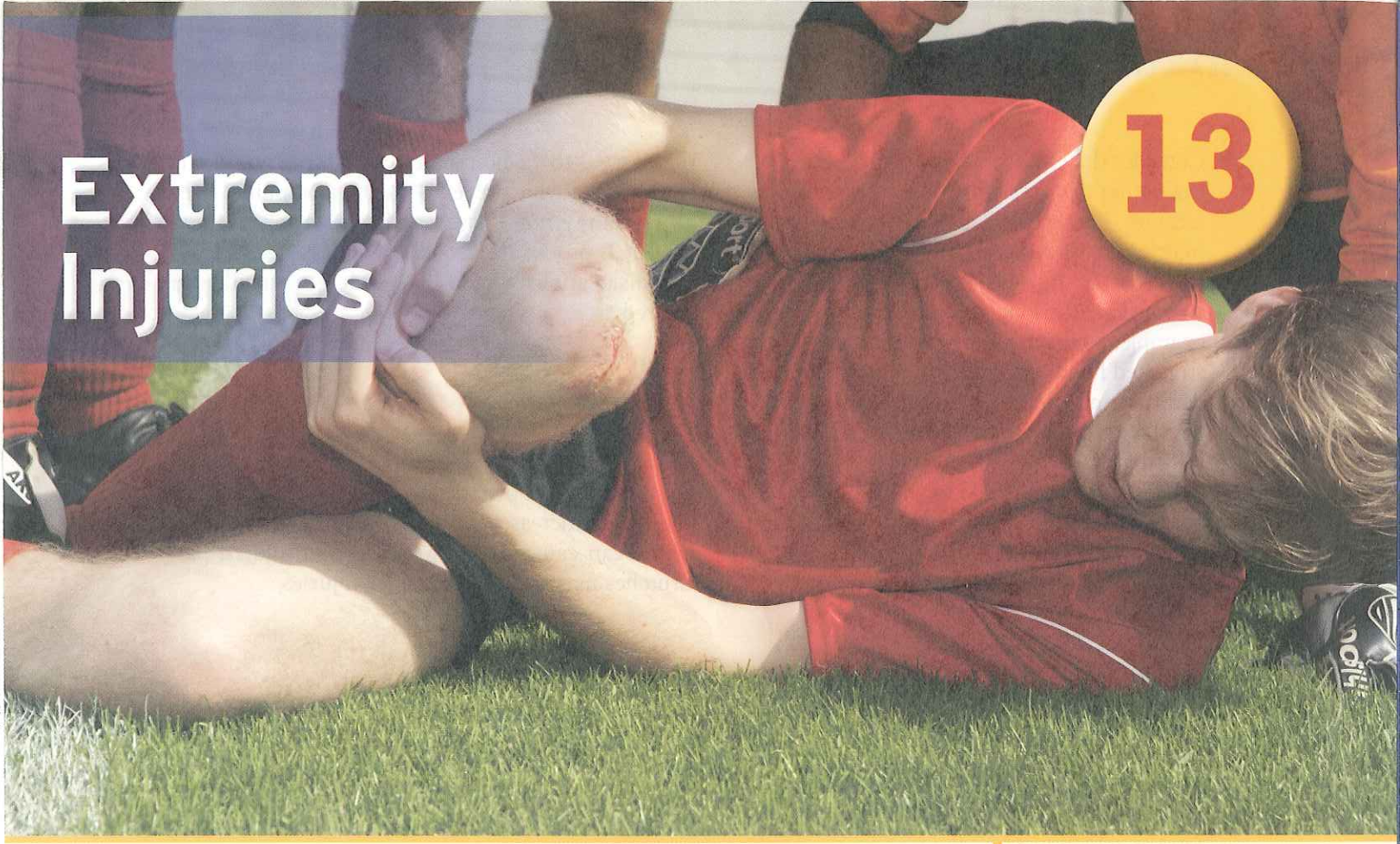


13 Extremity Injuries

Extremity Injuries

Injuries to the extremities are common because people are involved in active lifestyles that include sports and wilderness activities. This chapter focuses on bone, joint, and muscle injuries of the extremities; bleeding, wounds, and other soft-tissue injuries are covered elsewhere. Most of the conditions discussed result from sudden trauma, although some chronic injuries incurred over time, such as tennis elbow, are included.

