Chapter 29 Orthopaedic Injuries Principles of Splinting

Types of Muscles

- ________________________
  - Striated
  - Skeletal
- ________________________
  - Smooth
- ________________________

Anatomy and Physiology of the Musculoskeletal System

Skeletal System

Skeletal System Functions

- Gives ________________________ to the body
- Supports body and allows it to ____________________________ erect
- Protects body ____________________________

Skeletal System

- Bone is a ________________________ tissue just as muscles are. A rich blood supply constantly provides oxygen and nutrients required by bones.
- Bone heals by forming new ________________________. It is the only tissue that heals by forming more of itself. All other tissues form scar tissue.

Terms

- ________________________ : gradual progressive weakening of the bones
- ________________________ Plate: transverse cartilage plate near the end of a long bone of a child. Allows
growth.

- ___________________________ (“Soft Spot”) Place on infants where bones of the skull have not yet fused.

**Terms**

- ___________________________: (articulation): where 2 bones come in contact

2 Main Types of joints

- ___________________________: only bend and straighten
  - Ball and Socket: Bending and rotation

- Ligament: Connects bone to bone
- ___________________________: Connects muscle to bone

**Types of Musculoskeletal Injuries**

1. ___________________________
   - Broken bone
2. ___________________________
   - Dislocation of a joint
   - Joint injury with injury of ligaments
   - ___________________________
     - Stretching or tearing of a muscle

**Mechanism of Injury**

- ___________________________ may be applied in several ways:
  - Direct blow
  - ___________________________ force
  - ___________________________ force
  - High-energy injury

**Mechanism of Injury**

- Direct Blow, Indirect Force
• Twisting Force
• High Energy Injury

12 Fractures

1. _____________________________ fracture
   – A fracture that does not break the skin
   • Open fracture
     – External wound associated with fracture

2. Nondisplaced fracture
   – Simple crack of the bone
   • _____________________________ fracture
     – Fracture in which there is actual deformity.

13 Types of Fractures (1 of 2)

• _____________________________ : passes only part way through. Only in kids
• Comminuted: More than two fragments
• _____________________________ : Due to age
• Epiphyseal: in a growth section
• _____________________________ : Broken at an angle across the bone

14 Types of Fractures (2 of 2)

• _____________________________ : Across the shaft
• _____________________________ : Twisting
• Incomplete: Does not run completely through the bone
• _____________________________ : Usually occur in falls or jumps

15 Greenstick Fracture

16 Comminuted Fracture

17 Pathologic Fracture
18  Epiphyseal Fracture

19  Signs and Symptoms of a Fracture (1 of 2)
   • _____________________________
   • Tenderness
   • _____________________________
   • Swelling
   • _____________________________

20  Signs and Symptoms of a Fracture (2 of 2)
   • _____________________________
   • False motion
   • Exposed _______________________
   • Pain
   • _____________________________ joint

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25  Signs and Symptoms of a Dislocation
   • Marked _______________________
   • Swelling
   • _____________________________
   • Locked Joint
   • Tenderness on palpation
   • Virtually complete loss of joint function
   • Numbness or impaired _______________________ to the limb and digit

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Signs and Symptoms of a Sprain

• Point tenderness can be elicited over injured ligaments.
• ________________________ and ecchymosis appear at the point of injury to the ligaments.
• Instability of the joint is indicated by increased motion.
• ________________________

Assessing Musculoskeletal Injuries (1 of 2)

• Assess mechanism of injury
• Consider ___________________________ stabilization
• Initial assessment
• Focused physical exam
• Follow ___________________________ precautions
• Give oxygen if needed
• DCAP-___________________________

Assessing Musculoskeletal Injuries (2 of 2)

• If patient critically injured, ___________________________ immediately
• Be alert for compartment syndrome
• ___________________________ injury
• Transport
• Check ______________________________ status during transport

Compartment Syndrome (1 of 2)

• Most often occurs with a fractured
Compartment Syndrome (2 of 2)
Characterized by:
• Pain that is out of _______________________ to the injury
• Pain on passive stretching of muscles within the compartment
• _______________________ 
• Decreased _______________________ 
• Decreased power

Complications (1 of 3)
• Orthopaedic injuries can also lead to systemic changes or illnesses.
• The likelihood of having a complication is often related to the:
  – Strength of the _______________________ that caused the injury
  – Injury’s _______________________ 
  – Patient’s overall _______________________ 

Complications (2 of 3)
• To prevent _______________________ following an open fracture:
  – Brush away any debris on the skin
  – Do not enter or _______________________ the site
• Long-term disability is one of the most devastating consequences of an orthopaedic injury.
Complications (3 of 3)

• You can help reduce the risk or duration of long-term disability by:
  – Preventing further _______________________
  – Reducing the risk of wound _______________________
  – Minimizing pain by the use of _______________________
  – Transporting patients to an appropriate medical facility

Severity of Injury

• ________________________ injuries can be identified using a musculoskeletal injury grading system.

