apparatus (see figure 3-2) to the casualty's boot using the following steps.

- (1) If any straps are fastened, loosen them.
- (2) Place the swivel where the traction strap connects to the instep strap on the bottom of the casualty's boot at the arch near the heel. Position the straps so the heel strap will point down when the instep strap is wrapped around the casualty's boot.
- (3) Bring the instep strap over the front of the boot and buckle the strap securely.
- (4) Bring the heel strap around the back of the heel and buckle the strap securely (see figure 3-3).

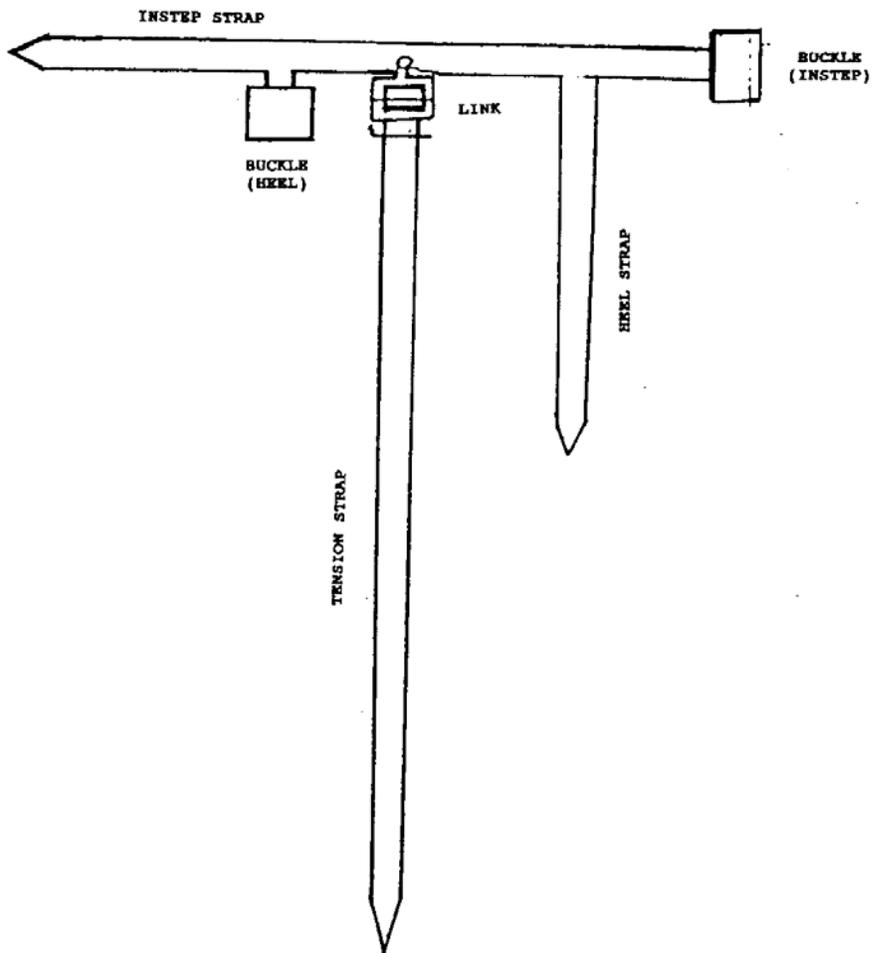


Figure 3-2. Traction apparatus for the Army Thomas leg splint.

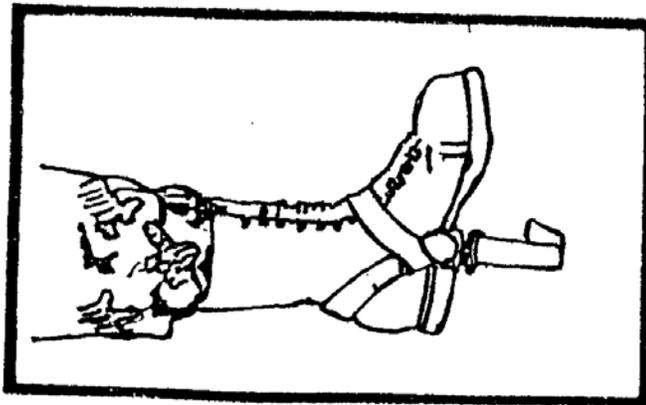


Figure 3-3. Traction apparatus applied to the casualty's foot.

d. **Adjust Splint.** While the traction assistant is applying the traction apparatus, have the splint assistant adjust the telescoping splint to the appropriate length using the following steps. If the splint is too short, proper traction cannot be applied. If the splint is too long, the traction strap cannot be applied properly.

(1) Lay the splint parallel to the casualty's uninjured leg with the top of the splint (end with padded half-ring) even with the bottom of the casualty's ischium (the lower bone of the pelvis shown in figure 3-4). The uninjured leg is used for measurement because the injured leg may be shortened due to muscle contraction.

(2) Loosen the locking devices on the two metal rods of the splint. The bottom of the splint is now free to slide and lengthen the splint.

(3) Pull on the lower part of the splint until the bottom of the splint is 6 to 8 inches beyond the bottom of the casualty's foot. Keep the top of the splint even with the ischium.

(4) The telescoping rods have small grooves that are used to lock the lower part of the splint in place. Adjust the lower part of the splint until the closest groove on each side of the splint is in place; then tighten the locking devices.

(5) Check the splint to make sure that the telescoping lower part of the splint is securely locked and will not slip. If it slips, traction will be lost.

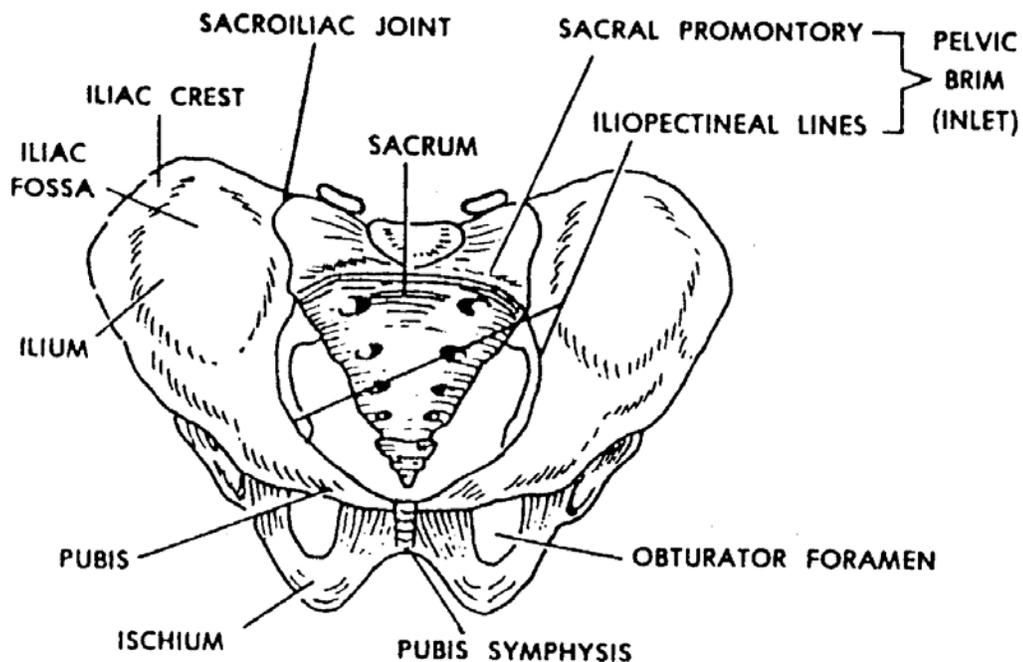


Figure 3-4. Pelvis showing the ischium.

(6) Position the splint next to the injured leg with the top of the splint even with the ischium on the casualty's injured side. The splint assistant waits until traction is applied before applying the splint to the limb.

e. **Prepare to Apply Manual Traction.** Have the traction assistant grasp the casualty's foot in such a way that the splint can be applied to the leg without the traction assistant releasing his hold on the casualty's foot.

(1) Reach between the rods of the splint with one arm. The arm should go under the outside rod and over the top of the inside rod (rod closest to the injured leg).

(2) Grasp the back of the ankle near the heel of the casualty's boot with the hand that passed between the rods.

(3) Grasp the toe portion of the boot with the other hand.

f. **Prepare to Support the Fractured Limb.** Place both of your hands under the casualty's injured limb, one above the fracture and one below the fracture, in readiness to support the limb.

g. **Apply Manual Traction.**

(1) Upon your command, have the traction assistant lean back and apply manual traction to the limb by lifting and pulling on the foot.

(2) At the same time, lift the leg 6 to 8 inches. Ensure the leg is aligned properly and continues to be properly aligned throughout the procedure.

CAUTION: Once manual traction is applied, the traction assistant must maintain the traction and you must continue to support the fracture limb until the cravats have been applied (paragraph 3-3k).

h. **Position the Splint.** After manual traction has been applied and the leg elevated, have the splint assistant position the splint under the injured leg and secure the padded half-ring using the following steps.

(1) Ease one side of the splint under the casualty's hip with the padded half-ring section beneath the casualty.

(2) Bend the half-ring so it is perpendicular to the rods and is seated under the junction of the buttocks and the thigh.

(3) Place padding over the thigh where the strap securing the half-ring will be applied.

(4) Bring the strap over the top of the casualty's thigh and padding.

(5) Secure the strap in the buckle so the top of the splint is secured to the casualty's thigh. Do not tighten the strap so much that it impairs circulation.

(6) Check the casualty's popliteal pulse. If there is no pulse, loosen the strap and tighten the strap again.

i. **Tighten the Traction Strap.** After the splint is positioned and the half-ring secured, have the splint assistant go to the foot end of the splint and secure the traction strap using the following steps.

(1) Take the free end of the traction strap over the end of the splint at the notch.

(2) Bring the traction strap down under the notched end of the splint, back to the link at the swivel, and through the link (bottom to top) as shown in figure 3-5. This creates a pulley effect when the strap is tightened.

(3) Pull on the free end of the strap until the force of the strap is maintaining the traction on the injured limb.

NOTE: Have the traction assistant tell the splint assistant when sufficient tension has been applied by the strap.

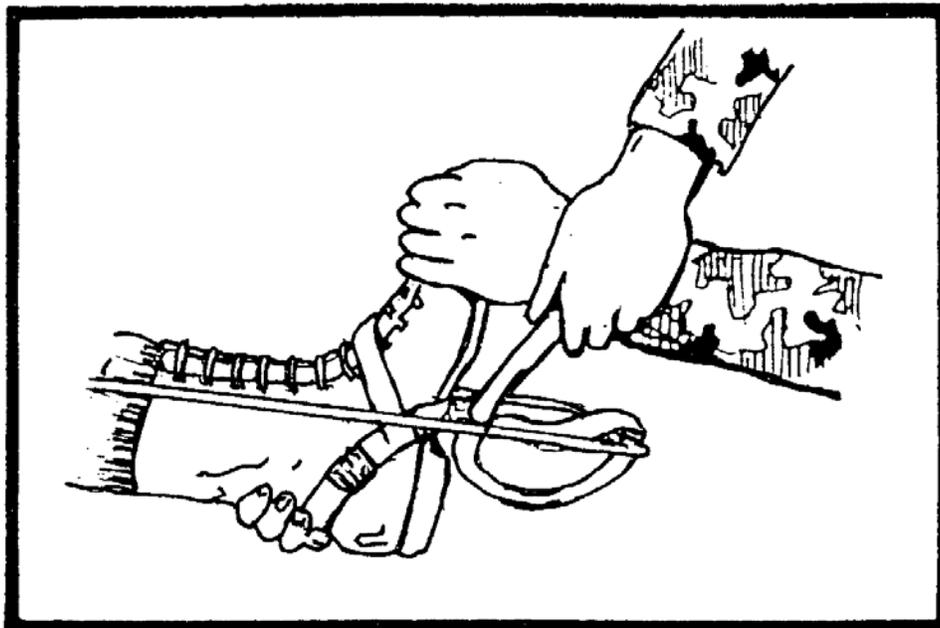


Figure 3-5. Traction strap being secured to splint.

(4) Pinch the traction strap with the free hand so the tension will not be released as the strap is being secured.

(5) Tie the strap at the notch on the splint so the knot will not slip. If the knot slips, traction will be lost.

CAUTION: The traction assistant continues to provide support to the limb by maintaining his hold on the heel and toe of the boot. Even though traction is now provided by the traction strap, do not allow the traction assistant to release his hold on the casualty's foot until the footrest has been secured (paragraph 3-3I).

CAUTION: Once the traction strap has been secured, only a physician should loosen the traction. If the strap becomes loose, it may be tightened by trained medical personnel.

j. **Apply the Footrest.** After the traction strap is secure, have the splint assistant apply the footrest to the end of the splint.

(1) Position the footrest between the arms of the traction assistant (who is still holding the casualty's foot) with the narrow end of the footrest up.

(2) Slip the footrest over the end of the splint.

(3) Slide the tracks of the footrest over the rods of the splint until the footrest barely touches the sole of the casualty's boot.

k. **Apply Cravats.** After the footrest has been applied, have the splint assistant apply five cravats to support the leg and secure the splint to the leg. The first cravat is applied to the thigh above the fracture, the second to the thigh below the fracture, the third below the knee, the fourth at the top of the boot, and the fifth at the ankle. The following procedures are used to apply each cravat. [**NOTE:** The casualty's leg is not shown in Figure 3-6 so the positioning of the cravat can be seen clearly.]

CAUTION: A cravat is not applied around the fracture site. You may need to move your hands supporting the casualty's leg as the splint assistant applies the cravats.

(1) Insert one end of the cravat between the outer rod and the leg.

(2) Bring the end of the cravat under the leg and then between the leg and the inner rod.

(3) Bring both ends straight up for measurement.

(4) Adjust the cravat so the outer part of the cravat (side on the outer part of the limb) is about 6 inches longer than the inner part. (This will result in the tails of the cravat being about equal when the knot is tied.)

(5) Drop each end of the cravat over its rod (see figure 3-6A).

(6) Form a cradle (see figure 3-6B).

(a) Bring the outside (longer) tail around the outer rod, under the casualty's limb, around the inner rod, and over the top of the casualty's limb.

(b) At the same time, bring the inside tail around the inner rod, under the casualty's limb, and around the outer rod.

(7) Bring the longer end of the cravat (end which is now on the inside) over the top of the casualty's limb and tie the tails together in a nonslip knot directly over the outer splint rod (see figure 3-6C).

(8) Check the casualty's pulse below the cravat, if possible. If the cravat interferes with the blood circulation, loosen the cravat and secure it again.

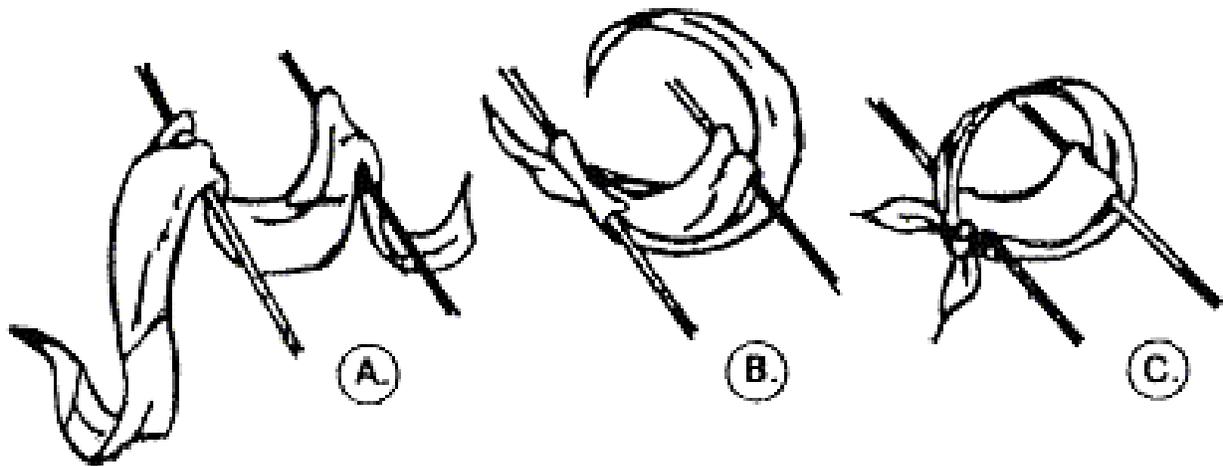


Figure 3-6. Applying cravats to secure the splint.

I. **Secure the Foot to the Footrest.** After the five cravats have been applied (see figure 3-7), release your support of the injured limb, allowing the cravat cradles to provide the support, and secure the casualty's foot to the footrest.

(1) Push the footrest against the sole of the boot so the sole and footrest are flush.

(2) Apply a sixth cravat to secure the toe of the boot to the footrest (see figure 3-8). The cravat is applied in the same manner as the other five cravats.

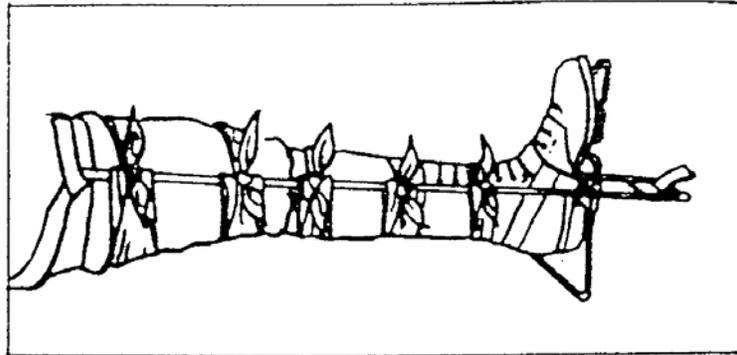


Figure 3-7. Five cravats applied to the casualty's leg.