Assessment

Use these guidelines to assess injuries to the extremities:

- Look for signs and symptoms of fractures and dislocations.
- Examine the extremities, using the mnemonic DOTS (Deformity, Open wound, Tenderness, Swelling). Look at and gently feel the extremity, starting at the distal end (fingers or toes) and working upward.
- Compare one extremity with the other to determine size and shape differences.
- Use the "rule of thirds" for extremity injuries. Imagine each long bone as being divided into thirds. If deformity, tenderness, or swelling is located in the upper or lower third of a long bone, assume that the nearest joint is injured.

chapter at a glance

- Consider the cause of injury (COI) when evaluating the possibility of a fracture and its location. Forces that cause musculoskeletal injuries are direct forces (for example, a car bumper striking a pedestrian's leg), indirect forces along the long axis of bones (for example, a person falling onto an outstretched hand and fracturing the collarbone), and twisting forces (for example, a person's foot fixed in one spot with the leg suddenly twisting).
- Use the mnemonic CSM as a reminder to check the extremity for circulation, sensation, and movement of fingers or toes.

Types of Injuries

Types of injuries to the extremities range from a simple contusion to a complex open fracture:

- Contusion, or bruising of the tissue
- Strain, in which muscles are stretched or torn
- Sprain, which involves the tearing or stretching of the joints, causing mild to severe damage to the ligaments and joint capsules
- Tendinitis, which is inflammation of a tendon (cord that attaches muscle to bone) caused by overuse
- Dislocation, in which bones are displaced from their normal joint alignment, out of their sockets, or out of their normal positions
- Fracture, which is a break in a bone that may or may not be accompanied by an open wound

Care for Extremity Injuries

1. Use the RICE procedures for injuries described in this chapter (see Skill Drill 1, page 169).
2. Apply a splint to stabilize fractures and dislocations.

RICE Procedure for Bone, Joint, and Muscle Injuries

RICE is the acronym for rest, ice, compression, and elevation—the recommended immediate treatment for bone, joint, and muscle injuries. The steps during the first 48 to 72 hours after an injury can do a lot to relieve—even prevent—aches and pains. Treat all extremity bone, joint, and muscle injuries with the RICE procedure. In addition to RICE, fractures and dislocations should be splinted to stabilize the injured area.

R = Rest

Injuries heal faster if rested. Rest means the victim does not use or move the injured part. Using any part of the body increases the blood circulation to that area, which can cause more swelling of an injured part. Crutches may be used to rest leg injuries.

I = Ice

An ice pack should be applied to the injured area as soon as possible after the injury for 20 to 30 minutes as often as possible while awake, removing the ice pack for 5–10 minutes between each 20–30 minute period, during the first 24 to 48 hours. Never apply ice directly to the skin. Skin treated with cold passes through four stages: cold, burning, aching, and numbness. When the skin becomes numb, usually in 20 to 30 minutes, remove the ice pack. After removing the ice pack, compress the injured part with an elastic bandage and keep it elevated (the "C" and "E" of RICE).

CAUTION

DO NOT apply an ice pack for more than 20 to 30 minutes at a time. Frostbite or nerve damage can result.

DO NOT apply an ice pack on the back outside part of the knee. Nerve damage can occur.

DO NOT apply cold if the victim has a history of circulatory disease, Raynaud disease (spasms in the arteries of the extremities that reduce circulation), or abnormal sensitivity to cold, or if the injured part has been frostbitten previously.

DO NOT stop using an ice pack too soon. A common mistake is the early use of heat, which may result in swelling and pain. Use an ice pack three to four times a day for the first 24 hours, preferably up to 48 hours, before applying any heat. For severe injuries, using ice for up to 72 hours is recommended.

FYI

Heat and Cold: When to Use Which?

