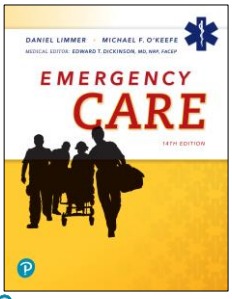
Emergency Care

Fourteenth Edition



Chapter 32

Musculoskeletal Trauma

Topics

Musculoskeletal System

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Musculoskeletal System (1 of 2)

- Bones
  - Framework
- Joints
  - Bending
- Muscles
  - Movement

Musculoskeletal System (2 of 2)

- Cartilage
  - Flexibility
- Ligaments
  - Connect bone to bone
- Tendons
  - Connect muscle to bone

Anatomy of Bone (1 of 2)

- Bones
  - Formed of dense connective tissues
  - Vascular and susceptible to bleeding on injury
  - Covered by periosteum
- Joints
  - Where bones meet

Bones

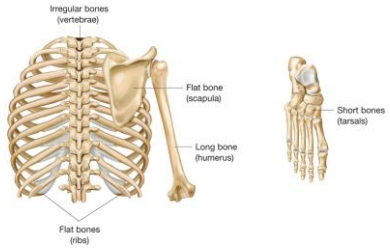
For long description, see slide 93: Appendix 1

Human skeleton.

Anatomy of Bone (2 of 2)

- Classification of shape
  - Long
  - Short
  - Flat
  - Irregular

Shapes of Bones



Bones are classified by shape.

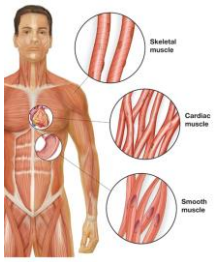
Self-Healing Nature of Bone

- Break causes soft tissue swelling and a blood clot in the fracture area.
- Interruption of blood supply causes cells to die at injury site.
- Cells further from fracture rapidly divide, forming tissue that heals the fracture and develops into new bone.

Muscles, Cartilage, Ligaments, and Tendons (1 of 4)

- Kinds of muscles
  - Skeletal (voluntary)
  - Smooth (involuntary)
  - Cardiac (myocardial)
- Cartilage helps form flexible structures of the body.

Muscles, Cartilage, Ligaments, and Tendons (2 of 4)

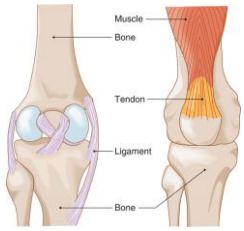


Three types of muscle.

Muscles, Cartilage, Ligaments, and Tendons (3 of 4)

- Tendons allow for the power of movement across joints.
  - MTB = muscle-tendon-bone
- Ligaments support joints by attaching bone ends to allow for stable range of motion
  - BLB = bone-ligament-bone

Muscles, Cartilage, Ligaments, and Tendons (4 of 4)



For long description, see slide 94: Appendix 2

Ligaments tie bone to bone. Tendons tie muscle to bone.

General Guidelines for Emergency Care

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Mechanisms of Musculoskeletal Injury

- Direct force
- Twisting (rotational) force
- Indirect force

Injury to Bones and Connective (1 of 4)

- Fracture
  - Any break in a bone, open or closed
  - Comminuted
    - Broken in several places
  - Greenstick
    - Incomplete break
  - Angulated
    - Bent at angle

Injury to Bones and Connective (2 of 4)

Closed fracture.
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Injury to Bones and Connective (3 of 4)

- Dislocation
  - "Coming apart" of a joint
- Sprain
  - Stretching and tearing of ligaments
- Strain
  - Overstretching or overexertion of muscle

Injury to Bones and Connective (4 of 4)

- Not all injuries can be confirmed as a fracture in the field.
- Treat all injuries with signs and symptoms of a fracture as a fracture.
- A traction splint should be applied to a suspected femur fracture.
- Splinting an extremity with a suspected fracture helps prevent blood loss from bone tissues.