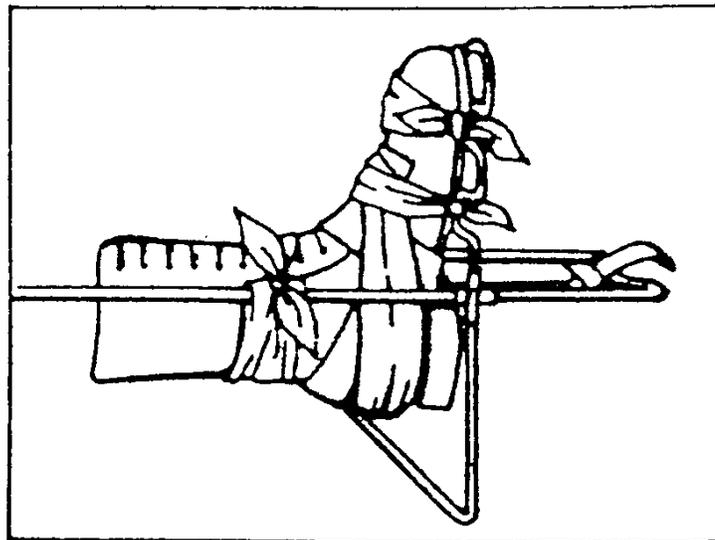


Figure 3-8. Sixth cravat applied to the toe of the boot.

m. **Place Casualty on Litter.** Once the traction splint has been applied, the casualty is moved to the litter using the procedures given in paragraph 3-5.

CAUTION: Once the traction strap has been applied, do not release the traction. Traction should only be released by a medical officer. If the strap becomes loose, have the traction assistant administer manual traction; then tighten and secure the strap again.

3-4. APPLY THE HARE TRACTION SPLINT

a. **Locate Fracture Site.** As you perform your survey of the casualty, cut or tear the pants leg to expose the injury and locate the site of the fracture. Dress any open wounds on the leg before applying the traction splint. Check the casualty's popliteal pulse.

b. **Obtain Splint.** Obtain the Hare traction splint set. The set contains the metal Hare splint with straps and ratchet, an ankle hitch, padding materials, and a litter bar. The Velcro straps provide support for the leg and secure the leg to the splint. The metal splint has a stirrup that lifts the splint off the ground like the bottom part of the footrest in an Army Thomas leg splint.

c. **Obtain Assistant.** The Hare traction splint can be applied by two people. In the following instructions, the person helping you will be identified as the assistant. Instruct the assistant in his functions and provide help as needed.

d. **Stabilize the Injured Leg.** Check for a pulse distal to the injury. Then grip the casualty's ankle and foot as shown in figure 3-9. Apply sufficient traction to stabilize the leg to prevent movement at the site of the fracture.

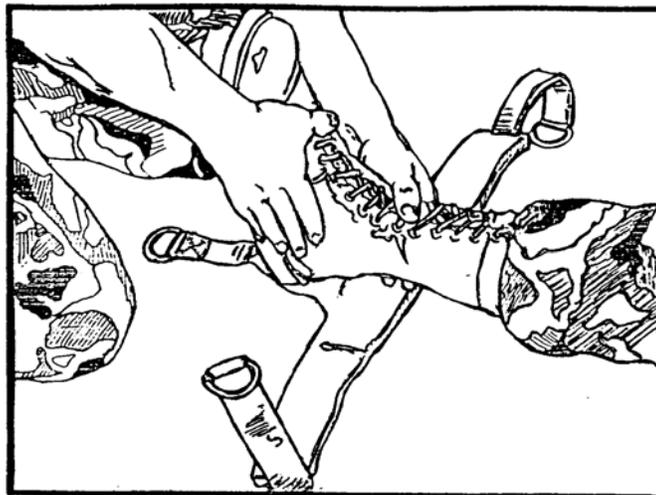


Figure 3-9. Positioning the ankle hitch of a Hare splint.

e. **Adjust Splint.** Have the assistant adjust the telescoping splint to the right length and lock the rod in place using the following steps.

(1) Loosen the locking devices on the two metal rods of the splint so the bottom of the splint is free to slide.

(2) Lay the splint parallel to the casualty's uninjured leg with the top of the splint even with the bottom of the casualty's buttocks (at the ischium).

(3) Pull on the lower part of the splint until the bottom of the splint is 8 to 12 inches beyond the bottom of the casualty's foot. Keep the top of the splint even with the ischium.

(4) Lock the splint in position.

(5) Test the splint to make sure the lower part of the splint is securely locked and will not slip.

(6) Position the splint next to the injured leg with the top of the splint even with the ischium on the casualty's injured side.

f. **Open and Position Support Straps.** The splint has five straps, the ischial (top) strap and four Velcro leg support straps. Have the assistant open all five straps and position the four Velcro support straps in the following positions:

(1) Position the first leg support strap (first strap below the ischial strap) so it will secure the thigh above the fracture site.

(2) Position the second leg support strap so it will secure the thigh below the fracture site.

(3) Position the third leg support strap so it will secure the lower leg below the knee.

(4) Position the fourth leg support strap so it will secure the lower leg above the ankle.

g. **Prepare Ratchet.** Have the assistant release the ratchet, pull the traction strap over the top of the ratchet, and place the "S" hook so the hook hangs off the splint.

h. **Apply the Ankle Hitch to the Boot.** Have the traction assistant apply the ankle hitch in the following manner:

(1) Slide the three-ringed ankle strap under the heel of the casualty's boot with the padded side of the strap against the foot. Place the bottom edge of the heel even with the lower edge of the sponge padding as shown in figure 3-9.

NOTE: You will need to change your grip on the casualty's ankle and foot to allow the assistant to apply the traction strap while you maintain your support. After the strap is applied, your hands should be over the "X."

(2) Crisscross the side straps high over the casualty's instep so the straps form an "X."

(3) Bring the ends of the crisscrossed straps down to meet the center strap.

Hold all three straps in place.

(4) Twist the center strap until it is even with the two side straps until all three straps can be firmly grasped and the three "D" rings at the end of the straps are together (see figure 3-10).

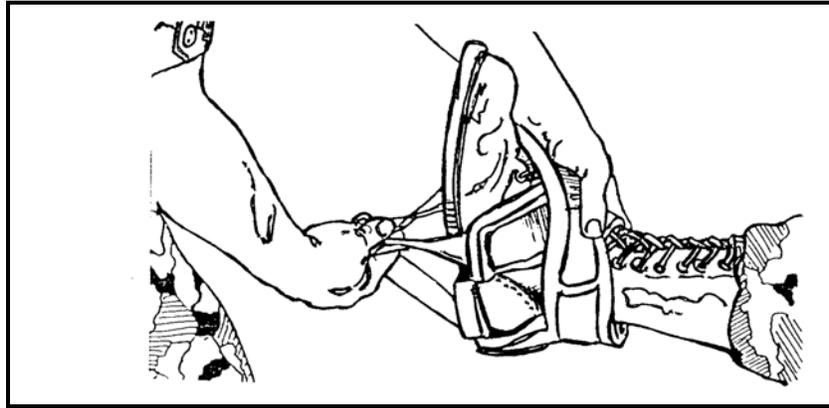


Figure 3-10. Ankle hitch applied to the casualty.

i. **Apply Manual Traction.** Have the assistant position himself at the casualty's injured thigh and gently support the thigh above and below the fracture site. Apply increased gentle, longitudinal manual traction to the casualty's limb. In unison with the assistant, lift the casualty's injured leg so the splint can be slipped beneath the leg (see figure 3-11).

NOTE: Traction and lift can be applied by leaning back. Apply only enough traction to align the limb to fit into the splint. Do not try to align the fracture fragments anatomically. Once you have applied increased traction, maintain the traction until the splint is in place and providing the traction.

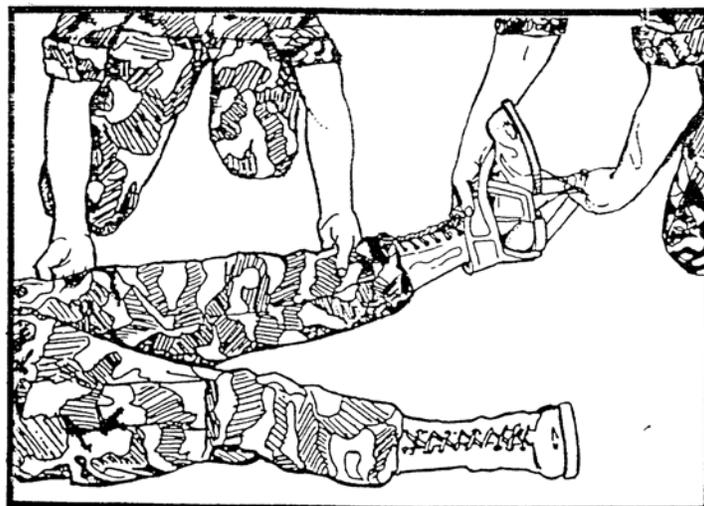


Figure 3-11. Applying manual traction and lifting the leg.

j. **Position the Splint.** While maintaining traction, have the assistant use one hand to support the fracture site and slide the splint into position under the casualty's hip and limb with his other hand (see figure 3-12). The ischial ring of the splint should be seated where the thigh joins the buttocks (on the ischial tuberosity).

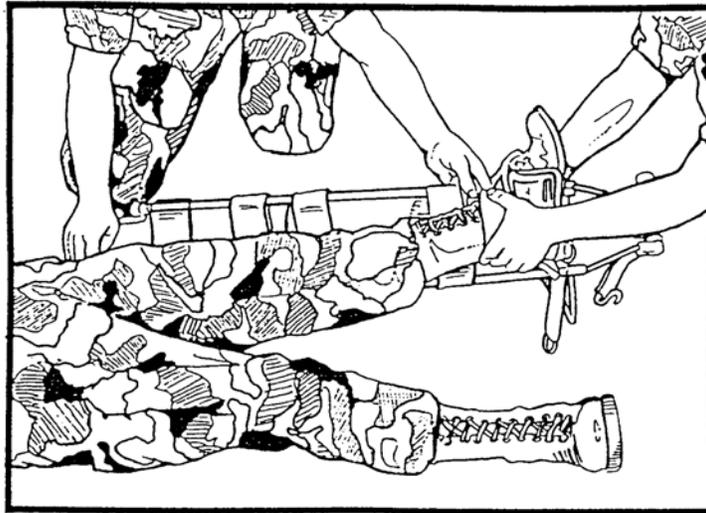


Figure 3-12. Positioning the Hare splint under the casualty's limb.

k. **Lower Leg Into Splint.** Upon your command, lower the casualty's leg into the cradle of the splint in unison with the assistant. Maintain traction as you and the assistant lower the limb. After the limb is in position, have the assistant remove the hand supporting the fracture site and prepare to secure the limb to the splint.

l. **Apply the Ischial Strap.** Have the assistant perform the following steps.

- (1) Make sure the ischial ring is seated on the ischial tuberosity.
- (2) Place padding around the groin area and where the ischial strap will cross the thigh.
- (3) Bring the ischial strap over the top of the casualty's thigh; then secure and tighten the ischial strap (strap has a buckle). Do not tighten the strap tight enough to impair circulation.
- (4) Check the casualty's popliteal pulse. If the strap is interfering with circulation, loosen the strap and check the pulse again.

m. **Apply Traction Using the Splint.** Have the assistant perform the following steps.

- (1) Have the assistant move to the ankle hitch and hold the traction straps again so that the three "D" rings are together.

(2) Slip the three "D" rings over the free end of the "S" hook.

(3) Tighten the traction strap to provide enough traction to maintain the limb's alignment (see figure 3-13).

CAUTION: Some models do not have a ratchet mechanism to tighten the strap. When a ratchet mechanism is used, do not apply undue traction to the limb. Overstretching the limb can cause further injury to the limb.

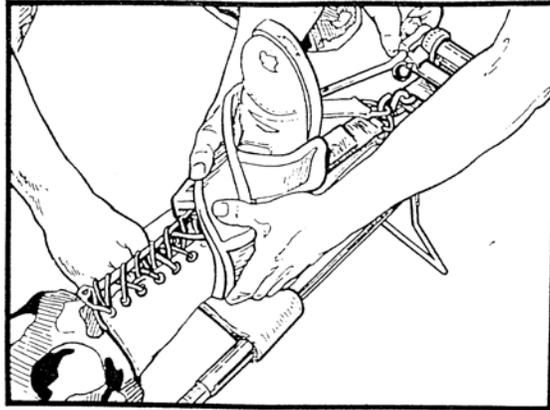


Figure 3-13. Applying mechanical traction with the Hare splint.

NOTE: Once the traction has been applied by the traction strap, you can lean forward and relax your manual traction. Continue to support the leg at the ankle until the remainder of the splint straps have been applied.

n. **Secure Velcro Support Straps.** The medical leader secures the four Velcro support straps so the limb is securely held in the splint.

(1) Tighten the straps on the thigh above the fracture, on the thigh below the fracture, below the knee, and above the ankle.

(2) Check the distal pulse after tightening each strap.

(3) If the strap interferes with the blood circulation, loosen the strap and secure it again.

o. **Place Casualty on Litter.** Once the traction splint has been applied, the casualty is moved to the litter using the procedures given in paragraph 3-5.

CAUTION: Once the traction strap has been applied, do not release the traction. Traction should only be released by a medical officer. If the strap becomes loose, have the traction assistant administer manual traction; then tighten and secure the strap again.

p. **Support the Lower Limb.** Position yourself next to the casualty's injured leg at the tibial area. Place both hands under the casualty's thigh, one above the fracture site and one below the fracture site. Manually support and stabilize the injured limb to prevent any movement at the fracture site. Continue providing support and stabilization as the traction assistant applies the ankle hitch and splint.

3-5. PLACE A CASUALTY WITH A TRACTION SPLINT ON A LITTER (LITTER BAR)

After the traction splint has been applied, attach the litter bar to the litter, place the casualty onto the litter, and secure the footrest or stirrup to the litter bar.

a. **Attach Litter Bar.** The litter bar attaches to the litter poles at the foot end of the litter. The litter bar locks the bottom of the splint support (footrest of the Thomas or stirrup of the Hare splint) in position. This helps to keep the leg immobile when the casualty is moved (carried by a litter team or placed in an evacuation vehicle).

(1) Place the litter bar on the litter poles at the end of the canvas bed of the litter. This position will keep the litter bar from interfering with the litter handles when carrying the litter or locking the litter in place in an evacuation vehicle.

(a) The strap attached to the bar should be free to go under the litter.

(b) The groove of the bar should be up.

(c) The locking cam on one side of the bar should be on the same side of the litter as the traction splint will be when the casualty is placed on the litter.

(d) Make sure the cam is in the open (unlocked) position.

(2) Pass the strap beneath the litter to the other side of the litter bar.

(3) Secure the litter bar by fastening the buckle at the end of the strap into the end of the litter bar and tightening the strap if needed.

b. Place Casualty on Litter.

(1) Place the litter next to and parallel with the casualty.

(2) Prepare to lift the casualty.

(a) If three people (bearers) are available, one bearer places his hands under the casualty's back and waist; the second places his hands under the casualty's hip and the calf of the uninjured leg; and the third places his hands under the traction splint.

(b) If only two people are available, one bearer slips his hands under the casualty's back and waist and the other bearer slips his hands under the casualty's thighs and calves.

(3) Upon commands of the leader, the bearers lift the casualty in unison, move the casualty over the litter, and lower the casualty onto the litter in unison.

c. Secure Splint Support to Litter Bar.

(1) Place the bottom of the splint support (footrest or stirrup) in the groove on the litter bar.

(2) Turn the cam and lock the splint support firmly in place.

d. Lift the litter using the appropriate litter carry and evacuate the casualty. Litter carries are presented in Subcourse MD0001, Evacuation in the Field.

3-6. SECURE THE SPLINT SUPPORT TO THE LITTER USING A ROLLER BANDAGE

If you do not have a litter bar, the splint support (footrest or stirrup) can be secured to the litter using a roller bandage or similar material.

a. Place the casualty onto the litter so the splint support is on the canvas bed of the litter.

b. Secure the end of the roller bandage to the outside of the splint support where the splint support meets the outer rod of the splint. (See figure 3-14A).

c. Bring the roller bandage down over the near litter pole and encircle the pole close to the canvas bed with two turns of the bandage.

d. Bring the roller bandage under the litter to the far litter pole.

e. Encircle the pole close to the canvas bed with two turns.

f. Carry the roller bandage to the inside rod of the splint where it joins the litter support.

g. Wrap the bandage around the site where the splint support meets the inner rod of the splint with two turns. (See figure 3-14B).

h. Carry the bandage back around in the reverse direction (two turns around the far litter pole, under the litter, and two turns around the near litter pole).

i. Secure the roller bandage to the place where the splint support meets the outside splint rod (the location where you began) so the bandage will not come undone; then cut the bandage (see figure 3-14C).