Many people use heat devices or ice packs to speed recovery from sports injuries—but when is the right time to use each technique? Cold usually should be applied immediately after an acute injury, such as an ankle sprain. Icing reduces pain, swelling, and muscle spasm immediately after injury, but its use should be discontinued after 2 or 3 days. Heat applications (heat packs, radiant heat, or whirlpool baths) can then be used to reduce muscle spasms and pain. In addition, heat increases blood flow and joint flexibility. Vigorous heat is used to treat chronic injuries, but mild heat can reduce muscle spasm. Heat is also effective for acute back pain, but ice massage is preferred if the back pain persists for 2 weeks or more.

Source: Kaul M P, Herring S A: Superficial heat and cold. *Physician and Sportsmedicine*. 22(12);65.

Cold constricts the blood vessels to and in the injured area, which helps reduce the swelling and inflammation, and it dulls the pain and relieves muscle spasms. Cold should be applied as soon as possible after the injury; healing time often is directly related to the amount of swelling that occurs. Heat has the opposite effect when applied to fresh injuries: It increases circulation to the area and increases the swelling and the pain.

Use either of the following methods to apply cold to an injury:

- Put crushed ice (or cubes) into a double plastic bag, hot water bottle, or wet towel. A layer of cloth should separate the ice from the skin. Secure it in place with an elastic bandage for 20 to 30 minutes. Ice bags can conform to the body's contours.
- Use a chemical "snap pack," a sealed pouch that contains two chemical envelopes. Squeezing the pack mixes the chemicals, producing a chemical reaction that has a cooling effect. Although they do not cool as well as other methods, they are convenient to use when ice is not readily available. They lose their cooling power quickly, however, and can be used only once. Also, they may be impractical because they are expensive.

FYI

Homemade Ice Packs

- Ice bags kept in a freezer freeze solid and cannot be shaped to fit the injured area. One part isopropyl (rubbing) alcohol to three parts water prevents freezing, and the ice bag can be easily molded. Bags can be reused for months.
- An unopened bag of frozen vegetables is inexpensive; keeps its basic shape (unlike ice chips, which melt); molds to the shape of the injured area; is reusable; and is packaged in a fairly puncture-resistant, watertight bag.
- For cold therapy over a fairly large area, soak a face towel in cold water, wring it out, fold it, and place it in a large self-sealing plastic bag. Store the bag in the freezer. To use the cold pack, wrap it in a light cotton towel and apply for 20 minutes, after which it can be refrozen. A washcloth in a smaller bag can be used to treat a smaller area.
- Fill a plastic bag with snow.
- Fill a polystyrene plastic cup with water and freeze it. When you need an ice pack, peel the cup to below ice level; the remaining part of the cup forms a cold-resistant handle. Rub the ice over the injured area (movement is necessary to prevent skin damage). These ice "packs" are inexpensive and convenient and take up little space.
- To make a funnel for filling an ice bag, push out the bottom of a paper cup and fit it into the neck of the ice bag. The ice will slide through the cup and into the bag.

C = Compression

Compressing the injured area squeezes fluid out of the injury site. Compression limits the ability of the skin and other tissues to expand and reduces internal bleeding. Apply an elastic bandage to the injured area, especially the foot, ankle, knee, thigh, hand, or elbow. Fill the hollow areas with padding such as a sock or washcloth before applying the elastic bandage.

Elastic bandages come in various sizes for different body areas:

- 2″ width for the wrist, hand, and foot
- 3″ width for the elbow and arm
- 4″ width for the ankle, knee, and leg

Start the elastic bandage several inches below the injury and wrap in an upward, overlapping (about one half to three fourths of the bandage's width) spiral,

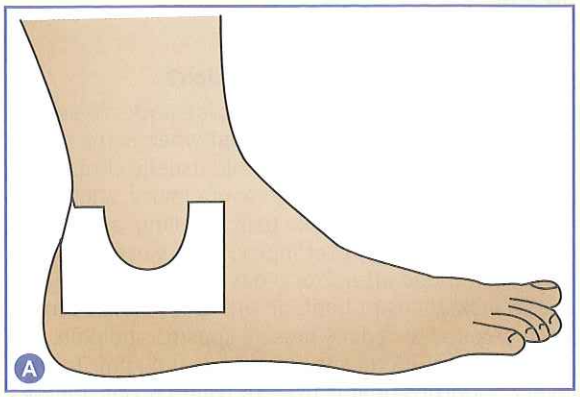
CAUTION

DO NOT apply an elastic bandage too tightly. If applied too tightly, elastic bandages will restrict circulation. Stretch a new elastic bandage to about one third its maximum length for adequate compression. Leave fingers and toes exposed so possible color change can be easily observed. Compare the toes or fingers of the injured extremity with those on the uninjured one. Pale skin, pain, numbness, and tingling are signs that the bandage is too tight. If any of these symptoms appears, immediately remove the elastic bandage. Leave the elastic bandage off until all the symptoms disappear, then rewrap the area less tightly. Always wrap from below the injury and move toward the heart.

