Chapter 29
Orthopaedic Injuries

Unit Summary

After students complete this chapter and the related course work, they will understand the anatomy and physiology of the musculoskeletal system. They will have learned the proper assessment for a suspected and obvious injury. They will have learned general and specific types of musculoskeletal injuries including fractures, sprains, and dislocations, with associated signs, symptoms, and emergency treatment including the use of splints, PASG, and traction splints.

National EMS Education Standard Competencies

Trauma

Applies fundamental knowledge to provide basic emergency care and transportation based on assessment findings for an acutely injured patient.

Orthopaedic Trauma

ÅRecognition and management of:

- ÅOpen fractures (pp 1007ï 1009, 1018ï 1047)
- ÅClosed fractures (pp 1007ï 1009, 1018ï 1047)
- ÅDislocations (pp 1010, 1018ï 1047)
- ÅAmputations (pp 1006, 1011, 1047ï 1048)

ÅPathophysiology, assessment, and management of:

- ÅUpper and lower extremity orthopaedic trauma (pp 1005ï 1047)
- ÅOpen fractures (pp 1007ï 1009, 1018ï 1047)
- ÅClosed fractures (pp 1007ï 1009, 1018ï 1047)
- ÅDislocations (pp 1010, 1018ï 1047)
- ÅSprains/strains (pp 1010ï 1011, 1048)
- ÅPelvic fractures (pp 1040ï 1041)
- ÅAmputations/replantation (pp 1006, 1011, 1047ï 1048)

Medicine

Applies fundamental knowledge to provide basic emergency care and transportation based on assessment findings for an acutely ill patient.

Nontraumatic Musculoskeletal Disorders

Anatomy, physiology, pathophysiology, assessment, and management of:

ÅNontraumatic fractures (pp 1007ï 1009, 1018ï 1047)

Knowledge Objectives

1. Describe the function of the musculoskeletal system. (pp 1001ï 1005)

2. Understand the anatomy and physiology of the musculoskeletal system. (pp 1001ï 1005)
3. Describe the different types of musculoskeletal injuries, including fractures, dislocations, amputations, sprains, and strains. (pp 1005ï 1011)
4. Name the four mechanisms of injury. (pp 1006ï 1007)
5. Differentiate between open and closed fractures. (pp 1007ï 1009)
6. Explain how to assess the severity of an injury. (p 1012)
7. Understand the emergency medical care of the patient with an orthopaedic injury. (pp 1018ï 1048)
8. Describe the emergency medical care of the patient with a swollen, painful, deformed extremity (fracture). (pp 1018ï 1046)
9. Understand the need for, general rules of, and possible complications of splinting. (pp 1020ï 1021)
10. Explain the reasons for splinting fractures, dislocations, and sprains at the scene versus transporting the patient immediately. (p 1020)
11. Recognize the characteristics of specific types of musculoskeletal injuries. (pp 1005ï 1012, 1031ï 1048)
12. Describe the emergency medical care of the patient with an amputation. (pp 1047ï 1048)

Skills Objectives

1. Demonstrate the assessment of neurovascular status. (pp 1015ï 1017, Skill Drill 29-1)
2. Demonstrate the care of musculoskeletal injuries. (pp 1018ï 1020, Skill Drill 29-2)
3. Demonstrate how to apply a rigid splint. (pp 1021ï 1022, Skill Drill 29-3)
4. Demonstrate how to apply a zippered air splint. (p 1023, Skill Drill 29-4)
5. Demonstrate how to apply an unzippered air splint. (pp 1023ï 1024, Skill Drill 29-5)
6. Demonstrate how to apply a vacuum splint. (pp 1024ï 1025, Skill Drill 29-6)
7. Demonstrate how to apply a Hare traction splint. (pp 1026ï 1028, Skill Drill 29ï 7)
8. Demonstrate how to apply a Sager traction splint. (pp 1028ï 1030, Skill Drill 29-8)
9. Demonstrate how to apply a pneumatic antishock garment (PASG). (pp 1031ï 1032, Skill Drill 29-9)
10. Demonstrate how to splint the hand and wrist. (pp 1039ï 1040, Skill Drill 29-10)
11. Demonstrate how to splint the clavicle, the scapula, the shoulder, the humerus, the elbow, and the forearm. (pp 1031ï 1038)
12. Demonstrate how to care for a patient with an amputation. (pp 1047ï 1048)

Lecture

I. Introduction

A. The human body is a well-designed system in which form, upright posture, and movement are provided by the musculoskeletal system.

B. The system also protects the vital internal organs of the body.

1. However, the bones and muscles are susceptible to external forces that can cause injury.

2. Also at risk are the tendons, the joints, and the ligaments.

C. Musculoskeletal injuries are among the most common reasons why patients seek medical attention.

1. Complaints related to the musculoskeletal system result in almost 60 million visits to physicians annually in the United States.
2. Musculoskeletal injuries are often easily identified because of associated pain, swelling, and deformity.
3. Although musculoskeletal system injuries are rarely fatal, they often result in short- or long-term disability.

D. Do not focus solely on a musculoskeletal injury without first determining that no life-threatening injuries exist.

II. Anatomy and Physiology of the Musculoskeletal System

A. The muscular system includes three types of muscles: skeletal, smooth, and cardiac.

1. Skeletal muscle, also called striated muscle because of its characteristic stripes, attaches to the bones and usually crosses at least one joint.
   a. Forms the major muscle mass of the body
   b. Called voluntary muscle because it is under direct voluntary control of the brain, responding to commands to move specific body parts
   c. Skeletal muscle is the component of the muscular system that is included in the overall musculoskeletal system.
      i. Cardiac muscle contributes to the cardiovascular system.
      ii. Smooth muscle is a component of other body systems, including the digestive system and the cardiovascular system.
   d. All skeletal muscles are supplied with arteries, veins, and nerves.
      i. Blood from the arteries brings oxygen and nutrients to the muscles.
      ii. Waste products, including carbon dioxide and lactic acid, are carried away in the veins.
   e. Skeletal muscle tissue is directly attached to the bone by tough, ropelike fibrous structures known as tendons.
      i. Tendons are extensions of the fascia that covers all skeletal muscle.
2. Smooth muscle, also called involuntary muscle because it is not under voluntary control of the brain, performs much of the automatic work of the body.
   a. Found in the walls of most tubular structures of the body, such as the gastrointestinal tract and blood vessels
   b. Contracts and relaxes to control the movement of the contents within these structures
3. Cardiac muscle is a specially adapted involuntary muscle with its own regulatory system.

B. The skeleton

1. The skeleton, which gives us our recognizable human form, protects our vital internal organs and allows us to move.
   a. Made up of approximately 206 bones
   b. The bones also produce blood cells (in the bone marrow) and serve as a reservoir for important minerals and electrolytes.
2. The skull is a solid vaultlike structure that surrounds and protects the brain.
3. The thoracic cage protects the heart, lungs, and great vessels
   a. The lower ribs protect the liver and spleen.
   b. The bony spinal canal encases and protects the spinal cord.
4. The pectoral (shoulder) girdle consists of two scapulae and two clavicles.
   a. The scapula (shoulder blade) is a flat, triangular bone held to the rib cage by powerful muscles that buffer it against injury.

b. The clavicle (collarbone) is a slender, S-shaped bone attached by ligaments to the sternum on one end and to the acromion process on the other.
    i. The clavicle acts as a strut to keep the shoulder propped up.
    ii. Because it is slender and very exposed, this bone is vulnerable to injury.