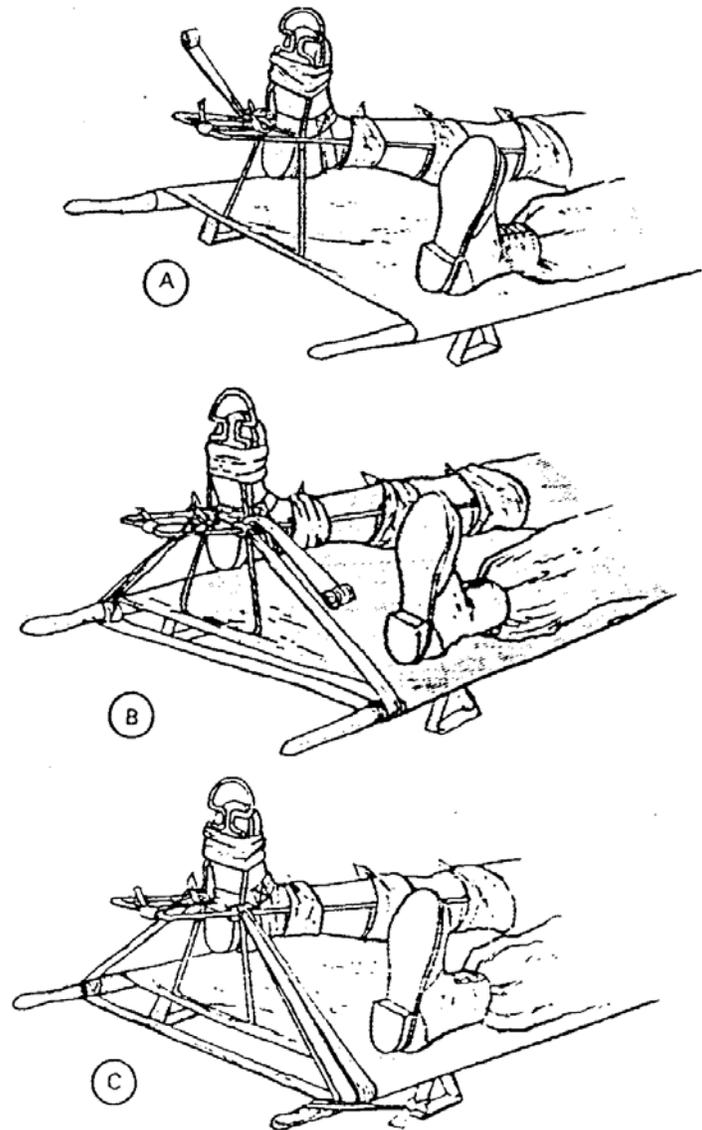


Figure 3-14. Securing a traction splint to the litter using a roller bandage.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. The Hare traction splint is used to immobilize a fractured _____.
2. When adjusting the Hare traction splint for use, the splint should reach from the ischium of the:
 - a. Injured leg to the bottom of the casualty's foot.
 - b. Injured leg to 8 to 12 inches below the casualty's foot.
 - c. Uninjured leg to the bottom of the casualty's foot.
 - d. Uninjured leg to 8 to 12 inches below the casualty's foot.
3. What is different about applying the ischial strap of a Hare traction splint and the four Velcro straps?
 - a. The ischial strap is applied before traction is applied using the ratchet mechanism and the Velcro straps are applied after traction has been applied mechanically.
 - b. The Velcro straps are applied before traction is applied using the ratchet mechanism and the ischial strap is applied after traction has been applied mechanically.

4. When applying the Army Thomas leg splint, the last cravat is used to:
 - a. Secure the padded half-ring to the casualty's thigh.
 - b. Form a cradle for the casualty's knee.
 - c. Secure the casualty's boot to the footrest.
 - d. Secure the boot of the injured leg to the boot of the uninjured leg.

5. Once the traction strap of an Army Thomas leg splint has been properly applied, should you loosen it?
 - a. Yes, when the casualty is transferred to a standard litter.
 - b. No.

6. When applying a litter bar to a standard litter, the bar should be positioned:
 - a. On the litter poles 8 to 12 inches before the end of the canvas bed.
 - b. On the litter poles at the end of the canvas bed.
 - c. On the litter handles 6 to 8 inches beyond the end of the canvas bed.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. Femur (or thigh) (para 3-2)
2. d (paras 3-4d(2), (3))
3. a (paras 3-5i, j, k)
4. c (para 3-3 (3))
5. b (para 3-3m, Caution)
6. b (para 3-5a(1))

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4

Fractures of the Lower Extremities.

LESSON ASSIGNMENT

Paragraphs 4-1 through 4-8.

LESSON OBJECTIVES

After completing this lesson, you should be able to:
be able to:

- 4-1. Identify the signs and symptoms of a fractured or dislocated hip.
- 4-2. Identify the procedures for immobilizing a fractured or dislocated hip.
- 4-3. Identify the procedures for immobilizing a fractured leg using an improvised splint.
- 4-4. Identify the procedures for immobilizing a fractured or dislocated knee using an improvised splint.
- 4-5. Identify the procedures for immobilizing a fractured or dislocated ankle using wire ladder splints.
- 4-6. Identify the procedures for immobilizing a fractured or dislocated ankle using a SAM splint.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

FRACTURES OF THE LOWER EXTREMITIES

4-1. IDENTIFY SIGNS AND SYMPTOMS OF A FRACTURED OR DISLOCATED HIP

Figure 4-1 shows the head of the femur and the hip form a "ball and socket" type joint. When the head of the femur is pulled away from the hip, a dislocation exists. When the neck or upper end of the femur is fractured, it is commonly called a "fractured hip" even though none of the pelvic bones is actually fractured. A dislocated hip and a fractured hip (upper femur) are very similar. Some of the signs and symptoms associated with these injuries are given below.

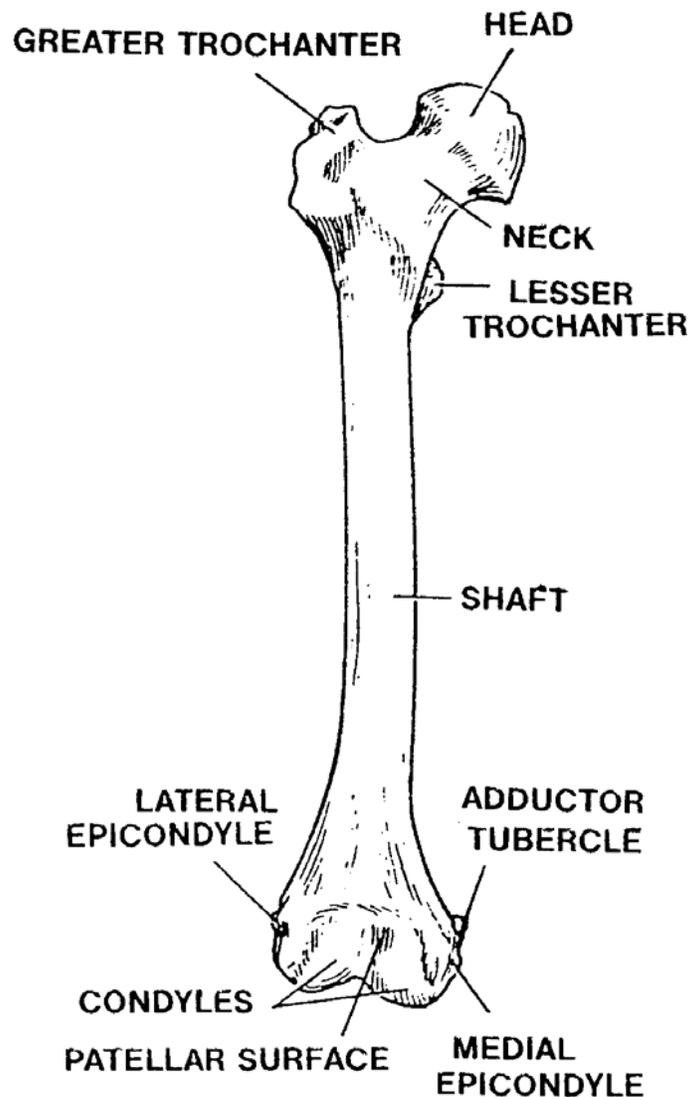


Figure 4-1. Femur.

a. **Pain.** Both injuries are accompanied by considerable pain. The casualty will resist moving because of the pain.

b. **Severe Deformity.** A hip injury results in severe deformity of the affected leg and hip.

(1) A posterior dislocation (see figure 4-2) is the most common form of hip dislocation. The hip joint is flexed with the knee drawn up. The hip is drawn toward the midline of the body (adduction) and the leg is rotated toward the midline of the body.

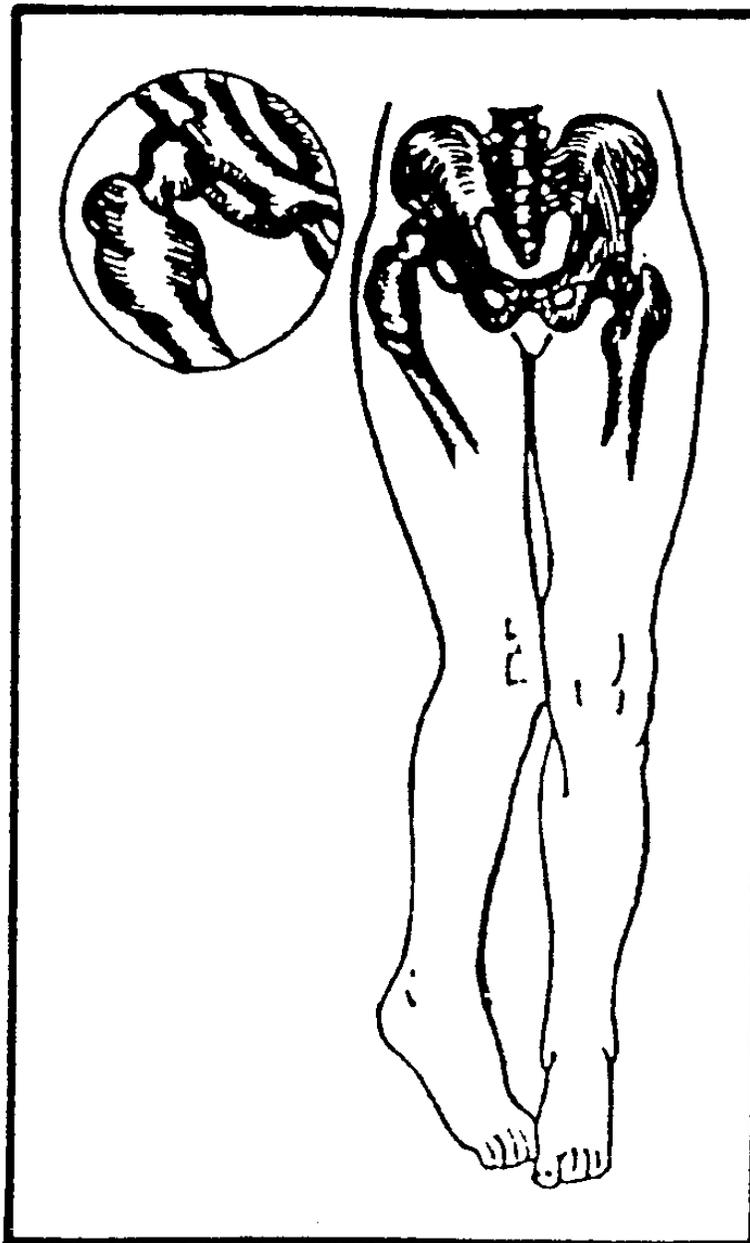


Figure 4-2. Posterior dislocation of the hip.

(2) An anterior dislocation (see figure 4-3) is caused by the legs suddenly being forced widely apart. The hip is drawn away from the midline of the body (abduction) and the leg is rotated away from the midline of the body. The knee is turned outward and the affected leg is shorter than the uninjured leg.

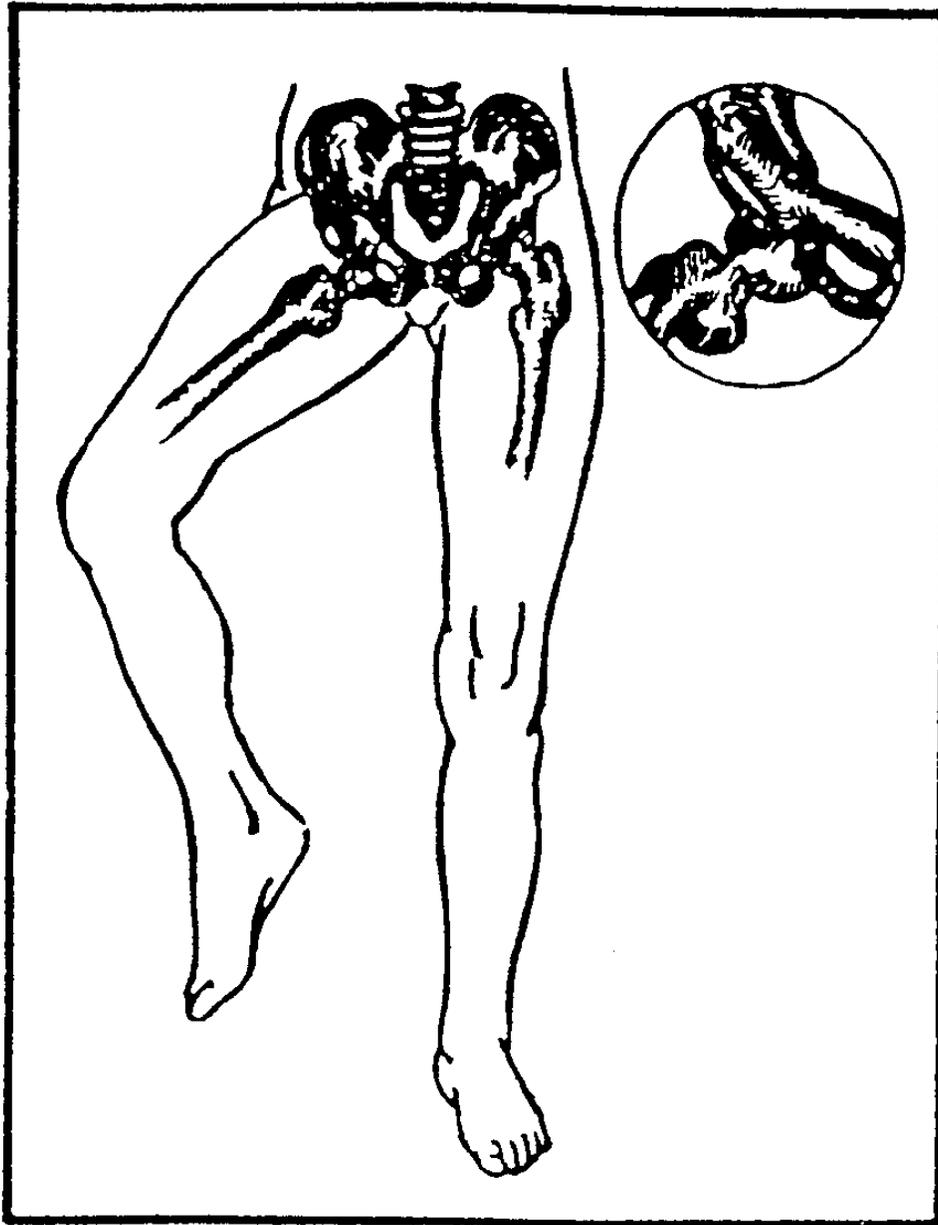


Figure 4-3. Anterior dislocation of the hip.

(3) When the top of the femur is fractured, the affected leg is rotated toward the midline of the body. The affected leg is usually shorter than the uninjured leg. There may be an open wound associated with the injury.

c. **Impaired Sensation.** The affected extremity may have tingling or other abnormal sensations (paresthesia) or the casualty may have a loss of sensation in the limb.

d. **Impaired Circulation.** Impaired circulation may result in coolness and/or cyanosis (bluish tint) of the affected limb. In some cases, the pulse distal to the injury may be lost due to pressure against the artery.

e. **Blood Loss.** Hip injuries usually result in significant blood loss, especially if a fracture is present. If there is no open wound, the internal bleeding will result in swelling. Significant internal bleeding may occur before the swelling is evident. The blood loss can result in hypovolemic shock.

4-2. IMMOBILIZE A FRACTURED OR DISLOCATED HIP (SPINE BOARD)

A casualty with signs and symptoms of a fractured or dislocated hip should be immobilized using a long spine board. If a long spine board is not available, use a door, wide plank, or other firm surface to immobilize the injured extremity and pelvis. Use the log roll technique given in paragraph 2-6 to place the casualty on the spine board. Some special considerations for performing the log roll and immobilizing the casualty when he has a hip injury are given on the following page.

a. If the casualty is lying on his abdomen, turn him onto his back using the procedures given in paragraph 2-11b. Position the assistants next to the casualty's uninjured side and have them secure holds on the injured side. In this way, the casualty will be rolled on his uninjured side, not his injured side.

b. When preparing to place the long spine board beneath the casualty, have the assistants kneel next to the casualty's uninjured side and have the spine board positioned on the casualty's injured side. Roll the casualty on his uninjured side, not on his injured side, and slip the board beneath the casualty. Position the casualty on the board.

c. Apply additional padding to the casualty to immobilize the hip and leg in a comfortable position. Secure padding materials in place.

(1) If the hip is dislocated, apply pillows, blankets, or other material to support the leg in its abnormal position.

(2) If the hip is fractured, place bulky support materials between the casualty's legs and strap the legs together. Position the casualty's knees in an up (flexed) position and place bulky support material beneath the knees. If there is no other major fracture of the lower extremities, support material may be placed beneath the buttocks to reduce abdominal pain.

d. Continue to check the pulse in the affected limb and observe for signs and symptoms of hypovolemic shock. Signs and symptoms of hypovolemic shock and procedures for treating hypovolemic shock are given in Subcourse MD0554, Treating Injuries in the Field.

4-3. IMMOBILIZE A FRACTURED FEMUR (IMPROVISED SPLINT)

A fractured femur should be immobilized using a traction splint whenever possible. If a traction splint is not available, immobilize the casualty using an improvised splint (see figure 4-4).