Minor Injuries

• Minor ________________________
• Fractures or dislocations of ________________________

Moderate Injuries

• ________________________ fractures of the digits
• Nondisplaced ________________________ bone fractures
• Nondisplaced pelvic fractures
• Major sprains of a major ________________________

Serious Injuries

• ________________________ long bone fractures
• Multiple hand and foot fractures
• ________________________ long bone fractures
• Displaced pelvic fractures
• Dislocations of major joints
• Multiple digit amputations
• Laceration of major ________________________ or blood vessels
Severe Life-Threatening Injuries (Survival Is Probable)

- Multiple _______________________ fractures
- Limb _______________________
- Fractures of both long bones on the leg (bilateral _______________________ fractures)

Critical Injuries (Survival Is Uncertain)

- Multiple _______________________ fracture of the limbs
- Suspected pelvic fractures with hemodynamic _______________________ 

Assessing Neurovascular Status (1 of 4)

- If anything causes _______________________ , do not continue that portion of exam.
- Pulse
  - Palpate the radial, posterior tibial, and pedis pulses.

Assessing Neurovascular Status (2 of 4)

- Capillary refill
  - Note and record skin _______________________ .
  - Press the tip of the fingernail to make the skin blanch. If refill > _________ seconds, you can assume that circulation is impaired.

Assessing Neurovascular Status (3 of 4)

- _______________________ 
  - Check feeling on the flesh near the tip of the index finger.
  - In the foot, check the feeling on the flesh of the big toe and on the _______________________ side of the foot.
Assessing Neurovascular Status (4 of 4)

• Motor function
  – Evaluate muscular activity when the injury is
    ______________________ the patient’s hand or foot.
  – Ask the patient to open and close his or her
    ______________________ .
  – Ask the patient to _______________________ his or her toes.

Emergency Medical Care (1 of 2)

• Stabilize ______________________
• Control C-spine if needed
• Completely cover open wounds and control
  ______________________
• If patient is not critically injured, splint on
  ______________________ .
• Prepare the patient for transport.

Emergency Medical Care (2 of 2)

• If swelling is present, apply ice or cold
  ______________________ .
• Goal is to _______________________ injury in most comfortable position that allows for maintenance of good circulation distal to site.
• Assess Neurovascular status ______________________ and AFTER splinting

Splinting

• Flexible or rigid device used to protect extremity
• Injuries should be splinted prior to moving patient, unless the patient is ______________________
• Splinting helps prevent further
General Principles of Splinting (1 of 3)
• Remove _______________________ from the area.
• Note and record the patient’s neurovascular status.
• Cover all wounds with a dry, _______________________ dressing.
• Do not move the patient before splinting unless immediate life threat exists. In this case a long _________________ board will suffice as a temporary splint.
• Immobilize joint above and below fractured bone

General Principles of Splinting (2 of 3)
• Immobilize the bones above and below the injured joint.
• _______________________ all rigid splints.
• Maintain manual immobilization.
• Use constant, _______________________ , manual traction if needed.
• If you find resistance to limb alignment, _______________________ the limb as is.

General Principles of Splinting (3 of 3)
• Immobilize all suspected spinal injuries in a _________________ in-line position.
• If the patient has signs of shock, align limb in normal anatomic position and transport.
• When in doubt, _______________________ .

In-line Traction Splinting
• Act of _______________________ on a body structure in the direction of its normal alignment.
• __________________________ fracture of the shaft of a long bone and avoids potential neurovascular compromise
• Use the least amount of __________________________ necessary.
• If resistance is met or pain increases, splint in deformed position.

56  **Rigid Splints**
• Non-formable splints that are made from firm material
• Examples include:
  - Padded __________________________ splints
  - Molded plastic and metal splints
  - __________________________ splints
  - __________________________ splints

57  **Applying a Rigid Splint (1 of 2)**
• Provide gentle support and __________________________ traction of the limb.
• Another EMT-B places the rigid splint alongside or __________________________ the limb.
• Place padding between the limb and __________________________ as needed.