5. The upper extremity extends from the shoulder to the fingertips and is composed of the arm (humerus), elbow, forearm (radius and ulna), wrist, hand, and fingers.
    a. The arm extends from the shoulder to the elbow.
    b. The upper extremity joins the shoulder girdle at the glenohumeral joint.
    c. The humerus connects with the bones of the forearm to form the hinged elbow joint.
    d. The radius and ulna make up the forearm.
        i. The radius, the larger of the two forearm bones, lies on the thumb side of the forearm.
        ii. The ulna is narrow and is on the little-finger side of the forearm.
        iii. When one is broken, the other is often broken as well.
    e. The hand contains three sets of bones.
        i. Wrist bones (carpals)
        ii. Hand bones (metacarpals)
        iii. Finger bones (phalanges)
6. The pelvis supports the body weight and protects the structures within the pelvis: the bladder, rectum, and female reproductive organs.
    a. The pelvic girdle is actually three separate bones fused together to form the innominate bone.
        i. Ischium
        ii. Ilium
        iii. Pubis
7. The lower extremity consists of the bones of the thigh, leg, and foot.
    a. The femur (thigh bone) is a long, powerful bone that connects in the ball-and-socket joint of the pelvis and in the hinge joint of the knee.
    b. The lower leg consists of two bones, the tibia and the fibula.
        i. The tibia (shinbone) connects to the patella (kneecap) to form the knee joint and runs down the front of the lower leg.
        ii. The much smaller fibula runs behind and beside the tibia.
    c. The foot consists of three classes of bones: ankle bones (tarsals), foot bones (metatarsals), and toe bones (phalanges).
        i. The largest of the tarsal bones is the heel bone, or calcaneus, which is subject to injury when a person jumps from a height and lands on the feet.
8. The bones of the skeleton provide a framework to which the muscles and tendons are attached.
    a. Bone is a living tissue that contains nerves and receives oxygen and nutrients from the arterial system.
    b. When a bone breaks, a patient typically experiences severe pain and bleeding.
9. A joint is formed wherever two bones come into contact.
    a. Joints are held together in a tough fibrous structure known as a capsule, which is supported and strengthened in certain key areas by bands of fibrous tissue called ligaments.
    b. In moving joints, the ends of bones are covered with a thin layer of cartilage known as articular cartilage.
    c. Joints are bathed and lubricated by synovial (joint) fluid.

III. Musculoskeletal Injuries

A. A fracture is a broken bone.

1. More precisely, it is a break in the continuity of the bone, often occurring as a result of an external force.
   a. Can occur anywhere on the surface of the bone and in many different types of patterns
   b. There is no difference between a broken bone and a fractured bone.
2. A potential complication of fractures is compartment syndrome.
   a. Elevated pressure within a fascial compartment

B. A dislocation is a disruption of a joint in which the bone ends are no longer in contact.

1. The supporting ligaments are often torn, usually completely, allowing the bone ends to separate completely from each other.
2. A subluxation is similar to a dislocation except the disruption of the joints is not complete.
   a. Therefore, a subluxation is an incomplete dislocation of a joint.
3. A fracture-dislocation is a combination injury at the joint in which the joint is dislocated and there is a fracture of the end of one or more of the bones.

C. A sprain is an injury to ligaments, articular capsule, synovial membrane, and tendons crossing the joint.

1. After the injury, the joint surfaces generally fall back into alignment, so the joint is not significantly displaced.
2. Sprains can range from mild to severe.
3. The most vulnerable joints are the knees, shoulders, and ankles.

D. A strain, or muscle pull, is a stretching or tearing of the muscle, causing pain, swelling, and bruising of the soft tissues in the area.

1. It occurs because of an abnormal contraction.
2. Strains may range from minute separation to complete rupture.
3. Unlike a sprain, no ligament or joint damage typically occurs.

E. An amputation is an injury in which an extremity is completely severed from the body.

1. This injury can potentially damage every aspect of the musculoskeletal systemð from bone to ligament to muscle.

F. Injury to bones and joints is often associated with injury to the surrounding soft tissues, especially the adjacent nerves and blood vessels.

1. The entire area is known as the zone of injury.
2. You should not focus on a patientôs obvious injury without first completing a rapid scan to check for associated injuries, which may be even more serious.

G. Mechanism of injury (MOI)

1. Significant force is generally required to cause fractures and dislocations.
   a. Direct blows
   b. Indirect forces
   c. Twisting forces
   d. High-energy forces
2. A direct blow fractures the bone at the point of impact.
3. Indirect force may cause a fracture or dislocation at a distant point.

4. Twisting forces are a common cause of musculoskeletal injury, especially to the anterior cruciate ligament in the knee.
5. High-energy injuries produce severe damage to the skeleton, surrounding soft tissues, and vital internal organs.
    a. A patient may have multiple injuries to many body parts.
    b. Can occur in automobile crashes, falls from heights, gunshot wounds, and other extreme forces
6. A significant MOI is not necessary to fracture a bone.
    a. A slight force can easily fracture a bone that is weakened by a tumor or osteoporosis.

H. Fractures

1. Fractures are classified as either closed or open.
2. Your first priority is to determine whether the overlying skin is damaged.
    a. If not, the patient has a closed fracture.
    b. With an open fracture, there is an external wound, caused either by the same blow that fractured the bone or by the broken bone ends lacerating the skin.
    c. You should treat any injury that breaks the skin as a possible open fracture.
3. Fractures are also described by whether the bone is moved from its normal position.
    a. A nondisplaced fracture (also known as a hairline fracture) is a simple crack of the bone that may be difficult to distinguish from a sprain or simple contusion.
        i. X-ray examinations are required.
    b. A displaced fracture produces actual deformity, or distortion, of the limb by shortening, rotating, or angulating it.
4. Medical personnel often use these special terms to describe particular types of fractures:
    a. Greenstick
        i. An incomplete fracture that passes only partway through the shaft of a bone
        ii. Occurs in children
    b. Comminuted
        i. A fracture in which the bone is broken into more than two fragments
    c. Pathologic
        i. A fracture of weakened or diseased bone generally produced by minimal force
        ii. Seen in patients with osteoporosis or cancer
    d. Oblique
        i. A fracture in which the bone is broken at an angle across the bone
        ii. Usually a result of a sharp-angled blow to the bone
    e. Transverse
        i. A fracture that occurs straight across the bone
        ii. Usually the result of a direct blow or stress fracture caused by prolonged running
    f. Spiral
        i. A fracture caused by a twisting force, causing an oblique fracture around the bone and through the bone
        ii. Often the result of abuse in very young children
    g. Incomplete
        i. A fracture that does not run completely through the bone
5. Suspect a fracture if one or more of the following signs are present:

a. Deformity
   i. The limb may appear to be shortened, rotated, or angulated at a point where there is no joint.
   ii. Always use the opposite limb as a mirror image for comparison.
b. Tenderness
   i. Point tenderness on palpation in the zone of injury is the most reliable indicator of an underlying fracture.
c. Guarding
   i. An inability to use the extremity is the patientôs way of immobilizing it to minimize pain.
   ii. The muscles around the fracture contract in an attempt to prevent any movement of the broken bone.
d. Swelling
   i. Rapid swelling usually indicates bleeding from a fracture and is typically followed by substantial pain.
e. Bruising
   i. Fractures are almost always associated with ecchymosis of the surrounding soft tissues.
   ii. Bruising may be present after almost any injury and may take hours to develop.
f. Crepitus
   i. A grating or grinding sensation can be felt and sometimes even heard when fractured bone ends rub together.
g. False motion
   i. This is motion at a point in the limb where there is no joint.
h. Exposed fragments
   i. In open fractures, bone ends may protrude through the skin or be visible within the wound.
   ii. Never attempt to push the end of a protruding bone back into place.
i. Pain
j. Locked joint
   i. A joint that is locked into position is difficult and painful to move.