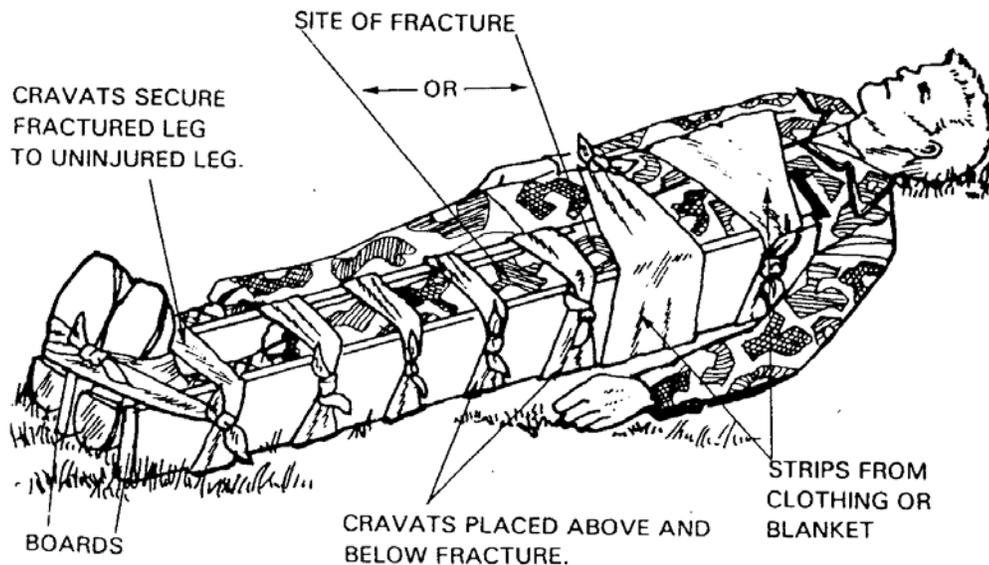


Figure 4-4. Improvised splint applied to a fractured femur.

a. **Obtain Materials.** You will need two rigid objects, padding, and securing materials.

(1) **Rigid objects.** Tree branches, poles, boards, sticks, unloaded rifle, or similar objects can be used. The rigid objects should be straight, long enough to extend beyond the joint above the fracture site and beyond the joint below the fracture site. Preferably, one should be long enough to extend from the groin to the foot and the other should extend from above the hip to the foot (see figure 4-4).

(2) **Padding.** Padding is needed to keep the rigid objects from rubbing against the skin on the injured limb. Blankets, jackets, ponchos, extra clothing, shelter halves, leafy plants, or the casualty's own clothing (trouser leg) can be used as padding. The padding helps to prevent excessive pressure that could interfere with blood circulation.

(3) **Securing materials.** The rigid objects and padding can be secured with cravats made from muslin bandages or other folded material. Rigid objects can also be secured with strips of clothing, belts, pistol belts, bandoleers, or similar materials. Narrow materials such as wire and cord should not be used since they could interfere with blood circulation.

b. **Position the Securing Materials.** Push the securing materials (cravats, and so forth) under natural body curvatures (ankle, knee, and back). Then gently move the securing materials up or down the limb until they are in proper position.

(1) Place securing materials under the ankle, at the top of the boot, below the knee, above the knee, at the hip, and at where the top of the long splint will rest. Place a second cravat so that it is under both ankles.

(2) There should be at least two cravats above the fracture site and at least two cravats below the fracture site (above the upper joint, between the upper joint and the fracture, between the fracture and the lower joint, and below the lower joint).

(3) Do not place securing material directly under the suspected fracture site. The pressure caused by the securing material when it is tightened could result in additional injury to the limb.

c. **Position the Rigid Objects.** Place the shorter rigid object on the inside of the injured leg and the longer one on the outside. Position them so the joint above the fracture and the joint below the fracture can be immobilized. Make sure the end of the inner rigid object is not pressing against the groin. Pressure on sensitive areas can interfere with blood circulation.

d. **Apply Padding.** Place padding between the rigid objects and the limb. Apply extra padding to bony body areas such as the knee and ankle and at sensitive areas such as the groin.

e. **Secure the Rigid Objects and Check Circulation.** Wrap the securing materials around the rigid objects so they immobilize the limb. Tie the tails of each securing cravat in a nonslip knot on the outer rigid object and away from the casualty. The securing material should be tight enough to hold the rigid objects securely in place, but not tight enough to interfere with blood circulation. (You should be able to slip one finger between the knot and the rigid object.) Check the casualty's pulse after each cravat is tied. If the cravat interferes with the casualty's circulation, loosen the cravat and apply it again.

(1) Begin with the cravat positioned above the fracture site.

(2) Next, apply the cravat just below the fracture site.

(3) Continue applying cravats, checking the casualty's circulation after each cravat is tightened.

(4) When securing the cravat going under the injured ankle only, bring the cravat up the outside of the splints, cross the tails over the boot, bring the tails down below the sole of the boot, cross the tails, bring the tails back to the top of the boot, and tie the tails in a nonslip knot at the instep.

(5) Use the cravat going under both ankles to secure the injured leg to the uninjured leg. Bring the cravat up the outside splint and the outside of the uninjured ankle, cross the cravat over the tops of the casualty's boots, bring the tails down below the boots, and tie them together in a nonslip knot at the soles.

4-4. IMMOBILIZE A FRACTURED LEG (IMPROVISED SPLINT)

A fractured tibia or fibula in the lower leg can be immobilized with an improvised splint. The improvised splint used to immobilize a fractured thigh (see paragraph 4-3) can also be used to immobilize a fractured leg. The following procedures are used to apply shorter boards to immobilize a fractured leg (see figure 4-5). The same basic procedures can also be used with other improvised splints. Figure 4-6 shows a tree limb splint used to immobilize a fractured leg or ankle. Figure 4-7 shows a blanket and poles splint used to immobilize a fractured knee (knee straight), leg, or ankle. Figure 4-8 shows the casualty's uninjured leg being used as the rigid object (anatomical splint) to immobilize the injured leg. A splint used for a fracture can also be used for a dislocation.

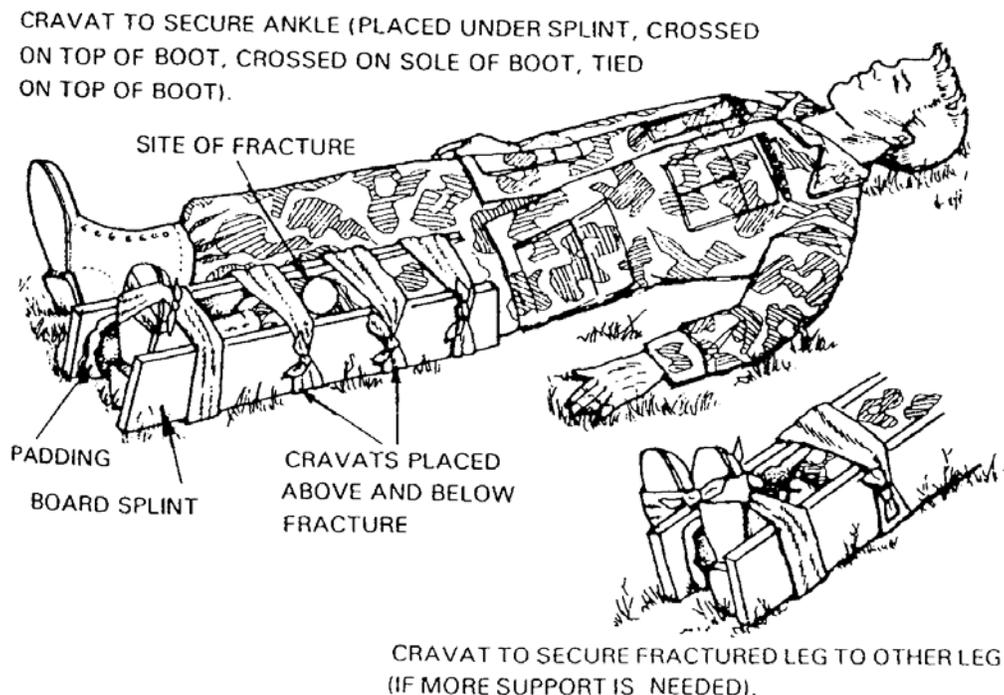


Figure 4-5. Improvised board splint applied to a fractured leg.

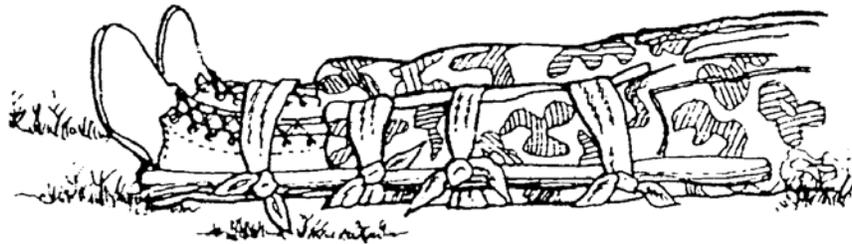


Figure 4-6. Improved tree limb splint applied to a fractured leg.

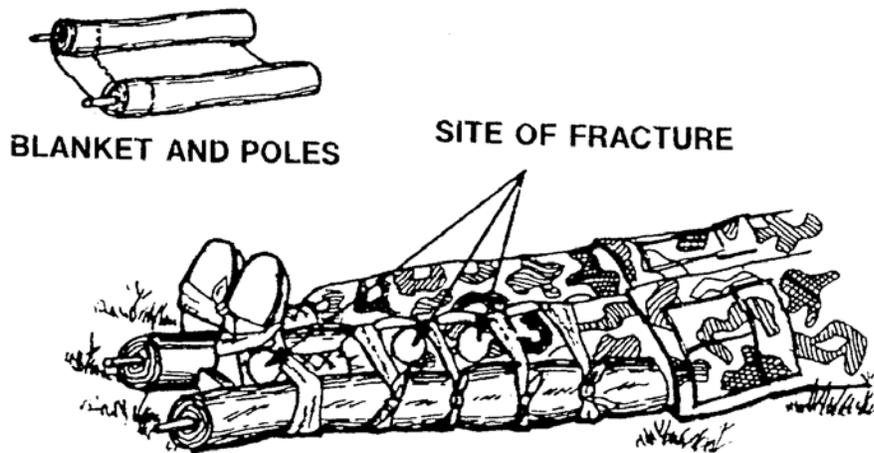


Figure 4-7. Improved blanket and poles splint applied to a fractured leg.

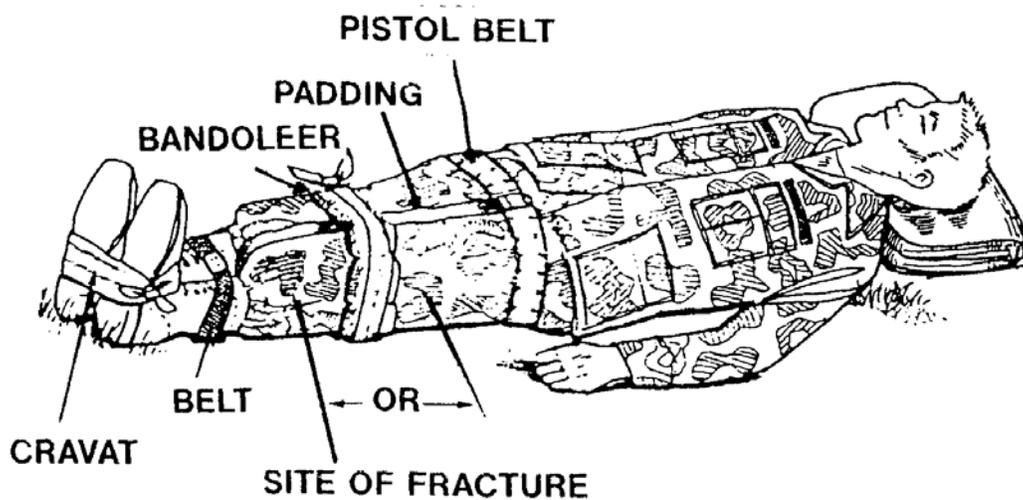


Figure 4-8. Uninjured leg used as an anatomical splint.

a. **Obtain Materials.** You will need two rigid objects, padding, and securing materials. The rigid objects should extend from the casualty's foot to approximately half way up his thigh.

b. **Position the Securing Materials.** Position two cravats above the fracture site and two below the fracture site. Push the securing materials under natural body curvatures and move them up or down until they are in proper position. Do not place a cravat directly under the fracture site.

- (1) Position one cravat above the knee.
- (2) Position the second cravat between the knee and the fracture site.
- (3) Position the third cravat between the fracture site and the ankle.
- (4) Position the fourth cravat beneath the ankle.

c. **Position the Rigid Objects.** Place one rigid object on the inside of the injured leg and the other on the outside. Position them so the joint above the fracture and the joint below the fracture can be immobilized.

d. **Apply Padding.** Place padding between the rigid objects and the limb. Apply extra padding to the knee and ankle areas.

e. **Secure the Rigid Objects and Check Circulation.** Wrap the securing materials around the rigid objects so they immobilize the limb. Tie the tails of each securing cravat in a nonslip knot on the outer rigid object and away from the casualty. The securing material should be tight enough to hold the rigid objects securely in place, but not tight enough to interfere with blood circulation. (You should be able to slip one finger beneath the knot.) Check the casualty's pulse after each cravat is tied. If the cravat interferes with the casualty's circulation, loosen the cravat and apply it again.

(1) When securing the cravat under the ankle, cup the heel in the cravat, bring the cravat up the outside of the splints, cross the tails over the boot, bring the tails down below the sole of the boot, cross the tails, bring the tails back to the top of the boot, and tie the tails in a nonslip knot at the instep.

(2) If additional support is desired, pass another cravat beneath both ankles and secure the injured leg to the uninjured leg. Bring the cravat up the outside splint and the outside of the uninjured ankle, cross the cravat over the tops of the casualty's boots, bring the tails down below the boots, and tie them together in a nonslip knot at the soles.

4-5. IMMOBILIZE A FRACTURED OR DISLOCATED KNEE (IMPROVISED SPLINT)

A fractured or dislocated knee is usually in a flexed (bent) position, and it is splinted in that position. The injury may include dislocation of the kneecap (patella). Instructions for immobilizing a knee in the flexed position are given in the following paragraphs. (See figure 4-9)

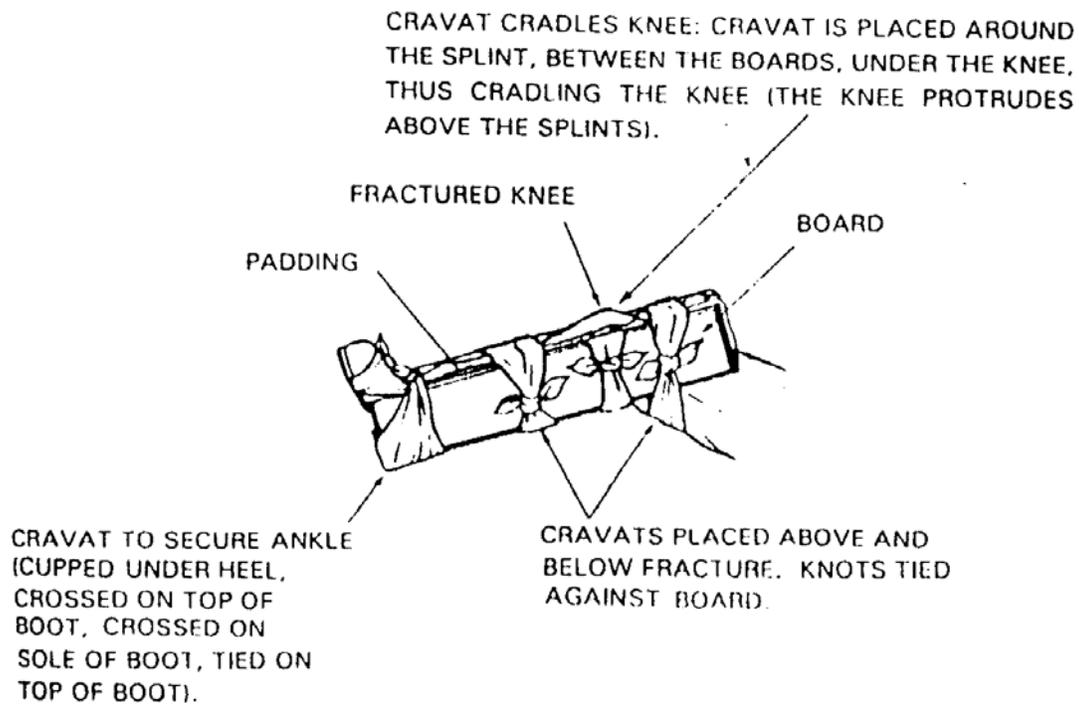


Figure 4-9. Board splint applied to a bent knee.

- a. **Obtain Materials.** You will need two rigid objects, padding, and securing materials. The rigid objects should extend from the casualty's ankle to approximately half way up his thigh.
- b. **Position the Securing Materials.** Position one cravat above the knee, one cravat below the knee, and one cravat beneath the ankle.
- c. **Apply Padding.** Place padding on the inside of the rigid objects.
- d. **Position the Rigid Objects.** Place one padded rigid object on the inside of the injured leg and the other on the outside. Do not attempt to straighten the knee. If the casualty is able, you can have him hold the rigid objects in place while you secure them.

e. **Secure the Rigid Objects and Check Circulation.** Wrap the cravats (or other securing materials) around the rigid objects so they immobilize the limb. Three cravats should be applied: above the knee, below the knee, and at the ankle. Tie the tails of each cravat in a nonslip knot on the outer rigid object. The cravats should be tight enough to hold the rigid objects securely in place, but not tight enough to interfere with blood circulation. (You should be able to slip one finger beneath the knot.) Check the casualty's pulse after each cravat is tied. If the cravat interferes with the casualty's circulation, loosen the cravat and apply it again.

(1) Secure the cravat above the knee.

