1 Chapter 29 Orthopaedic Injuries Principles of Splinting

2 Types of Muscles
   • __________________________
      • Striated
      • Skeletal
   • __________________________
      • Smooth
      • __________________________

3 Anatomy and Physiology of the Musculoskeletal System

4 Skeletal System

5 Skeletal System Functions
   • Gives __________________________ to the body
   • Supports body and allows it to __________________________ erect
   • Protects body __________________________

6 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.

7 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.

8 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

9 Types of Musculoskeletal Injuries
   • __________________________
     • Broken bone
     • Dislocation
     • Disruption of a joint

10 Mechanism of Injury
    • __________________________ may be applied in several ways:
      • - Direct blow
      • - __________________________ force
- High-energy injury

11 Mechanism of Injury
- Direct Blow, Indirect Force
- Twisting Force
- High Energy Injury

12 Fractures
- ________________ fracture
  - A fracture that does not break the skin
- Open fracture
  - External wound associated with fracture
  - ________________

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
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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30 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.
- _________________________

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32 Assessing Musculoskeletal Injuries (1 of 2)
- Assess mechanism of injury
- Consider _________________________ stabilization
- Initial assessment
- Focused physical exam
- Follow _________________________ precautions
- Give oxygen if needed
- DCAP-_______________________

33 Assessing Musculoskeletal Injuries (2 of 2)
- If patient critically injured, _________________________ immediately
- Be alert for compartment syndrome
- _________________________ injury
- Transport
- Check _________________________ status during transport

34 Compartment Syndrome (1 of 2)
- Most often occurs with a fractured ________________ or forearm of children
- Typically develops within __________ to __________ hours after injury, as a result of:
  - Excessive bleeding
  - A severely _______________________ extremity
  - The rapid return of blood to an ischemic limb

35 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

36 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 ________________

37 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.

38 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 ________________ and analgesia
  - Transporting patients to an appropriate medical facility

39 Severity of Injury
- ________________ injuries can be identified using a musculoskeletal injury grading system.

40 Minor Injuries
- Minor ________________
- Fractures or dislocations of ________________

41 Moderate Injuries
- ________________ fractures of the digits
- Nondisplaced _______________________ bone fractures
- Nondisplaced pelvic fractures
- Major sprains of a major _______________________

**42 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

**43 Severe Life-Threatening Injuries (Survival Is Probable)**
- Multiple _________________________ fractures
- Limb _________________________
- Fractures of both long bones on the leg (bilateral _________________________ fractures)

**44 Critical Injuries (Survival Is Uncertain)**
- Multiple _________________________ fracture of the limbs
- Suspected pelvic fractures with hemodynamic _________________________

**45 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.

**46 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.

**47 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.

**48 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.
49 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.

50 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

51 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 ________________________.
- ________________________ splinting materials when needed.

52 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

53 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.

54 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, ________________________.

55 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.

60 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.

61 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

62 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 ________________.

63 □ 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 ________________ function.

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 ________________
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 _______________________.

A/C Separation

- With A/C separation, the distal end of the clavicle usually sticks _______________________.
- _______________________ with sling and swathe

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.

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.

84  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.

85  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.

86 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.

87 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.

88 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 ____________________.

89 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.

90 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.

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

92 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.

93  **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 _______________________ .

94  **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.