starting with even and somewhat tight pressure, then gradually wrapping more loosely above the injury. Stretch the elastic bandage no more than one third its ability to stretch.

Applying compression may be the most important step in preventing swelling. The victim should wear the elastic bandage continuously for the first 18 to 24 hours (except when cold is applied). At night, have the victim loosen but not remove the elastic bandage.

For an ankle injury, place a horseshoe-shaped pad around the ankle knob and secure it with the elastic bandage Figure 1. The pad can be made from various materials (eg, twisting a wash cloth, socks). The pad will compress the soft tissues and the bones. Wrap the bandage tightest nearest the toes and loosest above the ankle. It should be tight enough to decrease swelling but not tight enough to inhibit blood flow. For a contusion or a strain, place a pad between the injury and the elastic bandage.



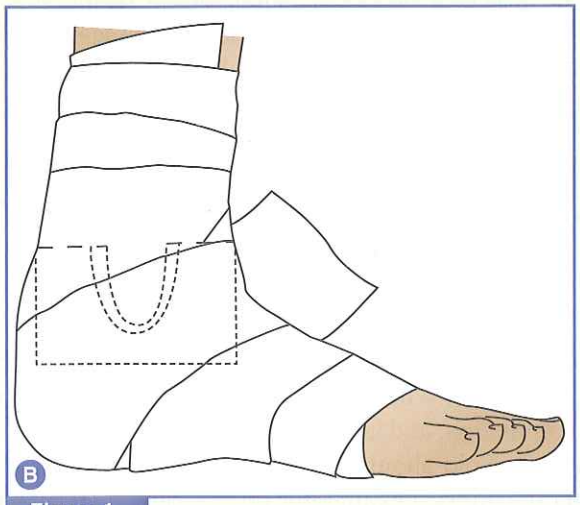


Figure 1

A. Place a horseshoe-shaped pad around the ankle knob. B. Secure the pad with an elastic bandage.

E = Elevation

Gravity slows the return of blood to the heart from the lower parts of the body. Once fluids get to the hands or feet, they have nowhere else to go, and those parts of the body swell. Elevating the injured area, in combination with ice and compression, limits circulation to that area, which in turn helps limit internal bleeding and minimize swelling.

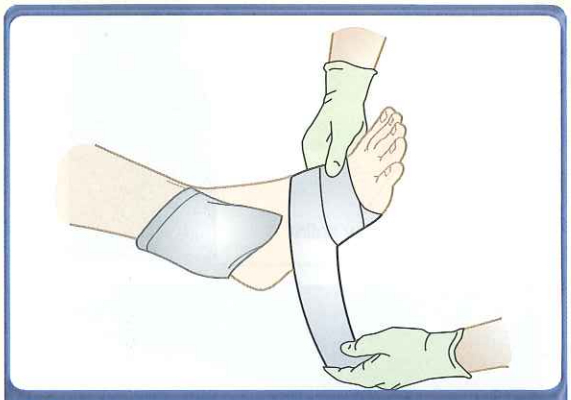
It is simple to prop up an injured leg or arm to limit bleeding. Whenever possible, elevate the injured part above the level of the heart for the first 24 hours after an injury. If a fracture is suspected, do not elevate an extremity until it has been stabilized with a splint. Along with the use of RICE procedures, fractures and dislocations should be splinted.

