MEDAVIE

HealthEd

ÉduSanté

MSK Trauma

DND Primary Care Paramedicine

Module: 05

Section: 08

Lecture Outline

- Introduction
- Pathophysiology
- Musculoskeletal injury assessment
- Musculoskeletal injury management

Introduction

- Second in frequency only to soft-tissue trauma
- Usually result from significant direct or transmitted blunt kinetic forces
- Painful and debilitating but rarely threaten life

Prevention Strategies

- Optimal way to reduce musculoskeletal injuries
  - Application of modern vehicle and highway designs
  - Workplace safety standards
  - Protective sports equipment
  - Good safety practices and public education

Types of Muscular Injuries

- Contusion
- Compartment syndrome
- Penetrating injury
- Muscle fatigue
- Muscle cramp
- Muscle spasm
- Muscle strain

Muscular Injuries

- Muscle fatigue
  - Occurs as muscle reach limits of performance
  - Cell environment becomes hypoxic
  - Strength diminishes, further exertion becomes painful
- Muscle cramp
  - Muscle consume oxygen and energy sources
  - Circulation cannot clear metabolic wastes
  - Irritation, muscle contraction (spasm)

Muscular Injuries

- Muscle spasm
  - Affected muscle goes into contraction
    - Clonic: intermittent
    - Tonic: constant
  - Usually subsides with restoration of circulation

Muscular Injuries

- Strain
  - Muscle overstretched by forces stronger than muscle
  - Muscles stretch
  - Ligaments may stretch or tear
  - Pain that increases with use

Joint Injuries

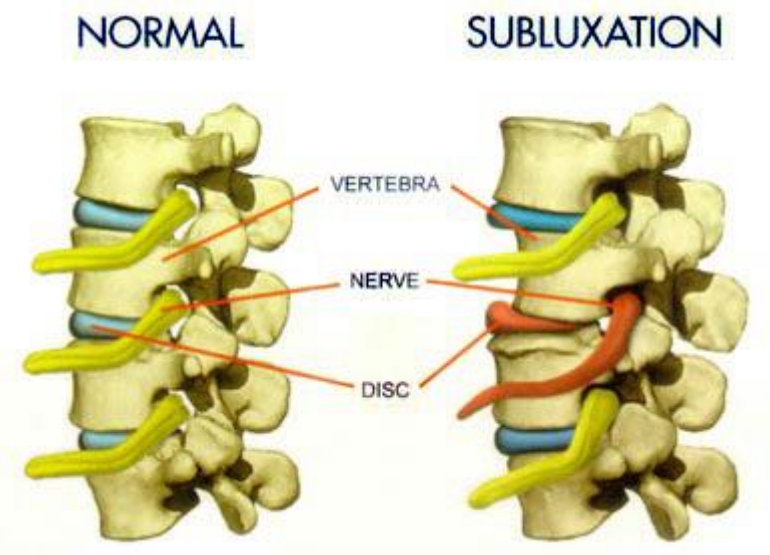
- Sprain
- Subluxation
- Dislocation

Sprain

- Tearing of a joint capsule's connective tissue
  - Grade I
    - Minor and incomplete tear of muscle fibers
    - Mild painful but minimal swelling
    - Joint stable
  - Grade II
    - Partial tear
    - Moderate to severe pain and swelling
    - Joint intact but unstable
  - Grade III
    - Complete tear
    - Severe pain and spasm
    - Loss of function/Joint unstable

Subluxation

- Partial displacement of a bone end from its position within a joint capsule
- Significantly reduces joint's integrity
- Caused by:
  - Hyperflexion
  - Hyperextension
  - Rotation beyond normal
  - Extreme forces



Dislocation

- Complete displacement of a bone end from its normal joint position
- Danger of entrapping, compressing or tearing blood vessels
- Caused when joint moves beyond its normal range of motion
  - Usually with great force

Knee Dislocation

Bone Injury

- Fracture
  - An involved fracture that ultimately interrupts the continuity of bone
- May be by direct or indirect
- Complications:
  - Nerve damage
  - Vascular damage
  - Associated injuries to muscles, tendons, ligaments etc.