Assessment of Musculoskeletal Injuries

- Rapidly identify and treat life-threatening conditions.
- Be alert for injuries besides grotesque wound.
- Cut or remove patient's clothing to complete examination according to the environment and severity of situation.

Compartment Syndrome

- Severe swelling in the extremity as a result of fracture
- Progression
  - Fracture or crush injury causes bleeding and swelling in extremity.
  - Pressure and swelling become so great the body can no longer perfuse the tissues against pressure.
  - Cellular damage occurs, causing additional swelling.
  - Blood flow to the area is lost.
    - Limb may also be lost if the pressure is not relieved.

Patient Assessment (1 of 2)

- Pain and tenderness
- Deformity and angulation
- Grating (crepitus)
- Swelling and bruising
- Exposed bone ends
- Joints locked into position
- Nerve/blood vessel compromise

Patient Assessment (2 of 2)

- Six P's of assessment
  - **P**ain or tenderness
  - **P**allor (pale skin)
  - **P**arasthesia (pins and needles)
  - **P**ulses diminished or absent
  - **P**aralysis
  - **P**ressure

Think About It

- Do the patient's musculoskeletal injuries add up to serious multiple trauma?
- Does the patient have circulation, sensation, and motor function (CSM) distal to the suspected fracture or dislocation?

Patient Care

- Take Standard Precautions.
- Perform primary assessment.
- During secondary assessment, apply cervical collar if you suspect spine injury.
- Splint any suspected extremity fractures after treating life-threatening conditions.
- Cover open wounds with sterile dressings.

Splinting

- Advantages
  - Minimizes movement of disrupted joints and broken bone ends
  - Decreases pain
  - Prevents additional injury to soft tissues
    - Nerves, arteries, veins, muscles
  - Can prevent a closed fracture from becoming an open fracture
  - Minimizes blood loss

Realignment of the Deformed Extremity (1 of 3)

- Assists in restoring effective circulation to extremity and to simplify splinting
- If not realigned, splint may be ineffective, causing increased pain and possible further injury.

Realigning Deformed Extremity

Realigning an extremity.

Realignment of the Deformed Extremity (2 of 3)

- If not realigned, increased chance of nerves, arteries, and veins being compromised
- Increased pain is only momentary.
- Splint in the position found unless distal extremity is cyanotic or lacks pulses
- If extremity is cyanotic or lacks pulses, align joint to neutral position using gentle traction

Realignment of the Deformed Extremity (3 of 3)

- Guidelines
  - One EMT grasps distal extremity while partner place one hand above and below injury site.
  - Partner supports first EMT who creates gentle manual traction in direction of long axis of extremity.
  - If no resistance is felt, maintain gentle traction until extremity is properly aligned and splinted.

Strategies for Splinting (1 of 4)

- Effective splinting may require some ingenuity.
- Three types available on EMS units
  - Rigid splints
  - Formable splints
  - Traction splints

Strategies for Splinting (2 of 4)

Splints and accessories for musculoskeletal injuries.

Strategies for Splinting (3 of 4)

- Care for life-threatening problems first.
- Expose injury site.
- Assess distal CSM.
- Align long-bone injuries to anatomical position.
- Do not push protruding bones back into place.

Strategies for Splinting (4 of 4)

- Immobilize both injury site and adjacent joints.
- Choose a method of splinting.
- Splint before moving patient to stretcher or other location if possible.
- Pad voids.

Hazards of Splinting

- "Splinting patient to death"
  - Splinting before life-threatening conditions addressed
- Not ensuring ABC's
- Too tight
  - Compresses soft tissues
- Too loose
  - Allows too much movement
- Splinting in deformed position

Splinting Long-Bone and Joint Injuries (1 of 3)

- Take appropriate Standard precautions.
- If possible, expose area to be splinted.
- Manually stabilize injury site.

Treatment: Splinting Long-Bone and Joints (1 of 4)

First Take Standard Precautions.