(2) Secure the cravat below the knee.

(3) Secure the cravat under the ankle. Cup the heel in the cravat, bring the cravat up the outside of the splints, cross the tails over the boot, bring the tails down below the sole of the boot, cross the tails, bring the tails back to the top of the boot, and tie the tails in a nonslip knot at the instep.

f. **Cradle Knee.** Apply a fourth cravat to cradle the knee. The knee will protrude above the rigid objects.

(1) Insert one end of the cravat between the outer rigid object and the knee.

(2) Bring the end under the knee and between the knee and the inner rigid object.

(3) Bring both ends straight up for measurement.

(4) Adjust the cravat so the outer tail is about 6 inches longer than the inner tail.

(5) Bring each tail over the top of its rigid object, down, under the knee, and up the other rigid object.

(6) Bring the inside tail across to the outside of the outer rigid object.

(7) Tie the tails together in a nonslip knot on the outer rigid object.

4-6. IMMOBILIZE A FRACTURED OR DISLOCATED ANKLE (TWO WIRE LADDER SPLINTS)

A wire ladder splint (see figure 4-10) is made from steel. It is about 31 inches long and about 3.5 inches wide. It contains 48 crosspieces and weighs about a half pound. The wire ladder splint can be bent to conform to the shape of the injured limb. The following paragraphs give instructions for applying two wire ladder splints to a fractured or dislocated ankle. The splints can also be used for a fractured foot.

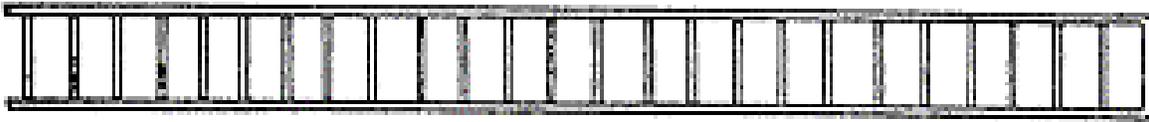


Figure 4-10. Wire ladder splint.

- a. **Position Casualty.** The casualty may be either sitting up or lying down.
- b. **Expose Injury.** Cut the boot laces on the injured foot. Then cut the boot tongue on the outside edge from top to bottom all the way down.
- c. **Check Pulse.** Check the casualty's pulse along the top of the foot. If a pulse is absent, the casualty should be evacuated as soon as the splint is applied.
- d. **Form Rigid Splint.**
 - (1) Bend the prongs (sharp ends) of the two splints away from the flat side of the wire ladder splint.
 - (2) Bend one splint into an "L" shape so that the flat surface is on the inside and the bottom of the "L" fits the length of the casualty's boot. Bend the longer (top) end of the "L" back onto itself so it is even with the top of the casualty's boot. Use the casualty's uninjured foot for measurement.
 - (3) Bend the other splint into a "U" shape with a flattened bottom so the bottom of the soldier's boot fits the bottom of the splint and the ends of the "U" will go up the sides of his boots. Use the uninjured foot for measurement.
 - (4) Joint the L-shaped splint and the U-shaped splints together by fitting the U-shaped splint around the L-shaped splint to form a cradle and protective case for the injured ankle.
- e. **Apply Rigid Splint.**
 - (1) Gently lift the casualty's foot, ankle, and lower leg.
 - (2) Slide the cradle under the casualty's boot until the sole of the boot touches the bottom of the L-shaped splint.
 - (3) Lower the casualty's foot until the boot fits into the cradle.
 - (4) Apply padding to the sides, if needed. The boot should be sufficient padding.

f. **Secure the Rigid Splint With Cravats.** Figure 4-11 shows a two-piece wire ladder splint applied to a left ankle.



Figure 4-11. Wire ladder splint (2 pieces) applied to a fractured ankle.

(1) Apply a cravat immediately above the ankle. Begin on the outside of the leg, bring the tails to the inside, cross them, bring them to the outside again and tie the tails in a nonslip knot on the outer part of the U-shaped wire ladder splint.

(2) Check the casualty's pulse. If a pulse could be felt before but is no longer present, loosen and retie the cravat. If the pulse still cannot be felt and you can slip two fingers beneath the knot, evacuate the casualty as soon as possible after the splint is applied.

(3) Apply the second cravat below the ankle. Cup the heel of the boot in the center of the cravat and bring the tails up across the top of the boot. Cross the tails on the top of the boot toe, take them down under the sole of the boot, and tie the tails in a nonslip knot on the outer aspect of the rigid splint.

(4) Check the casualty's pulse. If a pulse could be felt before but is no longer present, loosen and retie the cravat.

(5) Apply the third cravat at the top of the splint in the same manner as the first cravat. Tie the cravat in a nonslip knot on the outer aspect of the rigid splint.

(6) Check the casualty's pulse. If a pulse could be felt before but is no longer present, loosen and retie the cravat.

4-7. IMMOBILIZE A FRACTURED ANKLE (THREE WIRE LADDER SPLINTS)

Another method of immobilizing an injured ankle using three wire ladder splints is given below. It is especially useful when the casualty's boot has been removed to treat other injuries.

a. **Check Pulse.** Check the casualty's pulse along the top of the foot. If a pulse is absent, the casualty should be evacuated as soon as the splint is applied.

b. **Form Rigid Splint.**

(1) Bend the prongs (sharp ends) of the three splints away from the flat side of the wire ladder splint.

(2) Bend one splint into an "L" shape so that the flat surface is on the inside and the bottom of the "L" fits the length of the casualty's foot. The bent prongs should be at the toes.

(3) Join the pronged ends of the other two wire ladder splints. Then bend the long splint into a "U" shape with a flattened bottom so the bottom of the soldier's foot fits the bottom of the splint and the ends of the "U" will go up the sides of his leg.

(4) Joint the L-shaped splint and the U-shaped splints together by fitting the U-shaped splint around the L-shaped splint to form a cradle and protective case for the injured ankle.

c. **Pad Rigid Splint.** Place padding along the three sides of the cradle and the bottom where the foot will rest (see figure 4-12A).

d. **Apply Splint.**

(1) Gently lift the casualty's foot, ankle, and lower leg.

(2) Slide the cradle under the casualty's foot and leg until the sole of the foot touches the bottom of the L-shaped splint.

(3) Lower the casualty's foot until the foot and leg fits into the cradle (see figure 4-12B).

e. **Secure the Rigid Splint.**

(1) The rigid splint can be secured with four cravats similar to the method used in paragraph 4-6f (cravats at the foot, above the ankle, midway between the ankle and the top of the rigid splint, and at the top of the rigid splint). Check the casualty's pulse after each cravat is applied. If a pulse could be felt before but is no longer present, loosen and retie the cravat.

(2) The rigid splint can also be secured with a roller bandage as shown in figure 4-12C. Check the casualty's pulse as the rigid splint is being secured. If a pulse could be felt before but is no longer present, remove the bandage and apply it again.

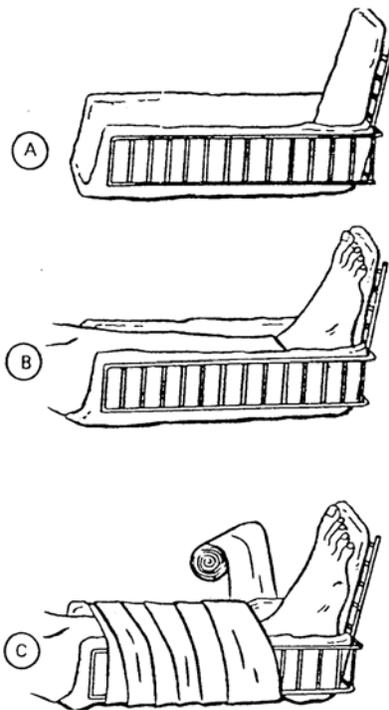


Figure 4-12. Wire ladder splint (3 pieces) applied to a fractured ankle.

4-8. IMMOBILIZE A FRACTURED OR DISLOCATED ANKLE USING A SAM SPLINT

The universal splint, called the SAM splint, can be used as the rigid object in splinting a fractured or dislocated ankle. The SAM splint is a piece of flat aluminum about 36 inches long and about 4.5 inches wide completely covered by foam, which serves as padding for the splint. The SAM splint is lightweight (less than 7 ounces). The splint is rolled up for easy storing (see figure 4-13A) and can be reused.

- a. Unroll the SAM splint and flatten it.
- b. Fold the SAM splint in half so it is a tall "V" shape.
- c. Bend the edges of the splint in until the splint generally conforms to the curve and shape of the foot and leg being splinted. Each half of the splint will have a "U" shape (see figure 4-13B). Bending the edges also increases the rigidity of the SAM splint.
- d. Flatten the vertex of the splint so the bottom of the casualty's foot will fit comfortably.
- e. Check the casualty's pulse below the fracture/dislocation site.

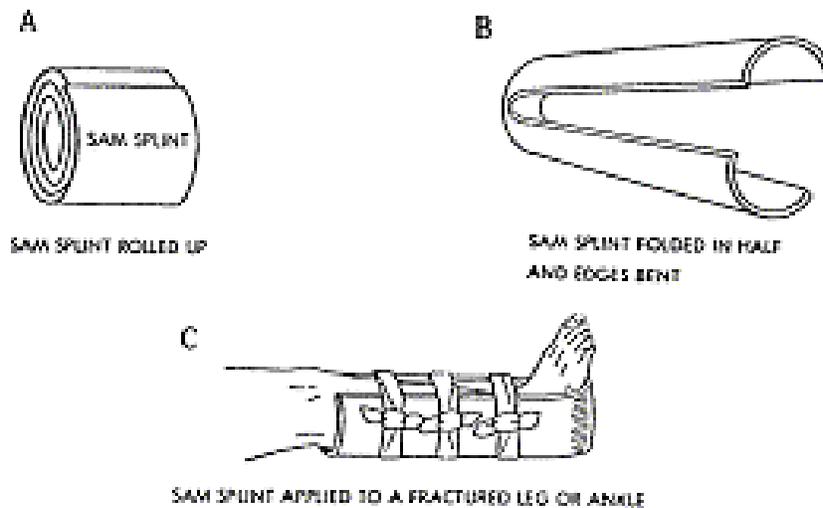


Figure 4-13. SAM splint applied to a fractured ankle.

f. Apply the splint around the casualty's foot and leg. Adjust the shape of the SAM splint to conform to the limb, if needed.

g. Secure the splint using at least three cravats (see figure 4-13C).

(1) Tie the tails of the cravats in a nonslip knot on the outside of the splint. Tuck the ends of the tails into the cravat to prevent accidental entanglement when the casualty is moved.

(2) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. A dislocation of the hip can include, which of the following signs and symptoms?
 - a. Extreme pain.
 - b. Leg rotated either toward the midline of the body or rotated away from the midline of the body.
 - c. Swelling.
 - d. All of the above.

2. When applying an improvised splint to a fractured femur, the longer splint goes on the _____ of the injured leg.
 - a. Inside.
 - b. Outside.

3. When applying an improvised splint to the upper or lower leg, should you apply a securing cravat on the fracture site?
 - a. Yes.
 - b. No.

4. When applying an improvised splint to a fractured lower limb, the joint _____ should be immobilized.
 - a. Above the fracture site.
 - b. Below the fracture site.
 - c. Above the fracture site and the joint below the fracture site.

5. When bending the prongs (sharp ends) of the wire ladder splint, the prongs should be bent _____ the flat side of the wire ladder splint.
 - a. Away from.
 - b. Toward.

6. A(n) _____ or _____ splint is made of a flat piece of aluminum about three feet long and about 4.5 inches wide covered by foam.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. d (paras 4-1a, b, e)
2. b (paras 4-3a(1), c)
3. b (paras 4-3b(3), 4-4b)
4. c (paras 4-3b(2), 4-4c)
5. a (paras 4-6d(1), 4-7b(1))
6. SAM, universal (either order) (para 4-8)

End of Lesson 4

LESSON ASSIGNMENT

LESSON 5

Fractures of the Upper Extremities.

LESSON ASSIGNMENT

Paragraphs 5-1 through 5-10.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 5-1. Identify the procedures for immobilizing a fractured arm using a wire ladder splint.
- 5-2. Identify the procedures for immobilizing a fractured upper arm or forearm using a SAM splint.
- 5-3. Identify the procedures for immobilizing a fractured upper arm, elbow, or forearm using an improvised splint.
- 5-4. Identify the procedures for immobilizing an arm using a sling and swathes.
- 5-5. Identify the procedures for immobilizing a dislocated shoulder.
- 5-6. Identify the procedures for applying a pneumatic splint.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 5

FRACTURES OF THE UPPER EXTREMITIES

5-1. IMMOBILIZE AN ARM WITH A WIRE LADDER SPLINT

A wire ladder splint can be used to immobilize a fracture of the forearm, a fracture of the humerus, a fracture of the elbow when the elbow is bent, or an arm with multiple fractures.

a. Prepare Wire Ladder Splint.

(1) Bend the prong ends of the splint away from the smooth side. About 1.5 inches should be bent.

(2) Place the smooth side of the splint against the casualty's uninjured arm with the bent end even with the top of the uninjured shoulder.

(3) Select a point slightly below the casualty's uninjured elbow.

(4) Remove the splint from the casualty's arm and bend the splint into an "L" shape at the selected point. The smooth side of the splint should be on the inside of the "L" and the bent prong should be on the outside.

(5) Pad the splint by wrapping a roller bandage around it (see figure 5-1) or by applying leaves, material, or other padding on the inside of the splint. If padding materials are not available, apply the splint.

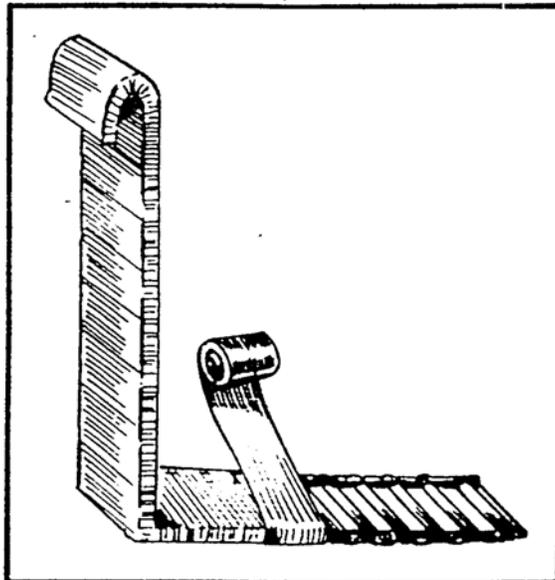


Figure 5-1. Padding a wire ladder splint with a roller bandage.

b. Apply the Wire Ladder Splint.

(1) Position the splint on the outside of the casualty's injured arm with the bent prongs away from the shoulder.

(2) The angle of the splint should extend beyond the elbow and not touch the elbow. The splint should not place pressure on the elbow. The upper arm, forearm, and hand will have contact with the splint.

(3) Check the distal end of the splint. If the splint does not extend beyond the ends of the casualty's fingers, use a basswood splint or other device to lengthen the splint.

(4) If possible, have the inside of the casualty's hand and forearm toward his chest.

(5) If possible, have the casualty support the splint and injured arm.

c. Apply Wad to Hand. Place a rolled cravat or similar material in the palm of the casualty's injured hand (see figure 5-2).



Figure 5-2. Rolled cravat placed in palm of injured hand.

d. Check Pulse. Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the upper arm is splinted.

e. Secure the Wire Ladder Splint.

(1) Apply five cravats to the wire ladder splint (see figure 5-3).

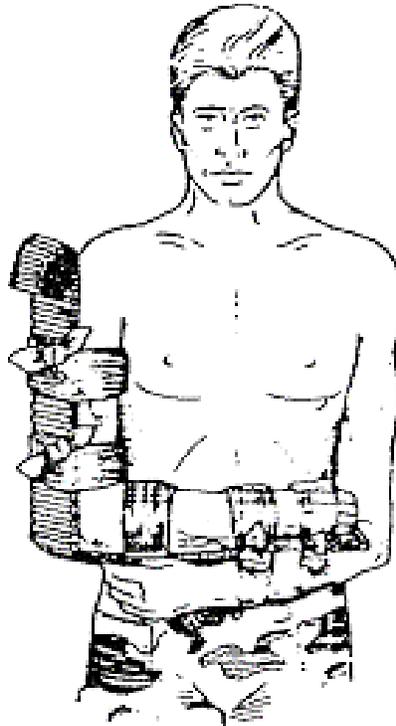


Figure 5-3. Wire ladder splint applied to an injured arm.

(a) Apply two cravats to the upper arm. If the humerus is fractured, apply one cravat above the fracture site and one cravat below the fracture site. Do not apply a cravat over the fracture site.

(b) Apply two cravats to the forearm. If the forearm is fractured, apply one cravat above the fracture site and one cravat below the fracture site. Do not apply a cravat over the fracture site.

(c) Apply one cravat around the hand and splint in an "X" pattern.

(2) Tie the tails of the cravats in a nonslip knot on the outside of the splint. Tuck the ends of the tails into the cravat.

(3) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.

f. **Apply Sling and Swathes.** Apply a sling and swathes to further immobilize the casualty's arm. (Slings and swathes are discussed in paragraphs 5-8 and 5-9.)

(1) If the humerus is fractured, apply two swathes--one above the fracture site and one below the fracture site.

(2) If the humerus is not fractured, make the swathe wide across the injured arm.

5-2. IMMOBILIZE A FRACTURED FOREARM WITH A SAM SPLINT

- a. Unroll the SAM splint and flatten it.
- b. Fold the SAM splint in half so it is a tall "V" shape.
- c. Bend the edges of the splint in until the shape of the splint generally conforms to the curve and shape of the limb being splinted (see figure 5-4A). Each half of the splint will have a "U" shape.
- d. Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the forearm is splinted.
- e. Apply the SAM splint to the forearm. The elbow should rest in the bottom of the "V" and the sides of the "V" are on the inside and outside of the forearm.
- f. Adjust the shape of the SAM splint to conform to the limb, if needed.
- g. Secure the splint using at least two cravats (see figure 5-4B).