I. Dislocations

1. Sometimes a dislocated joint will spontaneously reduce, or return to its normal position, before your assessment.
   a. You will be able to confirm the dislocation only by taking a patient history.
   b. A dislocation that does not spontaneously reduce is a serious problem.
   c. Commonly dislocated joints include the fingers, shoulder, elbow, and knee.
2. The signs and symptoms of a dislocated joint are similar to those of a fracture.
   a. Marked deformity
   b. Swelling
   c. Pain that is aggravated by any attempt at movement
   d. Tenderness on palpation
   e. Virtually complete loss of normal join motion (locked joint)
   f. Numbness or impaired circulation to the limb or digit

J. Sprains

1. A sprain occurs when a joint is twisted or stretched beyond its normal range of motion.
2. As a result, the supporting capsule and ligaments are stretched or torn.
3. A sprain should be considered a partial dislocation or subluxation.
4. The alignment generally returns to a fairly normal position, although there may be some displacement.

5. Severe deformity does not typically occur with a sprain.
6. The following signs and symptoms often indicate that the patient may have a sprain:
    a. Point tenderness
    b. Swelling and ecchymosis
    c. Pain
    d. Instability of the joint
7. You will frequently not be able to distinguish a nondisplaced fracture from a sprain.
    a. Remember to document the MOI.

K. Strains

1. A strain is an injury to a muscle and/or tendon that results from a violent muscle contraction or from excessive stretching.
2. Often no deformity is present and only minor swelling is noted at the site of the injury.
3. Some patients may complain of increased pain with passive movement of the injured extremity.

L. Compartment syndrome

1. Most often occurs with a fractured tibia or forearm of children
2. Is often overlooked, especially in patients with an altered level of consciousness
3. Compartment syndrome typically develops within 6 to 12 hours after injury, usual as a result of:
    a. Excessive bleeding
    b. A severely crushed extremity
    c. The rapid return of blood to an ischemic limb
4. This syndrome is characterized by:
    a. Pain that is out of proportion to the injury
    b. Pain on passive stretching of muscles within the compartment
    c. Pallor
    d. Decreased sensation
    e. Decreased power

M. Amputations

1. Amputations can occur as a result of trauma or a surgical intervention.
2. You must control bleeding and treat for shock.
3. Be aware of the victimôs emotional stress, which can lead to psychogenic shock.

N. Complications

1. Orthopaedic injuries can lead to numerous complicationsð not just those involving the skeletal system, but also systemic changes or illnesses.
    a. It is essential that you do not focus all of your attention on the skeletal injury.
2. The likelihood of having a complication is often related to the:
    a. Strength of the force that caused the injury
    b. Injuryôs location
    c. Patientôs overall health

3. To prevent contamination following an open fracture, you should brush away any obvious debris on the skin surrounding an open fracture before applying a dressing.
    a. Do not enter or probe the open fracture site.
4. Long-term disability is one of the most devastating consequences of an orthopaedic injury.
    a. You can help reduce the risk or duration of long-term disability by:
        i. Preventing further injury
        ii. Reducing the risk of wound infection
        iii. Minimizing pain by the use of cold and analgesia
        iv. Transporting patients to an appropriate medical facility

O. Assessing the severity of injury

1. The Golden Period is critical not only for life, but also for preserving limb viability.
    a. In an extremity with anything less than complete circulation, prolonged hypoperfusion can cause significant damage.
    b. Any suspected open fracture or vascular injury is considered a medical emergency.
2. Remember that most injuries are not critical.
    a. You can use the musculoskeletal injury grading system in Table 29-1 to identify critical injuries.

IV. Patient Assessment

A. Always look at the big picture, evaluating the overall complexity of the situation to determine and treat any life threats.

1. You must be able to distinguish mild injuries from severe injuries because some severe injuries may compromise neurovascular function, which could be limb threatening.

B. Scene size-up

1. Scene safety
    a. Information from dispatch may indicate the MOI, the number of patients involved, and any first aid procedures used prior to your arrival.
    b. Observe the scene for hazards and threats to the safety of the crew, bystanders, and the patient.
    c. Try to identify the forces associated with the MOI.
    d. Standard precautions may be as simple as gloves, but a mask and gown may be necessary.
    e. Consider the possibility that there may be hidden bleeding.
    f. Evaluate the need for law enforcement support, advanced life support, or additional ambulances.
2. Mechanism of injury/nature of illness
    a. Look for indicators of the MOI.
    b. Be alert for both primary and secondary injuries.
        i. Primary injuries occur as a result of the MOI.
        ii. Secondary injuries are the result of what happens after the initial injury.
    c. Consider how the MOI produced the injuries expected.

C. Primary assessment

1. Focus on identifying and managing life threats.
2. Form a general impression.

a. Introduce yourself and ask the patient his or her name.
b. Check for responsiveness using the AVPU scale.
c. Ask the patient about his or her chief complaint.
d. Administer high-flow oxygen via a nonrebreathing mask to all patients whose level of consciousness is less than alert and oriented.
e. Perform a rapid scan and ask about the MOI.
f. If there was significant trauma and multiple body systems are affected, the musculoskeletal injuries may be a lower priority.
    i. Scene time should not be wasted on prolonged musculoskeletal assessment or splinting.

3. Airway and breathing
    a. Fractures and sprains usually do not create airway and breathing problems.
    b. Evaluate the chief complaint and MOI.
    c. If a spinal injury is suspected, take the appropriate precautions and prepare for stabilization.
    d. Oxygen may be given to relieve anxiety and improve perfusion.
4. Circulation
    a. Focus on determining whether the patient has a pulse, has adequate perfusion, or is bleeding.
        i. Hypoperfusion and bleeding problems will most likely be your primary concern.
    b. If the skin is pale, cool, or clammy and capillary refill time is slow, treat your patient for shock immediately.
    c. Maintain a normal body temperature, and improve perfusion with oxygen.
    d. If musculoskeletal injuries in the extremities are suspected, they must be at least initially stabilized, if not splinted, prior to moving.
    e. Fractures can break through the skin and cause external bleeding.
        i. Careful handling of the extremity minimizes this risk.
        ii. If external bleeding is present, bandage the extremity quickly to control bleeding.
        iii. The bandage should be secure enough to control bleeding without restricting circulation distal to the injury.
        iv. Monitor bandage tightness by assessing the circulation, sensation, and movement distal to the bandage.
        v. If bleeding cannot be controlled, you should quickly proceed to applying a tourniquet.
5. Transport decision
    a. If the patient you are treating has an airway or breathing problem, or significant bleeding, provide rapid transport to the hospital for treatment.
    b. A patient who has a significant MOI but whose condition appears otherwise stable should also be transported promptly.
    c. When a decision for rapid transport is made, you can use a backboard as a splinting device to splint the whole body rather than splinting each extremity individually.
        i. Individual splints should be applied en route if the ABCs are stable and time permits.
    d. Patients with a simple MOI may be further assessed and their condition stabilized on scene prior to transport if no other problems exist.
        i. Handle fractures carefully while preparing for transport.