1. Manually stabilize the injured joint—in the case illustrated here, an injured elbow.

Splinting Long-Bone and Joint Injuries (2 of 3)

- Assess circulation, sensation, and motor function (CSM).
- Realign injury if deformed or if distal extremity is cyanotic or pulseless.

Treatment: Splinting Long-Bone and Joints (2 of 4)

2. Assess distal pulse, sensation, and motor function (CSM).

Splinting Long-Bone and Joint Injuries (3 of 3)

- Measure or adjust splint.
  - Move it into position.
- Apply and secure splint to immobilize injury site, adjacent joints.
- Reassess CSM distal to injury.

Treatment: Splinting Long-Bone and Joints (3 of 4)

4. Secure the splint.

Treatment: Splinting Long-Bone and Joints (4 of 4)

5. Reassess distal CSM.

Traction Splint (1 of 4)

- Counteracts muscle spasms and greatly reduces pain
- Types
  - Bipolar
  - Unipolar
- Amount of traction applied should be roughly 10 percent of patient's body weight
  - Not exceeding 15 pounds

Traction Splint (2 of 4)

- Take Standard Precautions and, if possible, expose the area to be splinted.
- Manually stabilize the leg and apply manual traction.
- Assess CSM distal to the injury.
- Adjust the splint to the proper length and position it at or under the injured leg.

Traction Splint (3 of 4)

- Apply the proximal securing device (ischial strap).
- Apply the distal securing device (ankle hitch).
- Apply mechanical traction.
- Position and secure support straps.

Traction Splint (4 of 4)

- Reevaluate the proximal and distal securing devices and reassess CSM distal to the injury.
- Secure the patient's torso and the traction splint to a long spine board to immobilize the hip and to prevent movement of the splint.

Treatment: Traction Splint (1 of 4)

1. Take Standard Precautions. Begin by assessing the limb.

Note: Assess the distal CSM both before and after immobilizing or splinting an extremity.

Treatment: Traction Splint (2 of 4)

2. Manually stabilize the injured leg.

Treatment: Traction Splint (3 of 4)

4. Adjust the splint to the proper length, and position it next to the injured leg.

Treatment: Traction Splint (4 of 4)

8. Secure support straps, as appropriate.

Emergency Care of Specific Injuries

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Shoulder Girdle Injuries (1 of 2)

- Patient assessment
  - Pain in shoulder
  - Dropped shoulder
  - Severe blow to back over scapula

Shoulder Girdle Injuries (2 of 2)

- Patient care
  - Assess distal CSM.
  - Use sling and swathe.
  - If evidence of anterior dislocation of head of humerus, place pillow between patient's arm and chest.
  - Do not attempt to straighten or reduce.
  - Reassess distal CSM.

Pelvic Injuries (1 of 3)

- Patient assessment
  - Pain in pelvis, hips, groin, or back
  - Pain when pressure applied to iliac crests
  - Cannot lift legs when lying supine
  - Lateral rotation of foot
  - Unexplained pressure in bladder
  - Bleeding from urethra, rectum, or vaginal opening

Pelvic Injuries (2 of 3)

- Patient care
  - Move patient as little as possible.
  - Determine CSM distal to injury site.
  - Straighten lower limbs to anatomical position.
  - Stabilize lower limbs.
  - Assume spinal injuries.

Pelvic Injuries (3 of 3)

  - Reassess distal CSM.
  - Care for shock, provide high-concentration oxygen.
  - Transport patient as soon as possible.
  - Monitor vital signs.

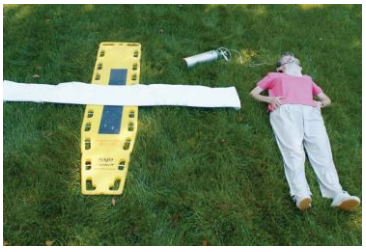
Pelvic Wrap (1 of 5)

- Commercially available devices
  - Can also use a sheet
- Applied to patients who have pelvic deformity or instability whether or not signs of shock are present

Pelvic Wrap (2 of 5)

A commercial pelvic splint.