To perform the RICE procedure, follow the steps in Skill Drill 1:

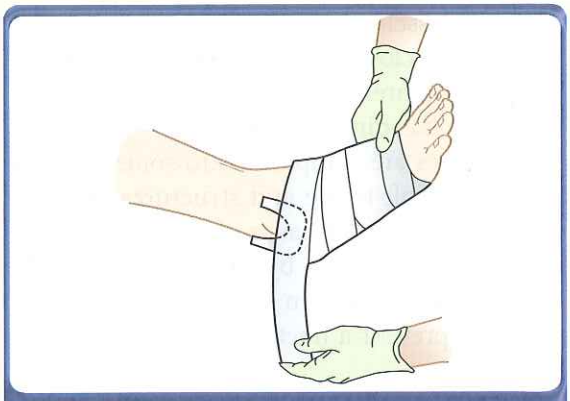
1. R = Rest. Stop using the injured area.
2. I = Ice. Place an ice pack on the injured area. Use an elastic bandage to hold the ice pack in place for 20 to 30 minutes (**Step** 1).
3. C = Compression. Remove the ice, apply a compression bandage, and leave in place for 3 to 4 hours (**Step** 2).
4. E = Elevation. Raise the injured area higher than the heart, if possible (**Step** 3).

skill drill

1 The RICE Procedure



1 Place an ice pack on the injured area. Use an elastic bandage to hold the ice pack in place for 20 to 30 minutes.



2 Remove the ice, apply a compression bandage, and leave in place for 3 to 4 hours.

3 Raise the injured area higher than the heart, if possible.

Splinting Extremities

Injured extremities should be stabilized by splinting the extremity in the position in which it was found. To stabilize means to minimize further injury by holding a body part to prevent movement. All fractures should be stabilized before a victim is moved. The reasons for splinting to stabilize an injured area are to:

- Reduce pain.
- Prevent damage to muscles, nerves, and blood vessels.
- Prevent a closed fracture from becoming an open fracture.
- Reduce bleeding and swelling.

All fractures are complicated to some degree by damage to the soft tissue and structures surrounding the bone. The major cause of tissue damage at a fracture site is movement by the end of the broken bone. The end of a broken bone is sharp, and it is important to prevent a fractured bone from moving into soft tissues.

Types of Splints

A splint is any device used to stabilize a fracture or a dislocation. Such a device can be improvised (for example, a folded newspaper), or it can be one of several commercially available splints (for example, SAM splint). Lack of a commercial splint should never prevent you from properly stabilizing an injured extremity. Splinting sometimes requires improvisation.

A rigid splint is an inflexible device attached to an extremity to maintain stability. It can be a padded board, a piece of heavy cardboard, or a SAM splint molded to fit the extremity. Whatever its construction, a rigid splint must be long enough to be secured well above and below the fracture site. A soft splint, such as a pillow, is useful mainly for stabilizing fractures of the lower leg or the forearm Figure 2.

A self-splint, or anatomic splint, is almost always available because it uses the body itself as the splint. A self-splint is one in which the injured extremity is tied to an uninjured part (for example, an injured finger to the adjacent finger, the legs together, or an injured arm to the chest).