D. History taking

1. Investigate the chief complaint.
    a. Obtain a medical history and be alert for injury-specific signs and symptoms and any pertinent negatives.
2. A SAMPLE history should be obtained for all trauma patients.

a. How much and in what detail you explore this history depends on the seriousness of the patientôs condition and how quickly you need to transport him or her to the hospital.
b. Make an attempt to obtain this history from family members and others who may have the information.
c. OPQRST can be of limited use in cases of severe injury and is usually too lengthy when matters of airway, breathing, circulation, and rapid transport require immediate attention.
    i. However, OPQRST may be useful when the MOI is unclear, the patientôs condition is stable, or details of the injury are uncertain.

E. Secondary assessment

1. The secondary assessment is a more detailed, comprehensive examination of the patient that can reveal injuries that may have been missed during the primary assessment.
2. Physical examinations
    a. If significant trauma has likely affected multiple systems, start with a full-body scan to be sure that you have found all of the problems and injuries.
    b. Begin with the head and work systematically toward the feet, checking the head, chest, abdomen, extremities, and back.
    c. The goal is to identify hidden and potentially life-threatening injuries.
    d. Assess the musculoskeletal system by performing a detailed full-body scan.
        i. Use the DCAP-BTLS approach.
    e. When lacerations are present in an extremity, an open fracture must be considered, bleeding controlled, and dressings applied.
    f. If your assessment finds no external signs of injury, ask the patient to move each limb carefully, stopping immediately if a movement causes pain.
        i. Skip this step if the patient reports neck or back pain.
    g. When nonsignificant trauma has occurred and your patient has a simple strain, sprain, dislocation, or fracture, you can take the time to focus your physical examination on that particular injury.
        i. Look for DCAP-BTLS.
        ii. Evaluate the circulation, motor function, and abnormal sensations distal to the injury.
        iii. Be sure to assess the entire zone of injury.
    h. Any injury or deformity of the bone may be associated with vessel or nerve injury.
        i. You must assess neurovascular function every 5 to 10 minutes during the assessment, depending on the patientôs condition, until he or she is in the hospital.
        ii. Always recheck the neurovascular function before and after you splint or otherwise manipulate the limb.
    i. Examination of the injured limb should include the 6 Ps of musculoskeletal assessmentð pain, paralysis, paresthesias (numbness or tingling), pulselessness, pallor, and pressure.
    j. To assess neurovascular status, follow the steps in ***Skill Drill 29-1***.
3. Vital signs
    a. Determine a baseline set of vital signs, including pulse rate, rhythm, and quality; respiratory rate, rhythm, and quality; blood pressure; skin condition; and pupil size and reaction to light.
    b. Trending these vital signs helps you to understand whether your patientôs condition is improving or getting worse over time.

F. Reassessment

1. Repeat the primary assessment to ensure your interventions are working as they should.
    a. A reassessment should be performed every 5 minutes for an unstable patient and every 15 minutes for a stable patient.

2. Interventions
    a. Because trauma patients often have multiple injuries, you must assess their overall condition, stabilize the ABCs, and control any serious bleeding.
    b. In a critically injured patient, you should secure the patient to a long backboard to stabilize the spine, pelvis, and extremities and provide prompt transport to a trauma center.
        i. In this situation, a secondary assessment is a waste of valuable time.
        ii. Reassess the patient en route to the emergency department.
    c. If the patient has no life-threatening injuries, you may take extra time at the scene to stabilize the patientôs overall condition.
        i. Remove the patientôs clothing to look for open fractures or dislocations, severe deformity, swelling, and/or ecchymosis.
        ii. Check the patientôs circulation, motor function, and sensation prior to and after splinting.
    d. When you have finished assessing the extremity, apply a secure splint, commercial or otherwise, to stabilize the injury prior to transport.
        i. A comfortable and secure splint will reduce pain, reduce shock, and minimize compromised circulation.
    e. The main goal in providing care in musculoskeletal injuries is stabilization in the most comfortable position that allows for maintenance of good circulation distal to the injury.
3. Communication and documentation
    a. Include a description of the problems found during your assessment.
    b. Report problems with the patientôs ABCs, open fractures, and compromised circulation that occurred before or after splinting.
    c. Document complete descriptions of injuries and the MOIs associated with them.
    d. Your careful documentation may protect you from legal action that patients may take later.

V. Emergency Medical Care

A. Perform a primary assessment.

B. Stabilize the patient's ABCs.

C. If needed, perform a rapid scan or focus on a specific injury.

D. Always follow standard precautions.

E. Be alert for signs and symptoms of internal bleeding.

F. Follow the steps in Skill Drill 29-2 when caring for patients with musculoskeletal injuries.

G. Splinting

1. A splint is a flexible or rigid device that is used to protect and maintain the position of an injured extremity.
2. Unless the patientôs life is in immediate danger, you should splint all fractures, dislocations, and sprains before moving the patient.
3. Splinting reduces pain and makes it easier to transfer and transport the patient.
4. In addition, splinting will help to prevent the following:
    a. Further damage to muscles, the spinal cord, peripheral nerves, and blood vessels from broken bone ends
    b. Laceration of the skin by broken bone ends
        i. One of the primary indications for splinting is to prevent a closed fracture from becoming an open fracture.
    c. Restriction of distal blood flow resulting from pressure of the bone ends on blood vessels
    d. Excessive bleeding of the tissues at the injury site caused by broken bone ends

e. Increased pain from movement of bone ends
f. Paralysis of extremities resulting from a damaged spine