Pelvic Wrap (3 of 5)



To devise a pelvic wrap, lay a sheet, folded flat, approximately 10 inches wide onto the backboard.

Pelvic Wrap (4 of 5)

Bring the sides of the sheet together.

Pelvic Wrap (5 of 5)

Tie the sheet firmly without overcompression to complete the pelvic wrap.

Hip Dislocation (1 of 2)

- Patient assessment
  - Anterior hip dislocation
  - Posterior hip dislocation
    - Rotation of leg inward and knee is bent.
    - Foot may hang loose and unable to flex the foot or lift toes.
    - Lack of sensation in limb

Hip Dislocation (2 of 2)

- Patient care
  - Assess distal CSM.
  - Move patient onto long spine board.
  - Immobilize limb with pillows and blankets.
  - Secure patient to spine board.
  - Reassess distal CSM.
  - Care for shock.
  - Transport, monitor vital signs, check for nerve and circulation impairment.

Geriatric Note

- Older adults are more susceptible to hip fracture because of brittle bones or weakness from various diseases.

Hip Fracture (1 of 2)

- Patient assessment
  - Pain is localized.
  - Sensitive to pressure exerted on greater trochanter
  - Surrounding tissues are discolored.
  - Swelling may be evident.
  - Unable to move limb while on back
  - Unable to stand
  - Foot on injured side turns outward.
  - Injured limb appears shorter.

Hip Fracture (2 of 2)

- Patient care
  - Place folded blanket between patient's legs, and bind legs together with wide straps, or wide cravats.
  - Use thin splints to push cravats or straps under patient at natural voids and readjust so they will pass across the chest, the abdomen just below the belt, below the crotch, above and below the knee, and at the ankle.

Hip Injuries

Binding together the legs of a patient with a hip injury.

Femoral Shaft Fracture (1 of 2)

- Patient assessment
  - Intense pain
  - Possibly open fracture
  - Injured limb may be shortened

Femoral Shaft Fracture (2 of 2)

- Patient care
  - Control bleeding.
  - Treat shock.
  - Assess distal CSM.
  - Apply traction splint.
  - Reassess distal CSM.

Pediatric Note

- When traction-splinting thigh injuries in children, be sure to use appropriately-sized splints.

Knee Injury

- Patient assessment
  - Pain and tenderness
  - Swelling
  - Deformity with swelling
- Patient care
  - Assess distal CSM.
  - Immobilize in current position.
  - Reassess distal CSM.

Tibia or Fibula Injury

- Patient assessment
  - Pain and tenderness
  - Swelling
  - Possible deformity
- Patient care
  - Apply vacuum split.
  - Apply air-inflated splint.
  - Immobilize fracture using two rigid board splits.
  - Apply single splint with ankle hitch.

Ankle or Foot Injury (1 of 3)

- Patient assessment
  - Pain
  - Swelling
  - Possible deformity

Ankle or Foot Injury (2 of 3)

- Patient care
  - Assess distal CSM.
  - Stabilize limb.
  - Lift limb.
  - Place cravats under ankle.
  - Lower limb onto pillow.
  - Tie pillow around ankle.

Ankle/Foot Injury

A pillow splint may be used for an injured ankle.

Ankle or Foot Injury (3 of 3)

  - Tie fourth cravat at arch of foot.
  - Elevate with second pillow or blanket.
  - Reassess distal CSM.
  - Care for shock if needed.
  - Apply cold pack as needed.

Forearm, Wrist, and Hand Injuries

- Signs
  - Forearm
    - Deformity and tenderness
  - Wrist
    - Deformity and tenderness
  - Hand
    - Deformity and pain
    - Dislocated fingers

Splinting Forearm, Wrist, and Hand Injuries (1 of 2)

Splinting A Finger: An injured finger can be taped to an adjacent uninjured finger, which acts as a splint to the injured finger, or it can be splinted with a tongue depressor. Some emergency department physicians prefer that care to an injured finger be limited to a wrap of soft bandages. Do not try to "pop" dislocated fingers back into place.