58  **Applying a Rigid Splint (2 of 2)**
• Secure the splint to the limb with __________________________
• Assess and record __________________________ neurovascular function.

59  **Applying an Air Splint**
• Hold the injured limb, apply gentle ________________ and support the injury site.
• Partner should place splint ________________
extremity.
- If splint has a zipper, zip the splint up.
- ______________________ by pump or by mouth.
- Check and record distal neurovascular function.

**Applying an Vacuum Splint**
- ______________________ and support the injury.
- Place the splint and wrap it around the limb.
- Draw the air out of the splint and ______________________ the valve.
- Check and ______________________ distal neurovascular function.

**Traction Splints**
Do Not use a traction splint under the following conditions:
- ______________________ extremity injuries
- Injuries close to or involving the
  ______________________
- Pelvis and ______________________ injuries
- Partial amputation or avulsions with bone separation
- Lower leg, foot, or ______________________ injuries

**Applying a Hare Traction Splint (1 of 4)**
- Expose the injured limb and ______________________ pulse, motor, and sensory function.
- Place splint beside the uninjured limb,
  ______________________ to proper length, and prepare straps.
- Support the injured limb as your partner fastens the ankle ______________________ .

**Applying a Hare Traction Splint (2 of 4)**
- Continue to support the limb as your partner applies gentle in-line traction to the ______________________
hitch and foot.
• Slide the splint into under the injured limb.
• Pad the groin and fasten the ___________________ strap.

64 Applying a Hare Traction Splint (3 of 4)
• Connect the ___________________ of the ankle hitch to the end of the splint as your partner continues traction.
• Carefully tighten the ratchet to the point that the splint holds adequate ___________________ .

65 Applying a Hare Traction Splint (4 of 4)
• Secure and check support ___________________ .
• Assess distal neurovascular function.
• ___________________ the patient and splint to a long board for transport.

66 Applying a Sager Traction Splint (1 of 3)
• ___________________ the injured extremity and check pulse, motor, and sensory function.
• Adjust the thigh strap of the splint.
• Estimate the proper splint ___________________ .
• Fit the ankle pads to the patient’s ankle.
• Place the splint along the ___________________ thigh.

67 Applying a Sager Traction Splint (2 of 3)
• Secure the ankle ___________________ .
• Snug the cable ring against the ___________________ of the foot.
• Pull ___________________ the inner shaft of the splint to apply traction.

68 Applying a Sager Traction Splint (3 of 3)
• Secure the _______________________ to the splint.
• Secure patient to a long backboard.
• Check pulse, motor, and _______________________

69 **Hazards of Improper Splinting**
• Compression of _______________________ , tissues, and blood vessels
• Delay in transport of a patient with a life-threatening condition
• Reduction of distal circulation
• ______________________ of the injury
• Injury to tissue, nerves, blood vessels, or ______________________

70 **Extremity Trauma**
71 **Clavicle and Scapula Injuries**
• Clavicle is one of the most ______________________ bones in the body.
• _______________________ is well protected
• Joint between clavicle and scapula is the acromioclavicular (A/C) joint
• Splint with a sling and _______________________.

72 **A/C Separation**
• With A/C separation, the distal end of the clavicle usually sticks _______________________.
• _______________________ with sling and swathe

73 **Dislocation of the Shoulder (1 of 3)**
• Most commonly dislocated _______________________ joint
• Usually dislocates _______________________
• Is difficult to immobilize
Dislocation of the Shoulder (2 of 3)
A patient with a dislocated shoulder will ________________ the shoulder, trying to protect it by holding the arm in a fixed position ________________ from the chest wall.

Dislocation of the Shoulder (3 of 3)
• Splint the joint with a _______________________ or towel between the arm and the chest wall.
• Apply a _______________________ and a swathe.

Fractures of the Humerus
• Occurs either _______________________ , in the midshaft, or distally at the elbow.
• Consider applying traction to _______________________ a severely angulated humerus, according to local protocols.
• Splint with sling and swathe, supplemented with a padded _______________________ splint.

Elbow Injuries
• Fractures and _______________________ often occur around the elbow.
• Injuries to nerves and blood _______________________ common.
• Assess neurovascular function carefully
  – Realignment may be needed to improve _______________________ .