5. A splint is simply a device to prevent motion of the injured part.
   a. It can be made from any material on occasions when you need to improvise.
6. General principles of splinting
   a. Remove clothing from the area of any suspected fracture or dislocation so that you can inspect the extremity for DCAP-BTLS.
   b. Note and record the patientôs neurovascular status distal to the site of the injury, including pulse, sensation, and movement.
   c. Cover all wounds with a dry, sterile dressing before splinting.
   d. Do not move the patient before splinting an extremity unless there is an immediate danger to the patient or you.
   e. In a suspected fracture of the shaft of any bone, be sure to stabilize the joints above and below the fracture.
   f. With injuries in and around the joint, be sure to stabilize the bones above and below the injured joint.
   g. Pad all rigid splints to prevent local pressure and discomfort to the patient.
   h. While applying the splint, maintain manual stabilization to minimize movement of the limb and to support the injury site.
   i. If fracture of a long-bone shaft has resulted in severe deformity, use constant, gentle manual traction to align the limb so that it can be splinted.
   j. If you encounter resistance to limb alignment, splint the limb in its deformed position.
   k. Stabilize all suspected spinal injuries in a neutral in-line position on a backboard.
   l. If the patient has signs of shock, align the limb in the normal anatomic position, and provide transport.
   m. When in doubt, splint.
7. General principles of in-line traction splinting
   a. Application of in-line traction is the act of pulling on a body structure in the direction of its normal alignment.
   b. It is the most effective way to realign a fracture of the shaft of a long bone so that the limb can be splinted more effectively.
   c. When applied correctly, traction stabilizes the bone fragments and improves the overall alignment of the limb.
   d. You should not attempt to reduce the fracture or force all of the bone fragments back into alignment.
   e. In the field, the goals of in-line traction are as follows:
      i. To stabilize the fracture fragments to prevent excessive movement
      ii. To align the limb sufficiently to allow it to be placed in a splint
      iii. To avoid potential neurovascular compromise
   f. Before you apply a traction splint, be sure to control any external bleeding.
   g. The amount of traction that is required varies but often does not exceed 15 lb.
   i. You should use the least amount of force necessary.
   h. Grasp the foot or hand at the end of the injured limb firmly; once you start pulling, you should not stop until the limb is full splinted.
   i. Imagine where the uninjured limb would lie, and pull gently along the line of that imaginary limb until the injured limb is in approximately that position.
8. Rigid splints
   a. Rigid (nonformable) splints are made from more material and are applied to the sides, front, and/or back of an injured extremity to prevent motion at the injury site.
   b. It takes two EMTs to apply a rigid splint.

c. Follow the steps in ***Skill Drill 29-3***.

d. There are two situations in which you must splint the limb in the position of deformity:

i. When the deformity is severe

ii. When you encounter resistance or extreme pain when applying gentle traction to the fracture of a shaft of a long bone

e. Most dislocations should be splinted as found, but follow local protocols.

9. Formable splints

a. The most commonly used formable or soft splint is the precontoured, inflatable, clear plastic air splint.

b. Always inflate the splint after applying it.

c. The air splint is comfortable, provides uniform contact, and has the added advantage of applying firm pressure to a bleeding wound.

d. Air splints are used to stabilize injuries below the elbow or below the knee.

e. Air splints have some drawbacks, particularly in cold weather areas.

i. The zipper can stick, clog with dirt, or freeze.

ii. Significant changes in the weather affect the pressure of the air in the splint.

f. You must first cover all wounds with a dry, sterile dressing, making sure that you use standard precautions.

g. For a splint that has a zipper, follow the steps in ***Skill Drill 29-4***.

h. If you use an unzippered or partially zippered type of air splint, follow the steps in ***Skill Drill 29-5***.

i. Other formable splints include vacuum splints, pillow splints, structural aluminum malleable (SAM) splints, a sling and swathe, and pelvic binders for pelvic fractures.

j. Follow the steps in ***Skill Drill 29-6*** to apply a vacuum splint.

10. Traction splints

a. Traction splints are used primarily to secure fractures of the shaft of the femur, which are characterized by pain, swelling, and deformity of the midthigh.

b. A traction splint should not be used if the patient has an obvious injury of the knee or ankle joint, foot, or lower leg.

c. Several different types of lower extremity traction splints are commercially available, such as:

i. Hare splint

ii. Sager splint

iii. Reel splint

iv. Kendrick splint

d. Traction splints are not suitable for use on the upper extremity because the major nerves and blood vessels in the patientôs axilla cannot tolerate countertraction forces.

e. Do not use traction splints for any of the follow conditions:

i. Injuries of the upper extremity

ii. Injuries close to or involving the knee

iii. Injuries of the hip

iv. Injuries of the pelvis

v. Partial amputations or avulsions with bone separation

vi. Lower leg, foot, or ankle injury

f. Proper application requires two well-trained EMTs.

g. To apply a Hare splint, follow the steps in ***Skill Drill 29-7***.

h. The Sager splint is lightweight and easy to store and applies a measurable amount of traction.

i. Follow the steps in ***Skill Drill 29-8*** to apply a Sager splint.

11. Pelvic binders
    a. Pelvic binders are used to splint the bony pelvis to reduce hemorrhage from bone ends, venous disruption, and pain.
    b. Pelvic binders are meant to provide temporary stabilization until definitive stabilization can be achieved.
    c. Generally, pelvic binders should be light, made of soft material, and easily applied by one person, and they should allow access to the abdomen, perineum, anus, and groin for examination.
12. Pneumatic antishock garments (PASGs)
    a. If a patient has injuries to the lower extremities or pelvis, you may be able to use a PASG as a splinting device.
    b. Do not use the PASG if any of the following conditions exist:
        i. Pregnancy
        ii. Pulmonary edema
        iii. Acute heart failure
        iv. Penetrating chest injuries
        v. Groin injuries
        vi. Major head injuries
        vii. A transport time of less than 30 minutes
    c. When applying the PASG, you should carefully inflate the device in increments.
    d. As a general rule, gradually inflate the legs of the PASG before inflating the abdominal portion.
    e. Always document all obvious injuries and deformities before application of the PASG.
    f. Follow the steps in ***Skill Drill 29-9*** to apply the PASG.
    g. Do not remove the PASG in the field.
13. Hazards of improper splinting
    a. Compression of nerves, tissues, and blood vessels
    b. Delay in transport of a patient with a life-threatening injury
    c. Reduction of distal circulation
    d. Aggravation of the injury
    e. Injury to tissue, nerves, blood vessels, or muscles as a result of excessive movement of the bone or joint

H. Transport

1. Very few, if any, musculoskeletal injuries justify the use of excessive speed during transport.
    a. The limb will be stable once a dressing and splint have been applied.
2. A patient with a pulseless limb must be given a higher priority.
3. If the treatment facility is an hour or more away, a patient with a pulseless limb should be transported by helicopter or immediate ground transportation.

VI. Specific Musculoskeletal Injuries

A. Injuries of the clavicle and scapula

1. The clavicle, or collarbone, is one of the most commonly fractured bones in the body.
    a. Fractures of the clavicle occur most often in children when they fall on an outstretched hand.
    b. A patient with a fracture of the clavicle will report pain in the shoulder and will usually hold the arm across the front of his or her body.
    c. Generally, swelling and point tenderness occur over the clavicle.

d. Because the clavicle is subcutaneous, the skin will occasionally ñtentò over the fracture fragment.