Splinting Forearm, Wrist, and Hand Injuries (2 of 2)

Splinting A Finger: An injured finger can be taped to an adjacent uninjured finger, which acts as a splint to the injured finger, or it can be splinted with a tongue depressor. Some emergency department physicians prefer that care to an injured finger be limited to a wrap of soft bandages. Do not try to "pop" dislocated fingers back into place.

Chapter Review

Chapter Review (1 of 3)

- Bones bleed. Fractures cause blood loss within the bone as well as from tissue damage around the bone ends. Serious or multiple fractures can cause shock.
- Splinting of long-bone fractures involves immobilizing the bone ends as well as the adjacent joints.

Chapter Review (2 of 3)

- Splinting protects the patient from further injury, reduces pain, and helps control bleeding.
- You may need to be creative while splinting. There are many correct ways to splint the same extremity.
- Injuries to bones and joints should be splinted prior to moving the patient.

Chapter Review (3 of 3)

- If patient has multiple trauma or appears to have shock (or a significant potential for shock), do not waste time splinting individual fractures. Place the patient on a long spine board and secure the limbs to the board. You can splint individual fractures en route if time and priorities allow.

Remember (1 of 4)

- Bones, joints, muscles, cartilage, tendons, and ligaments make up the musculoskeletal system.
- Bones provide the body with structure, store metabolic materials, and produce red blood. Joints are the places where bones articulate to create movement.

Remember (2 of 4)

- Fractures, dislocations, sprains, and strains are musculoskeletal injuries that are caused by direct force, indirect force, and twisting force. Injuries should be splinted prior to moving the patient.

Remember (3 of 4)

- A closed extremity injury is one in which the skin has not been broken. An open extremity injury is one in which the skin has been broken.
- Pelvic fractures and femoral shaft fractures often indicate more severe internal injuries.

Remember (4 of 4)

- EMTs must learn specific techniques for immobilizing particular injuries but at the same time must foster creativity while applying the general rules of splinting.

Questions to Consider (1 of 2)

- Have I fully addressed life threats and maintained my priorities even in the presence of a grossly deformed extremity?
- Does the patient have an injury that requires splinting?

Questions to Consider (2 of 2)

- Does the patient have multiple fractures, multiple trauma, or shock?
- Does the patient have adequate CSM distal to the musculoskeletal injury?
- Should I align the angulated extremity fracture?

Critical Thinking

- Patients who suffer fractures can be in extreme pain. Pain can cause anxiety and elevated pulse rates. How could you differentiate between a patient with a rapid pulse and anxiety from pain versus a patient with rapid pulse and anxiety from shock?

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Appendix 1

A skeleton superimposed on the image of a male. At the top of the body is the skull, with the maxilla of the upper jaw and mandible of the lower jaw. The neck consists of the cervical vertebrae, which lead down the spine to the thoracic vertebrae, lumbar vertebrae, sacrum, and coccyx. At the top of the chest are the clavicles, which are followed by the ribs that connect together in the front at the sternum. At the back of the shoulders are the scapula, which lead down to the humerus in the upper arms, the ulna and radius in the lower arms, the carpals in the wrists, the metacarpals in the hand, and the phalanges in the fingers. The pelvis consists of the pubis in front and the ilium in back. The femur in the upper legs leads to the patella in the knees, the tibia and fibula in the lower legs, the tarsals in the ankles, the metatarsals in the feet, and the phalanges in the toes.

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Appendix 2

Side by side illustrations of a joint show the bones, ligaments and tendons. One drawing shows a gray colored tissue, labeled ligament, connecting the bone above the joint to the bone below. The other drawing shows a large red fiber, labeled muscle, narrowing to a yellowish orange fiber, labeled tendon, and then connecting to the bone, all taking place above the joint.

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