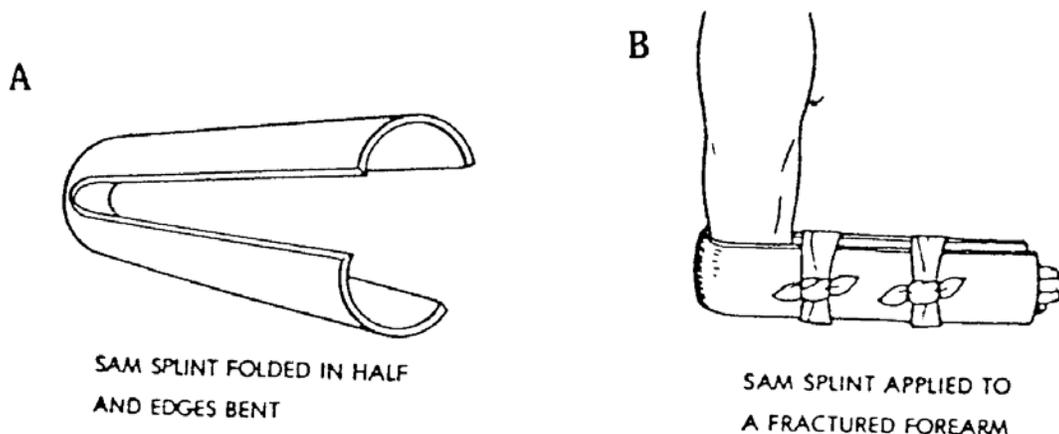


Figure 5-4. Immobilizing a forearm using a SAM splint.

(1) Apply at least one cravat above the fracture site and at least one cravat below the fracture site. If possible, apply two cravats above the fracture site and two cravats below the fracture site. Do not apply a cravat over the fracture site.

(2) Tie the tails of the cravats in a nonslip knot on the outside of the splint. Tuck the ends of the tails into the cravat to prevent accidental entanglement when the casualty is moved.

(3) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.

(4) If cravats are not available, use tape or a roller bandage to secure the SAM splint.

h. Position the casualty's forearm so it is across his chest with the wrist slightly higher than the elbow.

i. Apply a sling and a swathe to further immobilize the casualty's arm. Make the swathe wide across the injured arm.

5-3. IMMOBILIZE A FRACTURED HUMERUS WITH A SAM SPLINT

a. Unroll the SAM splint and flatten it.

b. Fold the SAM splint into an irregular (uneven) "V" shape with one side of the V about four to six inches longer than the other.

c. Bend the edges of the splint so the sides of the splint are U-shaped and generally conform to the shape of the limb being splinted.

d. Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the upper arm is splinted.

e. Position the casualty's forearm so it is across his chest with the wrist slightly higher than the elbow.

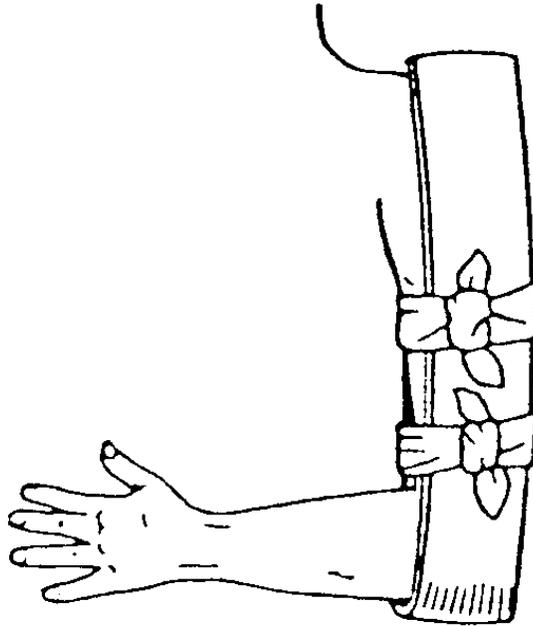
f. Apply the SAM splint to the upper arm. The upper part of the forearm (where it joins the elbow) should rest in the bottom of the "V," the short side of the "V" is on the inside of the upper arm (but not pressing on the arm pit), and the long side is on the outside of the upper arm with the end extending to or past the shoulder.

g. Adjust the shape of the SAM splint to conform to the limb, if needed.

h. Secure the splint using at least two cravats (see figure 5-5).

(1) Apply at least one cravat above the fracture site and at least one cravat below the fracture site. If possible, apply two cravats above the fracture site and two cravats below the fracture site. Do not apply a cravat over the fracture site.

(2) Tie the tails of the cravats in a nonslip knot on the outside of the splint. Tuck the ends of the tails into the cravat to prevent accidental entanglement when the casualty is moved.



**SAM SPLINT APPLIED TO
A FRACTURED HUMERUS**

Figure 5-5. Upper arm immobilized using a SAM splint.

(3) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.

(4) If cravats are not available, use tape or a roller bandage to secure the SAM splint.

i. Apply a sling and a swathe to further immobilize the casualty's arm. If possible, apply two swathes--one above the fracture site and one below the fracture site.

5-4. IMMOBILIZE A FRACTURED HUMERUS WITH AN IMPROVISED SPLINT

Wire ladder splints, SAM splints, and pneumatic splints are used to immobilize a fracture of the upper extremity. If these splints are not available, a splint can be made from improvised rigid objects and securing materials. Basswood boards, tree limbs, broken poles, boards, or rolled newspaper can be used as rigid objects. If a rigid object cannot be readily found, the casualty's chest can be used as the rigid object. Cravats, slings, and swathes are normally made from triangular bandages (paragraph 2-4c). If

muslin bandages or other materials are not available to make triangular bandages, strips of torn cloth, belts, or similar objects can be used. Wire, shoestrings, and other very narrow materials should not be used. General procedures for applying an improvised splint to a fractured humerus are given in the following paragraphs.

- a. Gather two rigid objects, securing materials, and padding.
- b. Pad the rigid objects.
- c. Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the splint is applied.
- d. Place the rigid objects on each side of the upper arm. Make sure the rigid objects are not pressing on the axilla (armpit).
- e. Secure the rigid objects with cravats or other securing material.
 - (1) Apply at least one cravat above the fracture site and at least one cravat below the fracture site. If possible, apply two cravats above the fracture site and two cravats below the fracture site. Do not apply a cravat over the fracture site.
 - (2) Tie the tails of the cravats in a nonslip knot on the outer rigid object and tuck in the tails.
 - (3) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.
- f. Apply a sling and a swathe to further immobilize the casualty's arm. If possible, apply two swathes—one above the fracture site and one below the fracture site.

5-5. IMMOBILIZE A FRACTURED ELBOW WITH AN IMPROVISED SPLINT

Immobilize the upper arm and forearm in the position you find them. If the elbow is bent, leave it bent. If the elbow is not bent (arm straight), do not try to bend it in order to apply a sling to the arm.

a. Elbow in Bent Position.

- (1) Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the splint is applied.
- (2) Apply a rigid object (padded, if possible) to the inside of the casualty's limb so it can immobilize the elbow.
- (3) Secure the rigid object with at least two cravats (see figure 5-6A).

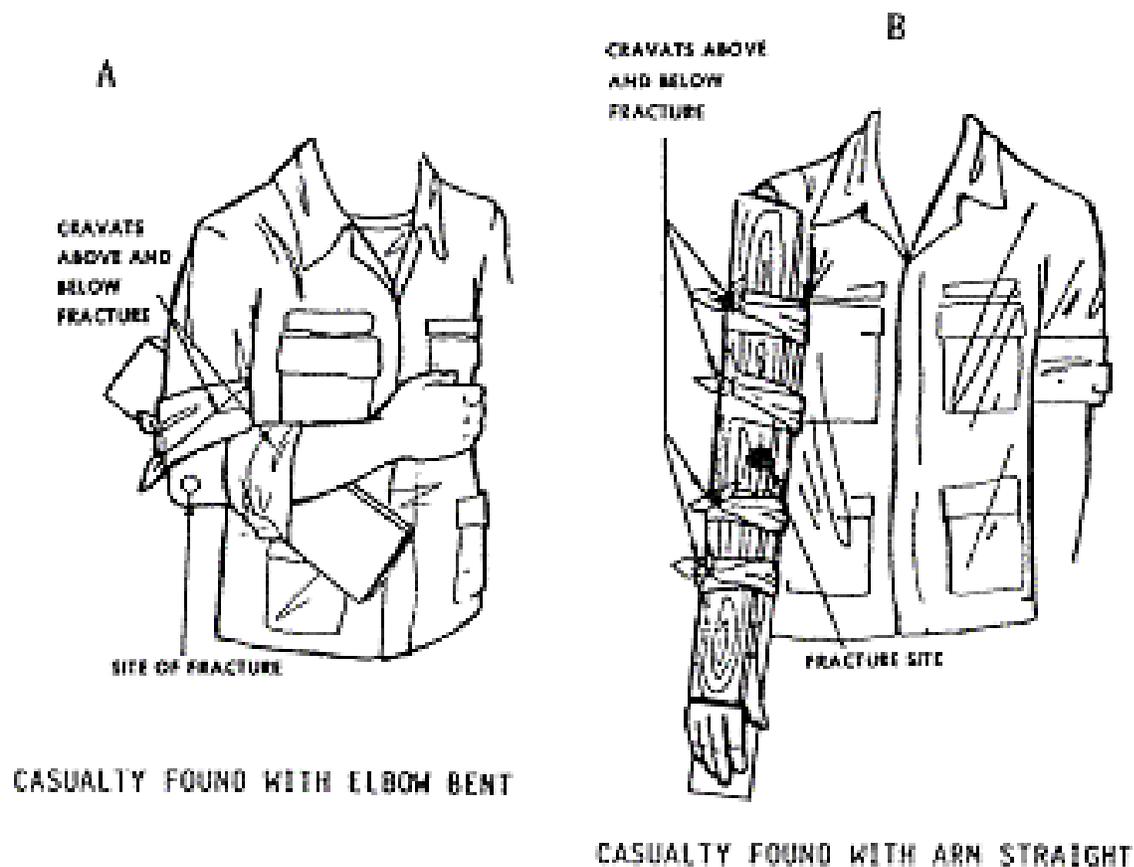


Figure 5-6. Improvised splints applied to fractured elbows.

(a) Apply at least one cravat above the fracture site (secure the upper arm to the rigid object) and at least one cravat below the fracture site (secure the forearm to the rigid object). Do not apply a cravat over the elbow.

(b) Tie the tails of the cravats in a nonslip knot on the rigid object and tuck in the tails.

(c) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.

(4) Apply a sling and swathe to help support the arm, but do not place the elbow and rigid object inside the sling.

b. Elbow Not Bent.

(1) Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the splint is applied.

(2) Apply two rigid objects (padded, if possible) to the casualty's limb. The rigid objects should be long enough to immobilize the elbow and the wrist. The bottom rigid object should extend beyond the fingers of the injured hand. Make sure the inner splint does not press on the axilla.

(3) Place a rolled cravat or similar material in the palm of the casualty's injured hand.

(4) Secure the rigid object with at least four cravats (see figure 5-6B).

(a) Apply at least two cravats above the fracture site and two cravats below the fracture site. Do not apply a cravat over the elbow.

(b) Tie the tails of the cravats in a nonslip knot on the outer rigid object and tuck in the tails.

(c) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.

(5) Apply two swathes, one above the elbow and one below the elbow.

5-6. IMMOBILIZE A FRACTURED FOREARM WITH AN IMPROVISED SPLINT

A fractured forearm can be splinted using one or two rigid objects. Figure 5-7 shows an improvised splint using a single board as the rigid object.

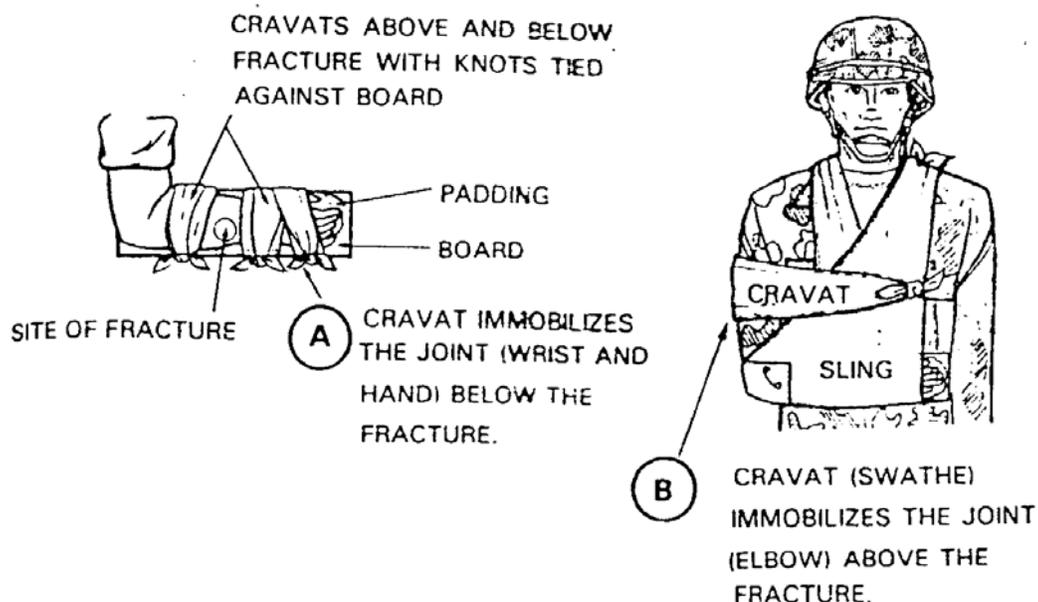


Figure 5-7. Improvised splint applied to a fractured forearm.

a. Gather one or two rigid objects, securing materials, and padding. The rigid object(s) should extend from the elbow to beyond the fingers.

b. Pad the rigid object(s).

c. Check the casualty's pulse below the fracture site. If no pulse is found, evacuate the casualty as soon as possible after the splint is applied.

d. Place the padded rigid object under the casualty's injured forearm so the splint extends from the elbow past the fingers. If two rigid objects are used, place the second padded rigid object on top of the forearm.

e. Place a rolled cravat or similar material in the palm of the casualty's cupped hand (see figure 5-2) and turn the hand so it will be in a natural position (palm toward casualty's body).

f. Secure the rigid object(s) with at least three cravats or other securing material.

(1) Apply the first cravat between the fracture site and the elbow.

(2) Apply the second cravat between the fracture site and the wrist.

(3) Apply the third cravat in an "X" fashion over the hand. Leave the fingernails exposed so a blanch test (pressing on nails, then releasing to see how fast color returns to the nail beds) can be performed.

(4) Tie the tails of the cravats in a nonslip knot on the outer part of the rigid object and tuck in the tails.

(5) Check the casualty's pulse after each cravat is applied. If the pulse can no longer be detected, loosen the cravat and apply it again. If this does not restore circulation, evacuate the casualty as soon as possible.

g. Apply a sling and a swathe to further immobilize the injured arm.

5-7. IMMOBILIZE A DISLOCATED SHOULDER

A dislocation of the shoulder occurs when the head of the humerus is pushed out of its socket at the shoulder. The dislocation can be either anterior (the head pushed forward) or posterior (the head pushed backward). Most dislocations will be anterior dislocations. Shoulder dislocations are painful and the casualty (if conscious) will usually attempt to hold the arm on the injured arm to prevent movement. The shoulder will not have its normal rounded appearance. Immobilize the injured shoulder and upper arm without attempting to reduce the injury (replace the humerus in its socket).

a. **Anterior Dislocation.** If the head of the humerus is displaced toward the casualty's front, the arm will be a fixed position away from the casualty's chest. Do not try to reposition the arm as any attempt to move the arm toward the chest will produce additional pain. Immobilize the arm in the extended position.

(1) Check the casualty's pulse below the dislocation. If no pulse is found, evacuate the casualty as soon as possible after the arm is immobilized.

(2) Apply padding (a rolled blanket, pillow, or other material) between the upper and the chest to fill the space between them.

(3) Flex the elbow so the casualty's wrist is slightly higher than the elbow.

(4) Apply a sling (arm sling number two) to support the forearm.

(5) Apply a swathe to further immobilize the arm and to secure the padding materials.

(6) Evacuate the casualty in either a sitting position or laying on a litter.

b. **Posterior Dislocation.** If the head of the humerus is displaced toward the casualty's back:

(1) Check the casualty's pulse below the dislocation. If no pulse is found, evacuate the casualty as soon as possible after the arm is immobilized.

(2) Position the casualty's forearm across his midsection with his wrist slightly higher than his elbow.

(3) Apply a sling to immobilize the arm. Use the arm sling number two method to protect the shoulder from additional pressure.

(4) Apply a swathe to further immobilize the arm.

(5) Evacuate the casualty, either in sitting position or laying on a litter.

5-8. APPLY A SLING TO AN ARM

A sling is used to support and immobilize the forearm. It also serves to immobilize the elbow and upper arm. A sling is normally made from a triangular bandage (see paragraph 2-4c and figure 5-8A). A swathe is normally applied to further immobilize the casualty's injured arm.

NOTE: The shoulder, upper arm, elbow, and forearm on the injured side may be referred to as "injured" whether or not that particular body part is actually injured.

a. **Apply a Sling (Arm Sling Number One) to an Arm.** This arm sling is used when the shoulder of the injured arm is not injured.