2. Fractures of the scapula, or shoulder blade, occur much less frequently because the bone is well protected by many large muscles.
    a. Fractures of the scapula are almost always the result of a forceful, direct blow to the back, directly over the scapula.
    b. Provide supplemental oxygen and prompt transport for patients who are having difficulty breathing.
    c. It is the associated chest injuries, not the fractured scapula itself, that pose the greatest threat of long-term disability.
    d. Abrasions, contusions, and significant swelling may occur, and the patient will often limit use of the arm because of pain at the fracture site.
3. The joint between the outer end of the clavicle and the acromion process of the scapula is called the acromioclavicular (AC) joint.
    a. This joint is frequently separated during football or hockey when a player falls and lands on the point of the shoulder, driving the scapula away from the outer end of the clavicle.
    b. This dislocation is often called an AC separation.
4. These fractures can all be splinted effectively with a sling and swathe.
    a. A sling is any bandage or material that helps support the weight of an injured upper extremity, relieving the downward pull of gravity on the injured site.
    b. To fully stabilize the shoulder region, a swathe, which is a bandage that passes completely around the chest, must be used to bind the arm to the chest wall.
    c. Leave the patientôs fingers exposed so that you can assess neurovascular function at regular intervals.

B. Dislocations of the shoulder

1. The glenohumeral joint (shoulder joint) is where the head of the humerus meets the glenoid fossa of the scapula.
2. The glenoid fossa joins with the humeral head to form the glenohumeral joint.
3. In shoulder dislocations, the humeral head most commonly dislocates anteriorly, coming to lie in front of the scapula as a result of forced abduction and external rotation of the arm.
4. Shoulder dislocations are extremely painful.
    a. The patient will guard the shoulder and try to protect it by holding the dislocated arm in a fixed position away from the chest wall.
    b. The shoulder joint will usually be locked, and the shoulder will appear squared off or flattened.
    c. Some patients may report numbness in the hand because of either nervous or circulatory compromise.
5. Stabilizing an anterior shoulder dislocation is difficult because any attempt to bring the arm in toward the chest wall produces pain.
    a. You must splint the joint in whatever position is most comfortable for the patient.
    b. Apply a sling to the forearm and wrist to support the weight of the arm.
    c. Secure the arm in the sling to the pillow and chest with a swathe.
    d. Transport the patient in a seated or semiseated position.

C. Fractures of the humerus

1. Fractures of the humerus occur either proximally, in the midshaft, or distally at the elbow.
2. Fractures of the proximal humerus resulting from falls are common among older people.
3. Fractures of the midshaft occur more often in young patients, usually as the result of a violent injury.

4. With any severely angulated fracture, you should consider applying traction to realign the fracture fragments before splinting them.
    a. Support the site of the fracture with one hand, and with the other hand, grasp the two humeral condyles just above the elbow.
    b. Pull gently in line with the normal axis of the limb.
    c. Splint the arm with a sling and swathe, supplemented by a padded board splint on the lateral aspect of the arm.

D. Elbow injuries

1. Fractures and dislocations often occur around the elbow, and the different types of injuries are difficult to distinguish without x-ray examinations.
    a. However, they all produce similar limb deformities and require the same emergency care.
2. Fracture of the distal humerus
    a. This type of fracture, also known as a supracondylar or intercondylar fracture, is common in children.
    b. Frequently, the fracture fragments rotate significantly, producing deformity and causing injuries to nearby vessels and nerves.
    c. Swelling occurs rapidly and is often severe.
3. Dislocation of the elbow
    a. This type of injury typically occurs in athletes and rarely in young children.
    b. The ulna and radius are most often displaced posteriorly.
    c. The posterior displacement makes the olecranon process of the ulna much more prominent.
    d. As with a fracture of the distal humerus, there is swelling and significant potential for vessel or nerve injury.
4. Elbow joint sprain
    a. This diagnosis is often mistakenly applied to an occult, nondisplaced fracture.
5. Fracture of the olecranon process of the ulna
    a. This fracture can result from direct or indirect forces and is often associated with lacerations and abrasions.
    b. The patient will be unable to actively extend the elbow.
6. Fractures of the radial head
    a. Often missed during diagnosis, this fracture generally occurs as a result of a fall on an outstretched arm or a direct blow to the lateral aspect of the elbow.
    b. Attempts to rotate the elbow or wrist cause discomfort.
7. Care of elbow injuries
    a. All elbow injuries are potentially serious and require careful management.
    b. Always assess distal neurovascular functions periodically in patients with elbow injuries.
    c. If you find strong pulses and good capillary refill, splint the elbow injury in the position in which you found it, adding a wrist sling if this seems helpful.
    d. A cold, pale hand or a weak or absent pulse and poor capillary refill indicate that the blood vessels have likely been injured.
        i. Further care of this patient must be dictated by a physician.
        ii. Notify medical control immediately.
    e. If the limb is pulseless and significantly deformed at the elbow, apply gentle manual traction in line with the long axis of the limb to decrease the deformity.
    f. Provide prompt transport for all patients with impaired distal circulation.

E. Fractures of the forearm

1. Fractures of the shaft of the radius and ulna are common in people of all age groups but are seen most often in children and older people.
2. Usually, both bones break at the same time when the injury is the result of a fall on an outstretched hand.
3. An isolated fracture of the shaft of the ulna may occur as the result of a direct blow to it.
    a. This is known as a nightstick fracture.
4. Fractures of the distal radius, which are especially common in elderly patients with osteoporosis, are often known as Colles fractures.
    a. The term ñsilver fork deformityò is used to describe the distinctive appearance of the patientôs arm.
5. To stabilize fractures of the forearm or wrist, you can use a padded board, air, vacuum, or pillow splint.
    a. If the shaft of the bone has been fractured, be sure to include the elbow joint in the splint.
    b. If possible, elevate the injured extremity above the heart to help alleviate swelling.

F. Injuries of the wrist and hand

1. Injuries of the wrist and hand, ranging from dislocation to sprains, must be confirmed by x-ray examination.
2. Dislocations are usually associated with a fracture, resulting in a fracture dislocation.
3. Another common wrist injury is the isolated, nondisplaced fracture of a carpal bone, especially the scaphoid.
4. Any questionable wrist sprain or fracture should be splinted and evaluated in the emergency department.
5. Because the fingers and hands are required to function in such intricate ways, any injury that is not treated properly may result in permanent disability, as well as deformity.
    a. For this reason, all injuries to the hand, including simple lacerations, should be evaluated by a physician.
    b. Always take any amputated parts to the hospital with the patient.
6. Follow the steps in ***Skill Drill 29-10*** to splint the hand and wrist.

G. Fractures of the pelvis

1. Fracture of the pelvis often results from direct compression in the form of a heavy blow that literally crushes the pelvis.
    a. The blow may be from a motor vehicle crash, a weapon, a falling object, or a fall from a height.
2. Injuries to the pelvis can also be caused by indirect forces.
3. However, not all pelvis fractures result from violent trauma.
4. Fractures of the pelvis may be accompanied by life-threatening loss of blood from the laceration of blood vessels affixed to the pelvis at certain key points.
    a. Up to several liters of blood may drain into the pelvic space and the retroperitoneal space, which lies between the abdominal cavity and the posterior abdominal wall.
    b. The result is significant hypotension, shock, and sometimes death.
    c. You must take immediate steps to treat shock, even if there is only minimal swelling.
5. Because the pelvis is surrounded by heavy muscle, open fractures of the pelvis are quite uncommon.
    a. However, pelvis fracture fragments can lacerate the rectum and vagina, creating an open fracture that is often overlooked.
6. You should suspect a fracture of the pelvis in any patient who has sustained a high-velocity injury and complains of discomfort in the lower back or abdomen.
    a. Deformity or swelling may be very difficult to see.

b. The most reliable sign of fracture of the pelvis is simple tenderness or instability on firm compression and palpation.

c. Assess for tenderness by taking the follow steps:

i. Place the palms of your hands over the lateral aspect of each iliac crest, and apply firm but gentle inward pressure on the pelvic ring.

ii. With the patient lying supine, place a palm over the anterior aspect of each iliac crest, and apply firm downward pressure.

iii. Use the palm of your hand to firmly but gently palpate the pubic symphysis.