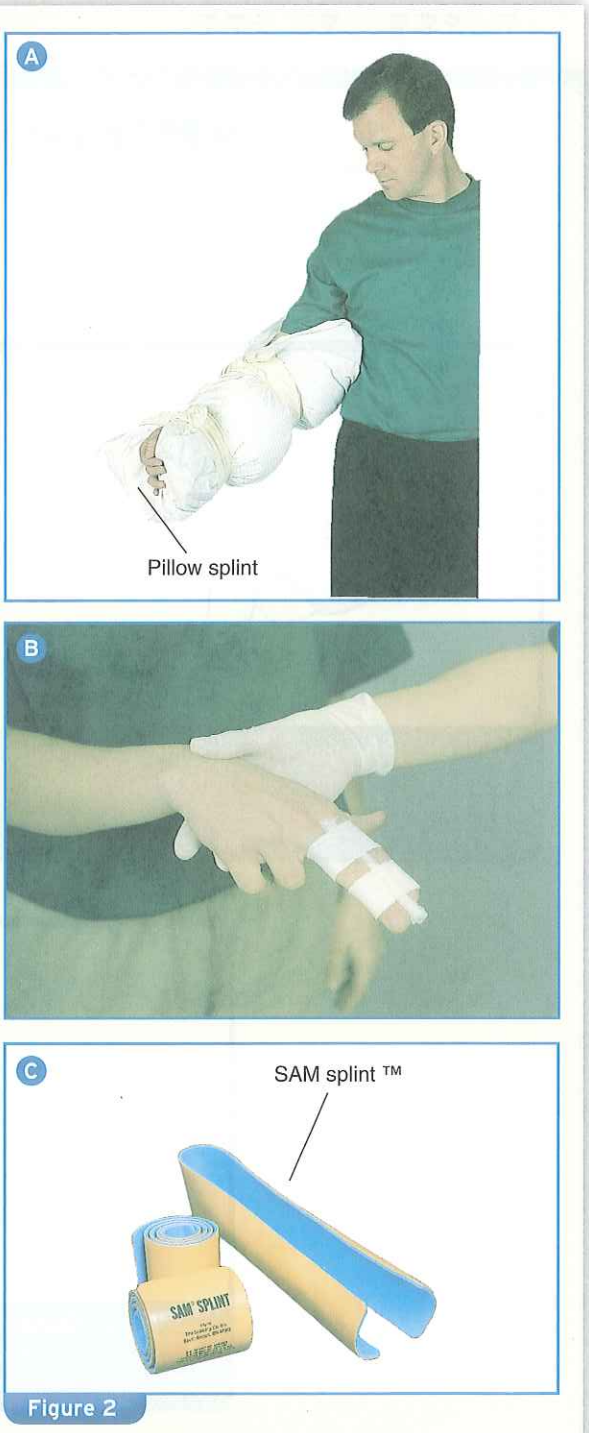


Figure 2

Examples of splints.
A. Soft splint. **B.** Self-splint. **C.** Rigid splint.

Splinting Guidelines

All fractures and dislocations should be stabilized before the victim is moved. When in doubt, apply a splint. To apply a splint:

1. Cover any open wounds with a sterile dressing before applying a splint.
2. Check the CSM in the extremity. If pulses are absent and medical help is hours away, gently line up a fracture or a dislocation to restore blood flow. Support the limb and move gently to line up the parts. Joints may be left in a position of comfort. Line up the limb above and below the joint, do not force anything into position. Any movement of a fracture is expected to cause pain; you should be aware of this and warn the victim. You do not have to align the limb perfectly, just align it enough to allow the return of circulation.
3. Determine what to splint by using the rule of thirds. Imagine each long bone as being divided into thirds. If the injury is located in the upper or lower third of a bone, assume that the nearest joint is injured. Therefore, the splint should extend to stabilize the bones above and below the unstable joint. For example, for a fracture of the upper third of the tibia (shinbone), the splint must extend above the knee to include the upper leg, as well as the lower leg, because the knee is unstable. For a fracture of the middle third of a bone, stabilize the joints above and below the fracture (for example, the wrist and elbow for a fractured radius or ulna; the shoulder and elbow for a fractured humerus; the knee and ankle for a fractured tibia or fibula). In addition to splinting an upper extremity fracture, place the injured arm in an arm sling and a swathe (binder).
4. If two first aiders are present, one should support the injury site and minimize movement of the extremity until splinting is completed.
5. When possible, place splint materials on both sides of the injured part, especially when two bones are involved, such as the radius and ulna in the lower arm or the tibia and fibula in the lower leg. This sandwich splint prevents the injured extremity from rotating and keeps the two bones from touching. With rigid splints, use extra padding in natural body hollows and around any deformities.
6. Apply splints firmly but not so tightly that blood flow into an extremity is affected. Check the CSM before and periodically after the splint is applied. If the pulse disappears, loosen the splint enough so you can feel the pulse. Leave the fingers or toes exposed so the CSM can be checked easily.
7. Use RICE (rest, ice, compression, and elevation) on the injured part. When practical, elevate the injured extremity after it is stabilized to promote drainage and reduce swelling. Do not, however, apply ice packs if a pulse is absent.

CAUTION

DO NOT straighten dislocations or fractures of the spine, elbow, wrist, hip, or knee because of the proximity of major nerves and arteries. Instead, if the CSM assessment findings are normal, splint joint injuries in the position in which you find them.