(1) Insert the triangular bandage between the injured arm and the casualty's chest so the arm is in the center, the apex of the sling is beyond the elbow, and the top corner of the material is over the shoulder of the injured side (see figure 5-8B).

(2) Position the forearm so the hand is slightly higher than the elbow (about a 10 degree angle).

(3) Fold the material along the base (the long side opposite the apex) back to the casualty's fingers, forming a cuff.

(4) Bring the lower portion of the material over the injured arm so the bottom corner goes over the shoulder of the uninjured side (see figure 5-8C). The elbow should be inside the sling.

(5) Bring the top corner behind the casualty's neck.

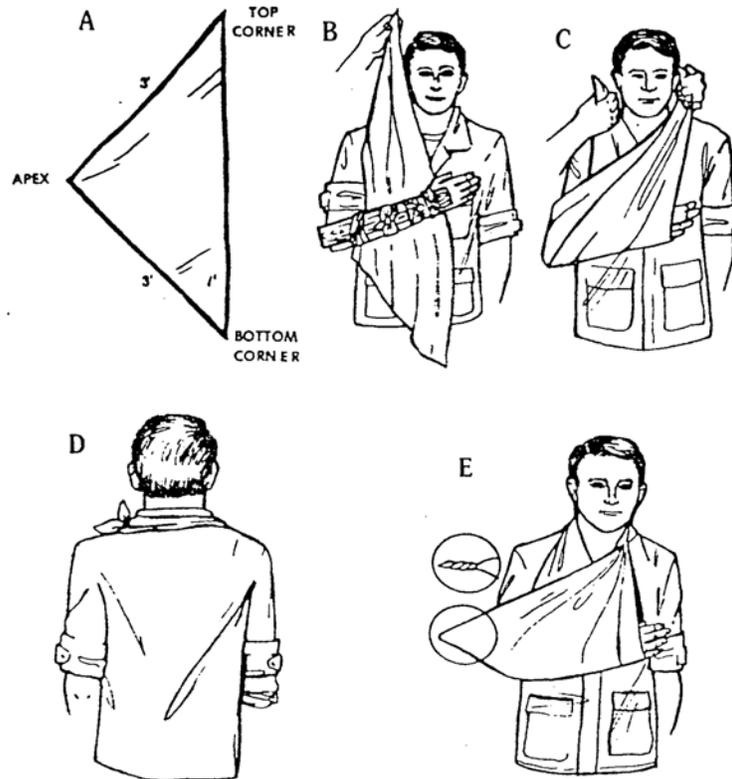


Figure 5-8. Applying a triangular bandage sling (arm sling number one).

(6) Tie the two corners together in a nonslip knot at the "hollow" at the neck on the uninjured side (see figure 5-8D). If the casualty's right arm is fractured, for example, tie the knot so it will rest in the hollow on the left side of his neck.

(7) Secure the apex of the sling to keep the elbow and forearm from slipping out of the sling.

(a) Safety pin method. Fold the apex forward over the elbow and sling. Pin the apex to the sling.

(b) Pigtailing (twisting) method. Twist the apex of the sling and tuck it in at the elbow (see figure 5-8E).

b. Apply a Sling (Arm Sling Number Two) to an Arm. This arm sling is used when the shoulder of the injured arm is also injured (dislocated or fractured). Note that the sling goes under, not over, the injured shoulder.

(1) Insert the triangular bandage between the injured arm and the casualty's chest so the arm is in the center, the apex of the sling is beyond the elbow, and the top corner of the material is over the shoulder of the uninjured side (see figure 5-9A).

(2) Position the forearm so the hand is slightly higher than the elbow (about a 10-degree angle).

(3) Fold the material along the base (the long side opposite the apex) back to the casualty's fingers, forming a cuff.

(4) Bring the lower portion of the material over the injured forearm and under the armpit of the injured arm (see figure 5-9B). The elbow should be inside the sling.

(5) Bring the top corner behind the casualty's neck.

(6) Tie the two corners together in a nonslip knot on the casualty's back between his shoulder blades (see figure 5-9C).

(7) Twist the apex of the sling and tuck it in at the elbow. The corner can also be secured using a safety pin or similar device.

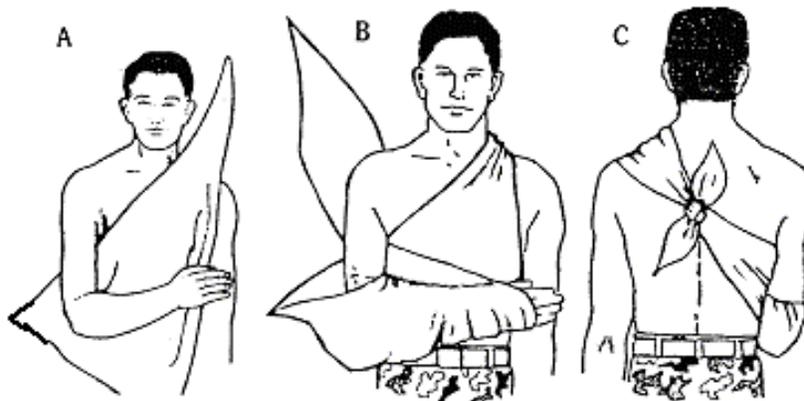


Figure 5-9. Applying a triangular bandage sling (arm sling number two).

c. **Apply a Jacket Flap Sling to an Arm.** The flap of a BDU jacket (coat) or a field jacket (coat) can be used as a sling if the time or the materials to make a triangular bandage sling are not available (see figure 5-10).



Figure 5-10. Jacket flap sling.

(1) Position the forearm on the casualty's chest with the hand positioned slightly higher than the elbow.

(2) Undo the jacket so the lower portion (flap) can be brought over the forearm to form a sling.

(3) Bring the flap up over the forearm to the pocket area. Position the elbow so that it is inside the sling and will not slip out of the sling.

(4) Push a stick or other rigid object through the flap and the upper portion of the jacket so the flap will not slip.

5-9. APPLY A SWATHE

A swathe is a large strip of cloth, muslin bandage, field dressing, blanket strip, pistol belt, trouser belt, bandoleer, or other material used to immobilize an arm. The swathe should be three to six inches wide.

a. The chest can be used as the rigid object to immobilize an arm (fractured or dislocated shoulder, fractured humerus, or fractured clavicle) by applying a sling to the

forearm and swathes to the upper arm. If the humerus is fractured, one swathe is applied above the fracture and one swathe is applied below the fracture (see figure 5-11).

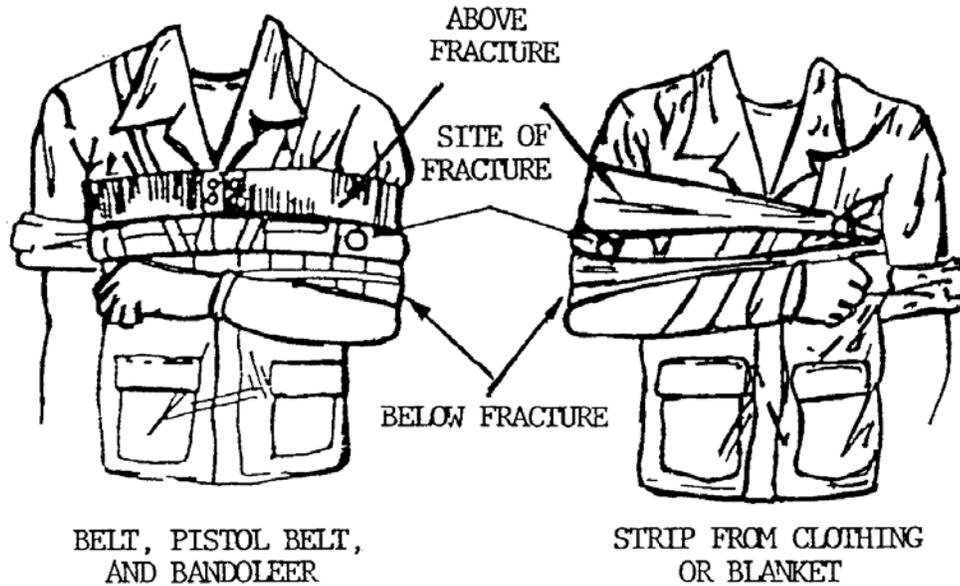


Figure 5-11. Sling and swathes used to immobilize a fractured humerus (chest used as the rigid object).

b. Two swathes are applied when immobilizing a fractured elbow (not bent) once the arm has been splinted. One swathe is applied above the elbow and one swathe is applied below the elbow (see figure 5-12).

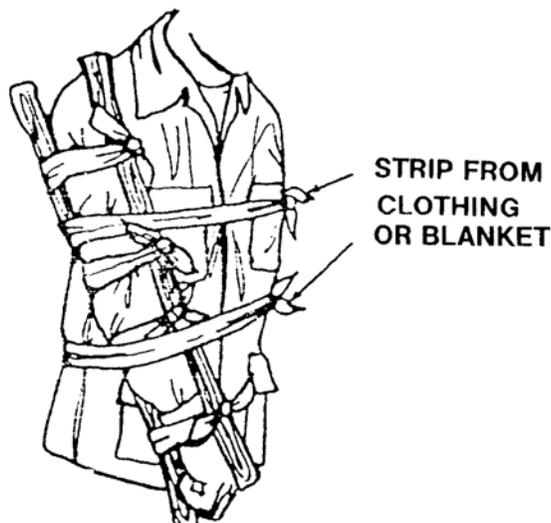


Figure 5-12. Swathes used to immobilize a fractured elbow (not bent).

c. A single swathe is normally used to immobilize a fractured forearm once a splint and a sling have been applied (see figure 5-13). The procedures below are for applying a swathe to such an injury, but the same general procedures can be used for applying swathes to other injuries. Applying the swathe over the sling helps to further limit movement of the forearm.

CAUTION: Do not apply a swathe on top of the fracture site. The pressure of the swathe could cause additional damage to the nerves and blood vessels around the broken bone.

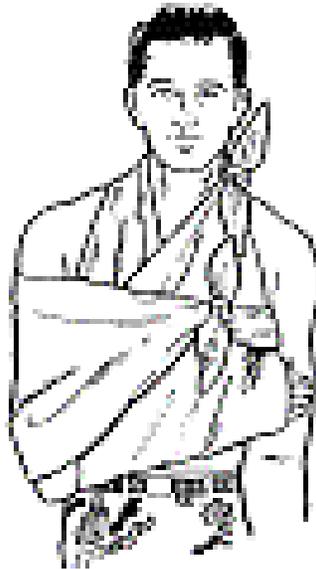


Figure 5-13. Swathe used to immobilize a fractured forearm.

(1) Place one end of the swathe on the sling at the breast pocket near the uninjured arm. Hold this end at this location.

(2) Wrap the other end of the swathe across the sling, around the upper arm on the injured side, behind the casualty's back, under the uninjured arm, and back to the breast pocket.

(a) You have now encircled the casualty's chest and injured arm. The uninjured arm, however, remains free to move.

(b) Since the fracture is in the forearm and not the upper arm, make the swathe wide (about 12 inches) when it goes across the injured arm. If the casualty had a fractured humerus, you would not make the swathe as wide since the swathe should not be applied on top of a fracture site.

(3) Tie the two ends of the swathe in a nonslip knot over the breast pocket on the uninjured side.

(4) Check the casualty's pulse below the swathe. If the casualty had a pulse before the swathe was applied but the pulse is no longer present, loosen and retie the swathe. If a pulse is still not present, evacuate the casualty as soon as possible.

5-10. IMMOBILIZE A FOREARM USING A PNEUMATIC SPLINT

A pneumatic (air) is normally used to immobilize a fracture of the forearm or lower leg. A pneumatic splint can be applied quickly and easily. Since they are transparent, the injury can be observed through the splint. Pneumatic splints, however, also have disadvantages. A pneumatic splint cannot be used with an open fracture since the pressure from the splint would force the bone back into the arm. The splint can also be rendered useless if it is torn or punctured. The pressure may need to be adjusted periodically, especially if the casualty is evacuated by air. The procedures below give the general steps for applying a pneumatic splint to a fractured forearm with the casualty lying on the ground.

a. **Inspect Splint.** Check the splint for cuts, tears, and punctures. Check the air valve and the zipper to make sure they function properly.

b. **Check Pulse.** Check the casualty's pulse distal to the suspected fracture. If no pulse is found, evacuate the casualty as soon as possible after the injury is splinted.

c. **Apply Splint.**

(1) Unzip the splint and lay it flat next to the injured forearm. The splint should be flat (not inflated).

(2) Gently lift the casualty's forearm. Support the elbow with your hand and cradle his arm in your arm..

(3) With your other hand, move the splint beneath the injured forearm. The splint should be as high on the injured forearm as possible.

(4) Gently lower the forearm onto the splint.

(5) Gently place the splint around the forearm and close the zipper completely.

d. **Inflate the Splint.**

(1) Open the air valve. This is usually done by turning the valve counterclockwise. A pneumatic (air) splint is normally used to immobilize a fracture of the forearm or lower leg. A pneumatic splint can be applied quickly and easily. Since they are transparent, the injury can be monitored easily.

(2) Inflate the splint by blowing into the air valve.

(a) Always inflate the splint by mouth. Do not use an air pump. It is easy to overinflate a splint when a pump is used. As the air pressure inside the splint increases, so does the pressure caused by the splint on the injured limb. Too much pressure can result in impaired circulation in the limb.

(b) When the splint is properly inflated, you will be able to make a small indentation in the splint by pressing on it with your finger or thumb.

(3) Close the air valve. This is usually done by turning the valve clockwise.

(4) Check the casualty's pulse distal to the splint. If the casualty had a pulse previously but a pulse can no longer be found, decrease the air pressure in the splint and recheck the pulse. If a pulse still cannot be felt, evacuate the casualty as soon as possible,

e. Monitor the Splint.

(1) Since the splint depends upon air pressure to remain rigid, continue to check the splint to make sure no leaks have developed.

(2) Observe for impaired circulation.

(a) Monitor the casualty's pulse and the color and temperature of the limb distal to the splint. Also ask the casualty about numbness or tingling sensations if he is responsive. Lower the air pressure if the splint is impairing circulation.

(b) Partially deflate the splint every 20 to 30 minutes to reestablish peripheral circulation in the forearm and hand; then inflate the splint again to its normal rigidity.

(3) Adjust for changes in environment by increasing or decreasing the amount of air in the splint.

(a) Changes in the weather and temperature can affect the air pressure inside the splint.

(b) Decrease the air pressure in the splint if the casualty is to be evacuated by air.

Continue with Exercises

EXERCISES, LESSON 5

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. When applying a wire ladder splint to a casualty's arm, position the splint on the _____ of the casualty's arm.

- a. Inside.
- b. Outside.

2. When applying a splint to a casualty's arm, what can you do to help keep two fingers in their natural position?

3. When applying a SAM splint to a fracture of the forearm, the casualty's _____ should rest in the bend of the splint.

- a. Elbow.
- b. Hand.

4. You are applying an improvised splint to a casualty's arm. Before you applied a cravat, he had good circulation below the fracture. Now he has no radial pulse. What should you do?

5. When applying an arm sling #1, the ends of the sling are tied in a nonslip knot at the casualty's neck on the:
- a. Same side as the injured arm.
 - b. Side opposite that of the injured arm.
6. Which of the following is correct concerning applying a sling to help immobilize the arm as part of the treatment for a dislocated shoulder?
- a. If the shoulder has an anterior dislocation, apply an arm sling number one (sling over the injured shoulder). If the shoulder has a posterior dislocation, apply an arm sling number two (sling under the injured shoulder).
 - b. If the shoulder has an anterior dislocation, apply an arm sling number two (sling under the injured shoulder). If the shoulder has a posterior dislocation, apply an arm sling number one (sling over the injured shoulder).
 - c. Apply an arm sling number one (sling over the injured shoulder) for both an anterior dislocation and a posterior dislocation.
 - d. Apply an arm sling number two (sling under the injured shoulder) for both an anterior dislocation and a posterior dislocation.
7. What is different about applying a swathe to a casualty with a fractured humerus and to a casualty with a fractured forearm?

8. A pneumatic splint should be inflated _____ the splint is applied to the injured limb.
- a. Before.
 - b. After.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 5

1. b (para 5-1b(1))
2. Place a wad of material in the casualty's palm. (para 5-6e, figure 5-2)
3. a (para 5-2e)
4. Loosen the cravat, apply it again, and check the pulse again. (para 5-4e(3))
5. b (para 5-8a(6))
6. d (paras 5-7a(4), b(3))
7. Apply two swathes about 3 to 6 inches wide (one above the fracture and one below the fracture) to the fractured humerus. Apply one swathe about 12 inches wide to the upper arm of the fractured forearm. (paras 5-9, 5-9a, c, c(2))
8. b (paras 5-10c, d)

End of Lesson 5

LESSON ASSIGNMENT

LESSON 6

Roller Bandages.

LESSON ASSIGNMENT

Paragraphs 6-1 through 6-10.

LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 6-1. Identify the functions of roller bandages.
- 6-2. Identify the procedures for applying an anchor wrap.
- 6-3. Identify the procedures for applying a circular wrap.
- 6-4. Identify the procedures for applying a spiral wrap.
- 6-5. Identify the procedures for applying a spiral reverse wrap.
- 6-6. Identify the procedures for applying a figure eight wrap.
- 6-7. Identify the procedures for applying a recurrent wrap.
- 6-8. Identify the procedures for monitoring a casualty with an elastic bandage applied to a limb.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 6

ROLLER BANDAGES

6-1. ROLLER BANDAGES

A roller bandage is a strip of gauze or cotton material prepared in a roll. Roller bandages can be used to immobilize injured body parts (sprains and torn muscles), provide pressure to control internal or external bleeding, absorb drainage, and secure dressings. Three types of bandages are the Kerlex bandage, the gauze bandage, and the elastic bandage (see figure 6-1).