7. If there has been injury to the bladder or the urethra, the patient will have lower abdominal tenderness and may have evidence of hematuria or blood at the urethral opening.

8. Patients in stable condition can be secured to a long backboard or a scoop stretcher to stabilize isolated fractures of the pelvis.

H. Dislocations of the hip

1. The hip is a very stable joint that dislocates only after significant injury.

2. Most dislocations of the hip are posterior.

3. You should suspect a hip dislocation in any patient who has been in an automobile crash and has a contusion, laceration, or obvious fracture in the knee region.

4. Posterior dislocation of the hip is frequently complicated by injury to the sciatic nerve, which is located directly behind the hip joint.

a. The sciatic nerve is the most important nerve in the lower extremity.

b. It controls the activity of muscles in the posterior thigh and below the knee and the sensation in most of the leg and foot.

c. When the head of the femur is forced out of the hip socket, it may compress or stretch the sciatic nerve, leading to partial or complete paralysis of the nerve.

d. Patients typically lie with the hip joint flexed and the thigh rotated inward toward the midline of the body over the top of the opposite thigh.

5. Dislocation of the hip is associated with very distinctive signs.

a. The patient will have severe pain in the hip and will strongly resist any attempt to move the joint.

b. The lateral and posterior aspects of the hip region will be tender on palpation.

c. Occasionally, sciatic nerve function will be normal at first and then slowly diminish.

6. As with any other extremity injury, you should make no attempt to reduce the dislocated hip in the field.

a. Splint the dislocation in the position of the deformity.

b. Place the patient supine on a long backboard.

c. Support the affected limb with pillows and rolled blankets.

d. Secure the entire limb to the backboard with long straps.

e. Provide prompt transport.

I. Fractures of the proximal femur

1. Fractures of the proximal end of the femur are common fractures, especially in older people.

2. The break goes through the neck of the femur, the intertrochanteric region, or across the proximal shaft of the femur.

3. Patients display a very characteristic deformity.

a. They lie with the leg externally rotated, and the injured limb is usually shorter than the opposite, uninjured limb.
b. Patients typically are unable to walk or move the leg.
c. The hip region is usually tender on palpation, and gentle rolling of the leg will cause pain but will not do further damage.

4. Assess the pelvis for any soft-tissue injury and bandage appropriately.
5. Assess pulses and motor and sensory functions, looking for signs of vascular and nerve damage.
6. Splint the lower extremity and transport to the emergency department.
7. The age of the patient and the severity of the injury will dictate how you splint the fracture.
8. All patients with hip fractures may lose significant amounts of blood.
   a. You should treat with high-flow oxygen and monitor vital signs frequently.
   b. Be alert for signs of shock.

J. Femoral shaft fractures

1. Fractures of the femur can occur in any part of the shaft, from the hip region to the femoral condyles just above the knee joint.
2. Following a fracture, the large muscles of the thigh spasm in an attempt to ñsplintò the unstable limb.
   a. The muscle spasm often produces significant deformity of the limb.
   b. Usually, the limb also shortens significantly.
3. Fractures may be open, and fragments of bone may protrude through the skin.
   a. Never attempt to push the bone(s) back into the skin.
4. There is often a significant amount of blood loss, as much as 500 to 1,000 mL, after a fracture.
   a. It is not unusual for hypovolemic shock to develop.
5. Because of the severe deformity that occurs with these fractures, bone fragments may penetrate or press on important nerves and vessels and produce significant damage.
   a. You must carefully and periodically assess the distal neurovascular function in these patients.
6. Cover any wound with a dry, sterile dressing.
7. A fracture of the femoral shaft is best stabilized with a traction splint, such as a Sager splint.

K. Injuries of knee ligaments

1. The knee is very vulnerable to injury; therefore, many different types of injuries occur in this region.
   a. Ligament injuries range from mild sprains to complete dislocation of the joint.
   b. The patella can also dislocate.
   c. All the bony elements of the knee can fracture.
2. The knee is especially susceptible to ligament injuries, which occur when abnormal bending or twisting forces are applied to the joint.
   a. When you examine the patient, you will generally find:
      i. Swelling
      ii. Occasional ecchymosis
      iii. Point tenderness at the injury site
      iv. A joint effusion
3. You should splint all suspected knee ligament injuries.

a. The splint should extend from the hip joint to the foot, stabilizing the bone above the injured joint and the bone below it.

b. A variety of splints can be used, including a padded, rigid, long leg splint or two padded board splints.

L. Dislocation of the knee

1. Dislocations of the knee are true emergencies that may threaten the limb.
2. When the knee is dislocated, the ligaments that provide support to it may be damaged or torn.
   a. The proximal end of the tibia completely displaces from its juncture with the lower end of the femur, usually producing a significant deformity.
   b. Always check the distal circulation carefully before taking any other step.
3. The direction of dislocation refers to the position of the tibia with respect to the femur.
   a. Anterior knee dislocations are the most common, occurring in almost half of all cases.
   b. In posterior dislocations, a direct blow to the knee forces the tibia to shift posteriorly.
   c. Medial dislocations result from a direct blow to the lateral part of the leg.
4. Patients will typically complain of pain in the knee and report that the knee ñgave out.ò
   a. Complications may include:
      i. Limb-threatening popliteal artery disruption
      ii. Injuries to the nerves
      iii. Joint instability
5. If adequate distal pulses are present, splint the knee in the position in which you found it, and transport the patient promptly.

M. Fractures about the knee

1. Fractures about the knee may occur at the distal end of the femur, at the proximal end of the tibia, or in the patella.
2. It is easy to confuse a nondisplaced or minimally displaced fracture about the knee with a ligament injury.
3. Management of the two types of injuries is as follows:
   a. If there is an adequate distal pulse and no significant deformity, splint the limb with the knee straight.
   b. If there is an adequate pulse and significant deformity, splint the joint in the position of deformity.
   c. If the pulse is absent below the level of the injury, suspect possible vascular and nerve damage, and contact medical control.
   d. Never use a traction splint if you suspect a fractured knee.

N. Dislocation of the patella

1. A dislocated patella most commonly occurs in teenagers and young adults who are engaged in athletic activities.
2. Usually, the dislocated patella displaces to the lateral side.
3. The displacement produces a significant deformity in which the knee is held in a moderately flexed position, and the patella is displaced to the lateral side of the knee.
4. Splint the knee in the position in which you found it.
   a. Most often, this is with the knee flexed to a moderate degree.
   b. Apply padded board splints to the medial and lateral aspects of the joint, extending from the hip to the ankle.

O. Injuries of the tibia and fibula

1. The tibia (shinbone) is the larger of the two leg bones that are responsible for supporting the major weight-bearing surface of the knee and ankle.