DO NOT apply traction on open fractures. Instead, cover the wound with a sterile dressing and apply a splint.

If the victim has a possible spinal injury and an extremity injury, the spinal injury takes precedence. Splinting the spine is always a problem. Tell the victim not to move. Then stabilize the spine with rolled blankets or similar objects placed on each side of the neck and torso. In most cases, it is best to wait until EMS personnel arrive with proper equipment to handle spinal injuries.

Most fractures do not require rapid transportation. An exception is an arm or a leg without a pulse, which means there is insufficient blood flow to the injured extremity. In that case, immediate medical care is necessary.

Seek medical care for the following injuries or situations:

- Any open fracture
- Any dislocation (injury that causes joint deformity)
- Any joint injury with moderate to severe swelling
- Any injury in which there is deformity, tenderness, or swelling over the bone
- If the victim is unable to walk or bear weight after a lower extremity injury
- If a snap, crackle, or pop was heard at the time of injury
- If the injured area, especially a joint, becomes hot, tender, swollen, or painful
- If you are unsure whether a bone was broken
- If the injury does not improve rapidly, especially over the first few days

Slings

An open triangular bandage can be used as a **sling**. A folded triangular bandage known as a cravat can be used as a **swathe** (binder) in conjunction with a sling. A cravat may also be applied using the same procedures as an open triangular sling but placed around the wrist when long splints on an upper arm or forearm may be in the way. To apply an arm sling to the upper arm, forearm, or hand/wrist injuries, follow the steps below:

1. Hold the victim's arm slightly away from the chest, with the wrist and hand slightly higher (about 40″) than the tip of the elbow. Place a triangular bandage between the forearm and chest with the point of the triangular bandage toward the elbow and stretch the bandage well beyond the elbow. Pull the upper end of the bandage over the uninjured shoulder.
2. Bring the lower end of the bandage over the forearm.

prep kit

Ready for Review

- Injuries to the extremities are common.
- There are many types of injuries to the extremities, ranging from simple contusions to complex open fractures.
- RICE is the acronym for Rest, Ice, Compression, and Elevation.

Vital Vocabulary

contusion A bruise; an injury that causes a hemorrhage in or beneath the skin but does not break the skin.

dislocation Bone is displaced from its normal joint alignment, out of its socket, or out of its normal position.

fracture A break or crack in the bone.

sling A triangular bandage applied around the neck to support an injured upper extremity; any material long enough to suspend an upper extremity by passing the material around the neck; used to support and protect an injury of the arm, shoulder, or clavicle.

splint Any support used to immobilize a fracture or to restrict movement of a part.

sprain A trauma to the joint that injures the ligaments.

strain An injury to a muscle caused by a violent contraction or an excessive, forcible stretching.

swathe A cravat tied around the body to decrease movement of a part.

tendinitis Inflammation of a tendon caused by overuse.

Assessment in Action

During a flag football game at a neighborhood park, your teammate is going back for a sure interception. He jumps for the ball, catches it, and comes down, twisting his ankle in a small hole on the field. Your teammate is in pain and is feeling nauseous.

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

Yes No **1.** It is difficult to distinguish between a severely sprained ankle and a fractured ankle.

Yes No **2.** If the victim cannot walk at least four steps and reports tenderness when you press on the ankle knob bone (malleous), suspect a fractured ankle.

Yes No **3.** Heat should be applied immediately to a sprained ankle to increase blood flow and decrease pain.

Yes No **4.** Swelling on both sides of the ankle usually indicates a sprained ankle.

prep kit

Check Your Knowledge

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

Yes No **1.** Injuries heal faster if rested.

Yes No **2.** Compression increases internal bleeding, helping the injury to heal faster.

Yes No **3.** A strain is actually a tear in the muscle.

Yes No **4.** The three bones in the fingers are very strong and do not break easily.

Yes No **5.** The hip joint is easily dislocated.

Yes No **6.** Considerable force is required to break the femur.

Yes No **7.** A strain is actually a tear in the muscle.

Yes No **8.** Knee injuries are not serious.

Yes No **9.** Shin splints are a pain that runs down the back of the leg.

Yes No **10.** Most ankle injuries are not fractures.