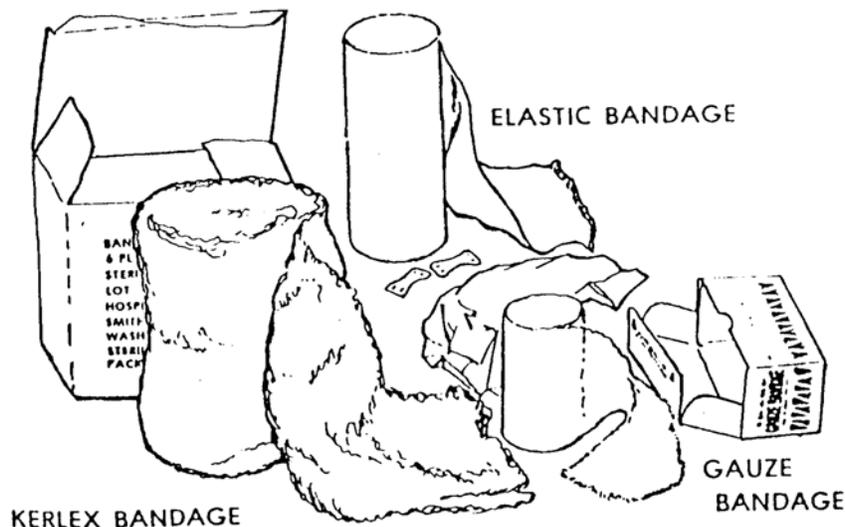


Figure 6-1. Examples of bandages.

- a. **Kerlex Bandage.** The Kerlex bandage is absorbent, loosely woven, and conforms easily to uneven surfaces such as the hand, wrist, elbow, shoulder, groin, knee, ankle, and foot. The Kling bandage is similar to the Kerlex bandage. These bandages are used primarily for bleeding injuries.
- b. **Gauze Roller Bandage.** The gauze roller bandage is absorbent, loosely woven, cotton fabric. It does not conform well to uneven surfaces and is not to be used on areas prone to chafing, such as shoulders, elbows, groin, and other jointed areas. It is used primarily on bleeding injuries on the upper arm, forearm, thigh, and lower leg.
- c. **Elastic Roller Bandage.** The elastic roller bandage is composed of cloth and elastic that allows it to stretch and retract. It conforms to uneven surfaces and applies even pressure to the area covered. It is used to apply pressure and/or restrict movement. The elastic bandage is normally used when a sprain needs to be immobilized. Take care to ensure the bandage is not tight enough to restrict blood flow unless it is used as a pressure dressing.

6-2. GENERAL RULES FOR APPLYING ROLLER BANDAGES

Some general rules for applying roller bandages are given below.

- a. Expose the limb to be bandaged. The limb should be as dry and clean as possible.
- b. Position the body part to be bandaged in a normal resting position (position of function).
- c. Check the circulation at a point below where the bandage will be applied.
- d. Choose the appropriate sized roller bandage. Roller bandages range from 1/2 inch to 6 inches in width. The wider widths are used for the larger body parts. The 2-inch roller bandage is primarily used for the hand. The 3-inch roller bandage is used for the forearm, lower leg, and foot. The 4-inch and 6-inch roller bandages are used for the thigh and chest.
- e. Pad bony areas and/or between skin surfaces (such as between fingers), which will be covered by the roller bandage.
- f. Apply the roller bandage. A roller bandage applied to a limb is normally applied beginning with the most distal point to be wrapped. The roller bandage is normally secured with an anchor wrap at the beginning and with a circular wrap at the end.
- g. Tape, clip, or tie the end of the bandage in a position that is easy to reach.
- h. Check the circulation below the wrapping. If the wrapping is interfering with the casualty's circulation, loosen the roller bandage and apply it again.
- i. Elevate the injured limb to help control swelling.

6-3. APPLY AN ANCHOR WRAP

The following steps are used to apply an anchor wrap to a limb. The anchor wrap is usually used to anchor (secure) the roller bandage when beginning other wrappings.

- a. Lay the end of the bandage on the bottom of the limb to be wrapped and at an angle so one corner (apex) of the bandage will not be covered when the bandage is brought around the limb (see figure 6-2A).
- b. Wrap the bandage completely around the limb twice and past the raised corner (see figure 6-2B).

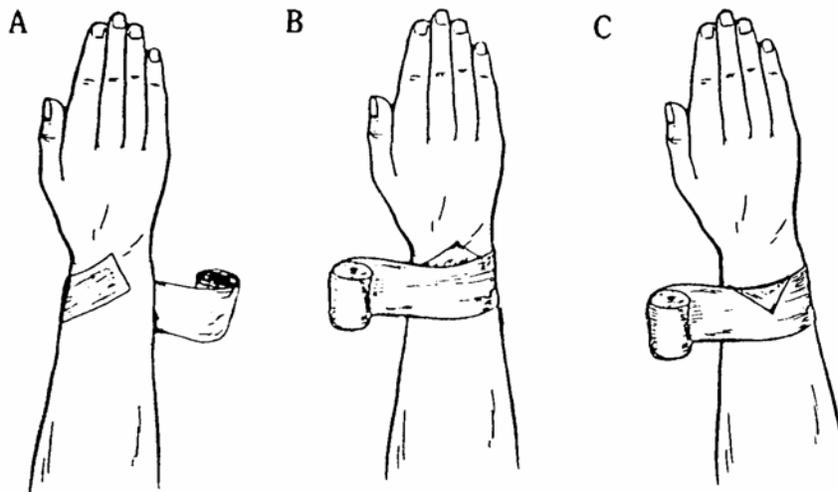


Figure 6-2. Applying an anchor wrap.

- b. Wrap the bandage completely around the limb twice and past the raised corner (see figure 6-2B).
- c. Fold the corner over the second turn of the bandage (see figure 6-2C).
- d. Continue wrapping the bandage around the limb a third time, bringing the bandage over and covering the turned-down corner. The bandage is now anchored.

6-4. APPLY A CIRCULAR WRAP

The circular wrap is usually used to end a bandage pattern, but can also be used to help immobilize a joint (see figure 6-3). Secure the bandage with two or more circular-turns, then tape, clip, or tie the end of the bandage.

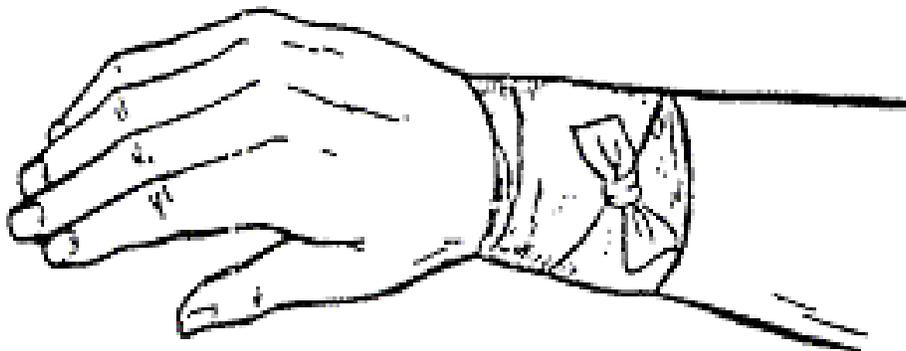


Figure 6-3. Circular wrap.

6-5. APPLY A SPIRAL WRAP

The spiral wrap is usually used to cover the forearm, upper arm, calf, or thigh. It is not used to cover elbows, knees, fingers, or toes.

- a. Apply an anchor wrap.
- b. Wrap the limb in a spiral manner (see figure 6-4). On each turn, overlap about one-third of the previous turn. Keep the bandage tight enough to apply pressure to the limb, but not tight enough to impair blood circulation.

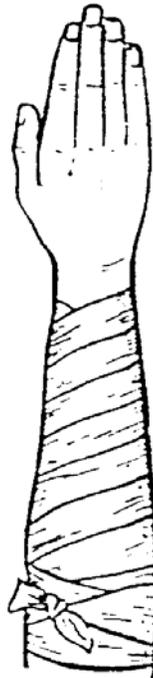


Figure 6-4. Spiral wrap.

- c. Continue wrapping until the entire portion of the limb has been wrapped.
- d. Secure the bandage with a circular wrap.
- e. Tape, clip, or tie the end of the bandage.

6-6. APPLY A SPIRAL REVERSE WRAP

Although the spiral wrap (see figure 6-5) is normally used to apply pressure to a limb, the spiral reverse wrap can also be used. It is especially useful when applying pressure to the calf (lower leg) since it follows the contours of the limb more closely than does the spiral wrap.

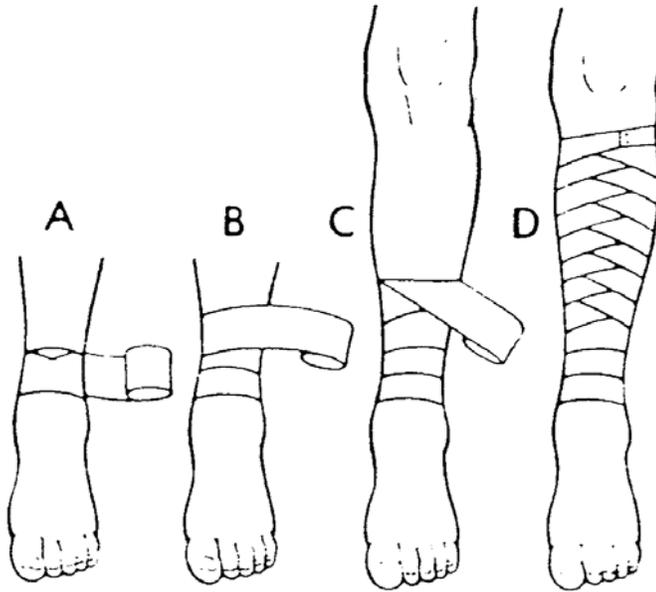


Figure 6-5. Applying a spiral reverse wrap.

- a. Secure the bandage at the ankle with an anchor wrap (see figure 6-5A).
- b. Apply about four spiral turns (see figure 6-5B).
- c. Place the thumb of your free hand on the upper edge of the uppermost turn and apply firm pressure to hold the bandage in place.
- d. Unwind about six inches of bandage from the roll.
- e. Give the roll a half-twist so the bandage is directed downward (see figure 6-5C). The upper edge of the turn should be parallel to the lower edge of the previous turn and overlap it by two-thirds of its width. The wrap continues in the same direction (figure shows counterclockwise).
- f. Carry the roll around the limb and back. The bandage should be at about the same location as the half-twist, but higher.
- g. Repeat steps c, d, e, and f to apply another layer of bandage using the spiral reverse method.
- h. Continue applying the bandage using the spiral reverse technique. The turns should be in line and uniform as shown in figure 6-5D.
- i. When you reach the top of the area to be bandaged, secure the bandage with a circular wrap.
- j. Tape, clip, or tie the end of the bandage (see figure 6-5D).

6-7. APPLY A FIGURE-EIGHT WRAP

A figure-eight wrap is used to limit joint movement of the hand, elbow, knee, ankle, or foot. Figure 6-6 shows a figure-eight wrap applied to a hand.

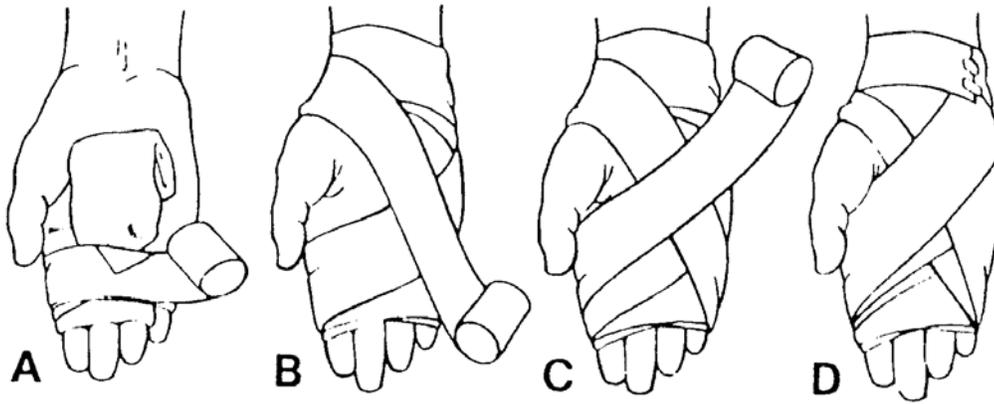


Figure 6-6. Applying a figure-8 wrap.

- a. Apply padding (usually gauze applied between the fingers or toes, around bony areas, and/or in hollow areas).
- b. Apply an anchor wrap below the joint (see figure 6-6A).
- c. Bring the roller bandage up diagonally and across the joint (wrist).
- d. Wrap the roller bandage around the limb above the joint (circular wrap).
- e. Bring the roller bandage down across the joint diagonally so that it crosses the upward portion of the figure-eight wrap (see figure 6-6B).
- f. Take the roll behind the body part (fingers) and up diagonally across the joint again. Overlap two-thirds of the previous upward wrap (see figure 6-6C).
- g. Take the roll behind the body part (wrist area) and down again diagonally, overlapping the previous downward wrap.
- h. Continue alternate upward and downward diagonal wraps until the joint is sufficiently supported.
- i. Apply a circular wrap above the joint.
- j. Tape, clip, or tie the end of the bandage (see figure 6-6D).

6-8. APPLY A RECURRENT WRAP

A recurrent wrap is used for a stump (amputated limb), finger, or hand. The procedures given below are for securing a dressing applied to a complete amputation.



Figure 6-7. Applying a recurrent bandage to a stump.

- a. Apply an anchor wrap above the stump. Apply the wrap so the apex will be pointing toward the stump when it is folded down over the bandage (see figure 6-7A).
- b. Bring the bandage down diagonally across the front of the limb (see figure 6-7A) and around the stump, encasing the edge of the dressing. Hold the bandage in back so it will not slip.
- c. Bring the bandage to the front.
- d. Move diagonally up across the front of the limb, forming an "X" pattern with the downward diagonal (see figure 6-7B).
- e. Encircle the "X" pattern at the anchor point with one complete turn.
- f. Form the first recurrent (running back to the source). Put your thumb on the top of the bandage to keep it in place, make a fold, bring the bandage down, over the far side of the dressing, and up the back (see figure 6-7C). Hold the dressing in place on the back of the limb with your index finger.
- g. Form the second recurrent. Make a fold at the back and bring the bandage down, over the opposite side of the dressing, and up the front (see figure 6-7D).
- h. Form the third recurrent. Make a fold at the front, bring the bandage down over the center of the dressing, and up the back.
- i. Lock the recurrences in place with a complete turn 3 to 4 inches from the bottom of the stump (below the anchor wrap).
- j. Move diagonally across the stump from the locking turn encasing the edges of the recurrences; then move back diagonally forming another "X" pattern.

- k. Overlap the "X" pattern with half the width of the bandage (circular turn).
- l. Tape, clip, or tie the end of the bandage (see figure 6-6D).

6-9. APPLY A SPICA WRAP

The spica wrap is a variation of the figure-eight wrap used for large areas (shoulder and hips).

- a. Anchor the bandage below the joint (around the upper arm or thigh).
- b. Wrap the bandage across the joint and around the trunk of the body (chest or abdomen).
- c. Return to and cross the previous wrap.
- d. Wrap the bandage behind the limb, overlapping one-third of the anchor wrap.
- e. Continue to wrap (steps b, c, and d) until the joint is sufficiently supported.
- f. Tape, clip, or tie the end of the bandage.

6-10. MONITOR A CASUALTY WITH A WRAPPED LIMB

After you have wrapped a casualty's limb with an elastic bandage, monitor the limb.

a. **Check for Impaired Circulation.** Even if the circulation was not impaired when you finished the wrap, pressure caused by swelling (edema and/or internal bleeding) may result in impaired circulation. If impaired circulation is discovered, loosen and apply the wrap again.

- (1) Check the pulse.
- (2) Perform the blanch test.
- (3) Ask the casualty about numbness, tingling, or a cold sensation in the limb.
- (4) Observe the skin below the bandage wrap for discoloration.

b. **Check for Skin Irritation.** Check for rubbing or wrinkles in the bandages. Correct the source of the irritation. If the bandage is removed, check the wrapped area for redness and sores.

Continue with Exercises

EXERCISES, LESSON 6

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. What are the primary uses of roller bandages?

2. One of the steps in applying an anchor wrap is to angle one corner (apex) of the bandage so it remains exposed when you encircle the limb with the roller bandage. What do you do with the corner?

3. What do you do after applying a circular wrap?

4. Which of the following wraps is usually used with an amputation stump?

- a. Recurrent wrap.
- b. Spica wrap.
- c. Spiral reverse wrap.
- d. Spiral wrap.

5. A _____ wrap is much like a figure-eight wrap, except it is used for larger joints like the shoulder and hip.
- a. Recurrent.
 - b. Spica.
 - c. Spiral reverse.
 - d. Spiral.
6. A completed spiral reverse wrap is secured with a(n):
- a. Anchor wrap.
 - b. Circular wrap.
 - c. Recurrent wrap.
7. If possible, obtain an elastic roller bandage and practice applying the anchor, spiral, circular, spiral reverse, figure-eight, and spica wraps.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 6

1. Immobilize body parts.
Provide pressure to control bleeding.
Absorb drainage.
Hold dressings in place. (para 6-1)
2. Turn it down on top of the second turn and cover it with the third turn
(paras 6-3c, d)
3. Secure (tape, clip, tie) the end of the bandage (para 6-5e).
4. a (para 6-7)
5. b (para 6-8)
6. b (para 6-5i)

End of Lesson 6