2. The fibula is the smaller of them.
3. Fracture of the shaft of the tibia or the fibula may occur at any place between the knee joint and the ankle joint.
    a. Usually, both bones fracture at the same time.
    b. Even a single fracture may result in a severe deformity, with significant angulation or rotation.
    c. Open fractures of the tibia are quite common.
4. These fractures should be stabilized with a padded, rigid long leg splint or an air splint that extends from the foot to the upper thigh.
    a. Correct severe deformity before splinting by applying gentle longitudinal traction.
5. These fractures are sometimes associated with vascular injury as a result of the distorted position of the limb following injury.
    a. Realigning the limb frequently restores an adequate blood supply to the foot.
    b. If it does not, transport promptly and notify medical control.

P. Ankle injuries

1. The ankle is a very commonly injured joint.
2. Ankle injuries occur in people of all ages and range in severity from a simple sprain to severe fracture-dislocations.
3. Any ankle injury that produces pain, swelling, localized tenderness, or the inability to bear weight must be evaluated by a physician.
4. The most frequent mechanism of ankle injury is twisting, which stretches or tears the supporting ligaments.
5. You can manage the wide spectrum of injuries to the ankle in the same way, as follows:
    a. Dress all open wounds.
    b. Assess distal neurovascular function.
    c. Correct any gross deformity by applying gentle longitudinal traction to the heel.
    d. Before releasing traction, apply a splint.

Q. Foot injuries

1. Injuries to the foot can result in the dislocation or fracture of one or more of the tarsals, metatarsals, or phalanges of the toes.
    a. Toe fractures are especially common.
    b. Of the tarsal bones, the calcaneus (heel bone) is the most frequently fractured.
2. Frequently, the force of injury is transmitted up the legs to the spine, producing a fracture of the lumbar spine.
3. If you suspect that the foot is dislocated, immediately assess for pulses and motor and sensory functions.
    a. If pulses are present, immobilize the extremity using a commercially available splint.
    b. If pulses are absent, contact medical control.
4. Injuries of the foot are associated with significant swelling but rarely with gross deformity.
    a. Vascular injuries are not common.
    b. Lacerations about the ankle and foot may damage important underlying nerves and tendons.
    c. Puncture wounds of the foot are common and may cause serious infection if not treated early.
5. To splint the foot, apply a rigid padded board splint, an air splint, or a pillow splint, stabilizing the ankle joint and the foot.
    a. Leave the toes exposed.
    b. When the patient is lying on the stretcher, elevate the foot approximately 6 inches to minimize swelling.

R. Compartment syndrome

1. If you have a pediatric patient with a fracture below the elbow or the knee, be on the lookout for these signs and symptoms:
    a. Extreme pain
    b. Decreased pain sensation
    c. Pain on stretching of affected muscles
    d. Decreased power
2. These are indicators that the pressure within a fascial compartment is elevated.
3. If you suspect that a patient has compartment syndrome, splint the affected limb and provide immediate transport.
    a. Reassess neurovascular status frequently during transport.
4. Compartment syndrome must be managed surgically.

S. Amputations

1. Surgeons today can occasionally reattach amputated parts.
2. With partial amputations, make sure to immobilize the part with bulky compression dressings and a splint to prevent further injury.
    a. Do not sever any partial amputations.
    b. Control any bleeding to the stump.
    c. If bleeding cannot be controlled, apply a tourniquet.
3. With a complete amputation, make sure to wrap the clean part in a sterile dressing and place it in a plastic bag.
    a. Put the bag in a cool container filled with ice.
    b. The goal is to keep the part cool without allowing it to freeze or develop frostbite.
    c. The amputated part should be transported with the patient to the appropriate resource hospital.

T. Strains and sprains

1. Strains
    a. Often no deformity is present and only minor swelling is noted at the site of injury.
    b. Patients may complain of:
        i. Increased sharp pain with passive movement
        ii. Severe weakness of the muscle
        iii. Extreme point tenderness
    c. General treatment is similar to that of fractures and includes the following:
        i. Rest; immobilize or splint injured area
        ii. Ice or cold pack over the injury
        iii. Compression with an elastic bandage
        iv. Elevation
        v. Reduced or protected weight bearing
        vi. Pain management as soon as practical
2. Sprains
    a. Sprains usually result from a sudden twisting of a joint beyond its normal range of motion that also causes a temporary subluxation.
    b. The majority of sprains involve the ankle or the knee.
    c. Sprains are typically characterized by:

i. Pain
ii. Swelling at the joint
iii. Discoloration over the injured joint
iv. Unwillingness to use the limb
v. Point tenderness

d. Sprains usually do not involve deformity, and joint mobility is usually limited by pain, not by joint incongruity.
e. Err on the side of caution and treat every sprain as if it is a fracture.
f. General treatment of sprains is the same as that of strains.

VII. Summary

A. Skeletal or voluntary muscle attaches to bone and forms the major muscle mass of the body. This muscle contains veins, arteries, and nerves.

B. There are 206 bones in the human body. When this living tissue is fractured, it can produce bleeding and significant pain.

C. A joint is a junction where two bones come into contact. Joints are stabilized in key areas by ligaments.

D. A fracture is a broken bone, a dislocation is a disruption of a joint, a sprain is a stretching injury to the ligaments around a joint, and a strain is a stretching of the muscle.

E. Depending on the amount of kinetic energy absorbed by tissues, the zone of injury may extend beyond the point of contact. Always maintain a high index of suspicion for associated injuries.

F. Fractures of the bones are classified as open or closed. Both are splinted in a similar manner, but remember to control bleeding and apply a sterile dressing to the open extremity injury before splinting.

G. Fractures and dislocations are often difficult to diagnose without an x-ray examination. You will treat these injuries similarly. Stabilize the injury with a splint, and transport the patient.

H. Signs of fractures and dislocations include pain, deformity, point tenderness, false movement, crepitus, swelling, and bruising.

I. Signs of sprain include bruising, swelling, and an unstable joint.

J. Compare the unaffected extremity with the injured extremity for differences whenever possible.

K. There are three main types of splints used by EMTs: rigid splints, traction splints, and formable splints.

L. Remember to splint the injured extremity from the joint above to the joint below the injury site for complete stabilization.

M. A sling and swathe is used commonly to treat shoulder dislocations and to secure injured upper extremities to the body. Lower extremities can be secured to the unaffected limb or to a long backboard.

N. The most common life-threatening musculoskeletal injuries are multiple fractures, open fractures with arterial bleeding, pelvic fractures, bilateral femur fractures, and limb amputations.

Post-Lecture

Unit Assessment

1. What structure attaches skeletal muscle to bone?

2. What type of injury is caused by a joint injury in which there is dislocation of the bone ends and damage to the ligaments?

3. What type of fracture is incomplete and occurs in children?

4. Describe crepitus.

5. How long after injury does compartment syndrome typically develop?

6. What four signs should be assessed to evaluate circulatory and nervous status distal to an injury?

7. How does splinting help an injury?

8. What are the contraindications to using a traction splint?

9. What are the hazards of improper splinting?

10. What is the most frequently fractured bone of the body?

Knowledge Objectives

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