Fractures of the Forearm
• Usually involves both radius and _______________________ 
• _______________________ Fracture: fracture of distal radius producing a “silver fork” deformity.
• ________________________ Fracture: fracture of distal radius producing a “hand down” deformity.
• Use a padded board, air, vacuum, or pillow splint.

79 Injuries to the Wrist and Hand (1 of 2)
• Follow BSI precautions.
• Cover all wounds.
• Form hand into the position of ________________________ .
• Place a roller bandage in ________________________ of hand.

80 Injuries to the Wrist and Hand (2 of 2)
• Apply padded ________________________ splint.
• Secure entire ________________________ of splint.
• Apply a sling and ________________________ .

81 Fractures of the Pelvis
• May involve life-threatening internal ________________________
• Assess pelvis for ________________________ .
• Stable patients can be secured to a long ________________________ or scoop stretcher to immobilize isolated fractures of the pelvis.

82 Assessment of Pelvic Fractures
• If there is injury to the bladder or ________________________ , the patient may have lower abdominal tenderness.
• They may have blood in the urine (_______________________ ) or at the urethral opening.

83 Stabilizing Pelvic Fractures
• A ________________________ patient with a pelvic
fracture may be placed on a long board.

- If the patient is unstable, consider using a __________________________ with the patient stabilized on the long board with legs bound together and padding between.
- May place pillow under ___________________________ if more comfortable for patient.

**Dislocation of the Hip**

- Hip dislocation requires significant ___________________________.

- Posterior dislocations lie with hip joint flexed and thigh rotated ___________________________.

- Anterior dislocations lie with leg extended straight out, and rotated, pointing ___________________________.

- Care
  - Limbs supported by pillows or rolled blankets in position of deformity.
  - Should be transported on rigid stretcher.
  - Can use PASG.

**Fractures of the Proximal Femur (1 of 2)**

- Presents with very characteristic ___________________________.

- Fractures from trauma injuries best managed with PASG and a spine board or by a spine board and binding legs together.

- Isolated fracture in elderly can be managed with long spine board or a ___________________________ stretcher.

- Use of traction splint, with traction, should be avoided if fracture is within ____________-___________ inches from joint.

**Fractures of the Proximal Femur (2 of 2)**
• A proximal femur fracture will be ________________________.

• Splint the injured leg to the ________________________ leg and secure the patient to a scoop stretcher or backboard.

**Femoral Shaft Fractures**

• Muscle _______________________ can cause deformity of the limb

• Significant amount of blood loss will occur.

• Immobilize with _______________________ splint.

• _______________________ may be applied over traction splint.

**Injuries of Knee Ligaments**

• Knee is very vulnerable to injury.

• Patient will complain of pain in the joint and be unable to use the extremity normally.

• Splint from hip joint to _______________________.

• Monitor distal neurovascular ________________________.

**Dislocation of the Knee**

• Produces significant ________________________

• More urgent injury is to the popliteal artery, which is often lacerated or compressed.

• Always check distal _______________________.

• Immobilize in position found unless distal circulation is absent. If absent, contact medical control, who may order to attempt X ____________ to re-align

**Fractures About the Knee**

• If there is adequate distal pulse and no significant deformity, splint the limb with the knee
• If there is adequate distal pulse and significant deformity, splint the joint in the position of

_______________________.

• If pulse is absent _______________________ the level of the injury, contact medical control immediately.

Dislocation of the Patella
• Usually dislocates to _______________________ side.
• Produces significant deformity.
• Splint in _______________________ found.
• Support with _______________________.

Injuries to the Tibia and Fibula
• Usually, both bones fracture at the same time.
• _______________________ fractures are common.
• Immobilize with a padded _______________________ long leg splint or an air splint that extends from the foot to upper thigh.
• Because the _______________________ is so close to the skin, open fractures are quite common.

Ankle Injuries
• Most commonly injured _______________________.
• Dress all open wounds.
• Assess distal N/V function.
• Correct any gross deformity by applying gentle longitudinal traction to the _______________________.
• Before releasing traction, apply a _______________________.

Foot Injuries
• Usually occur after a patient falls or jumps.
• Immobilize ankle joint and foot.
– _________________ splint very effective
• Leave toes exposed to assess neurovascular function.
• Elevate foot ________”.
• Also consider possibility of _________________ injury from a fall.

95 Foot Stabilization
A _________________ splint can provide excellent stabilization of the foot.

96 Injuries from Falls
Frequently after a fall, the force of the injury is _________________ up the legs to the spine, sometimes resulting in a fracture of the _________________ spine.