Types of Fractures

- Open fracture
- Closed fracture
- Hairline fracture
- Impacted fracture
- Transverse fracture
- Oblique fracture
- Comminuted fracture
- Spiral fracture
- Fatigue fracture
- Greenstick fracture
- Epiphyseal fracture

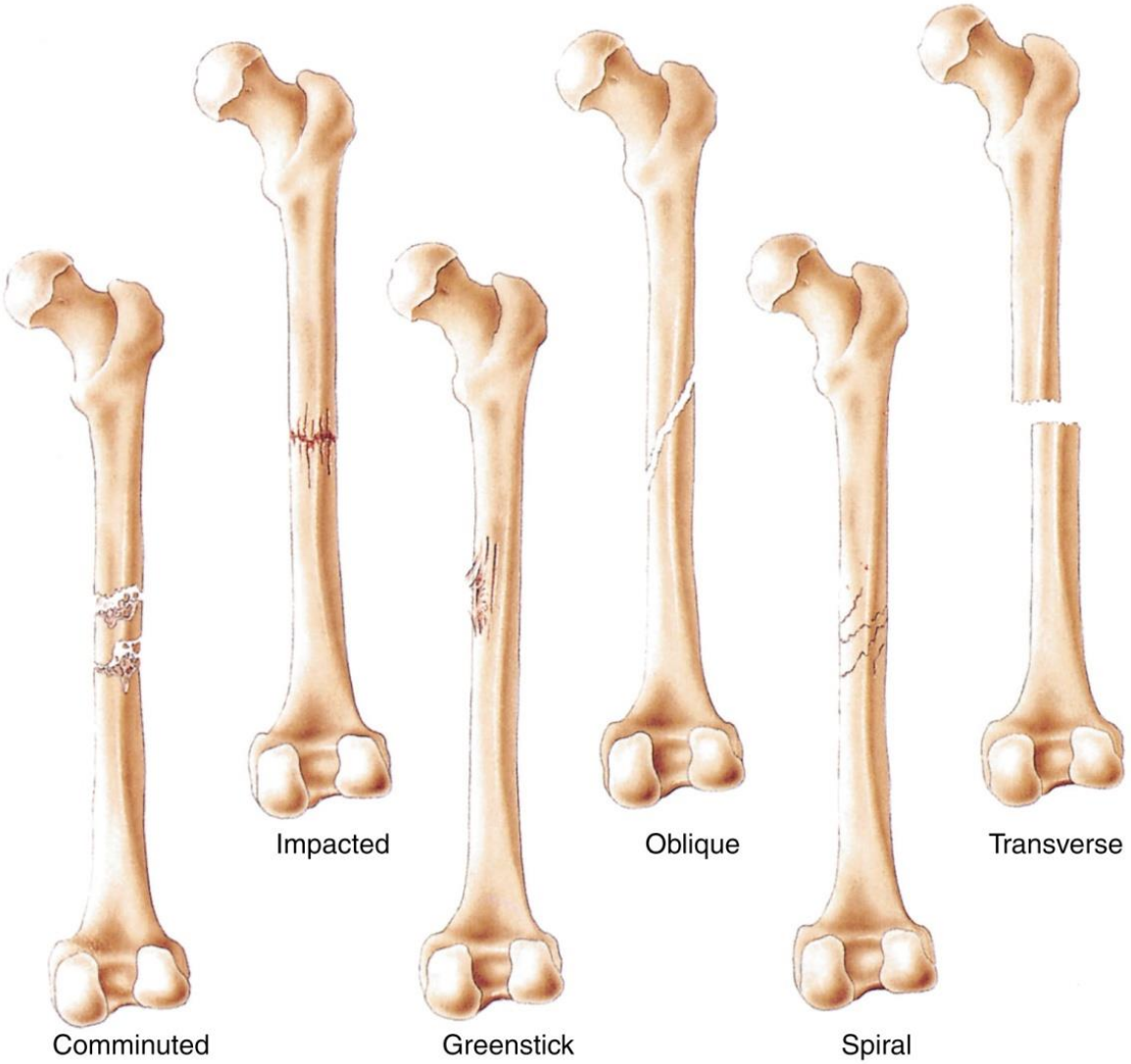
Types of Fractures

- Open
  - Bone is displaced and moves through muscle, sub Q tissue and the skin
  - Bone does not have to be visible to be classified as open
- Closed
  - Bone is not displaced enough to cause disruption in the skin

Types of Fractures

- Hairline
  - Small crack in bone that does not disrupt integrity of the bone
- Fatigue
  - Associated with prolonged or repeated stress
  - Bone weakens and fractures without force

Types of Fractures



Pediatric Considerations

- Contain greater proportion of cartilage than adult bones
- Flexible nature of bone
  - Susceptible to greenstick fracture
- Bone grows from epiphyseal plate
  - More prone to epiphyseal fractures
  - Growth plate disruption may lead to reduction or halt bone growth

Geriatric Considerations

- Aging causes changes to musculoskeletal system
  - Gradual decrease in bone mass and collagen structure
  - More brittle bones that heal more slowly
- Osteoporosis
  - Accelerated degeneration of bone tissue due to loss of essential minerals
  - Becomes most serious after menopause

Pathological Fractures

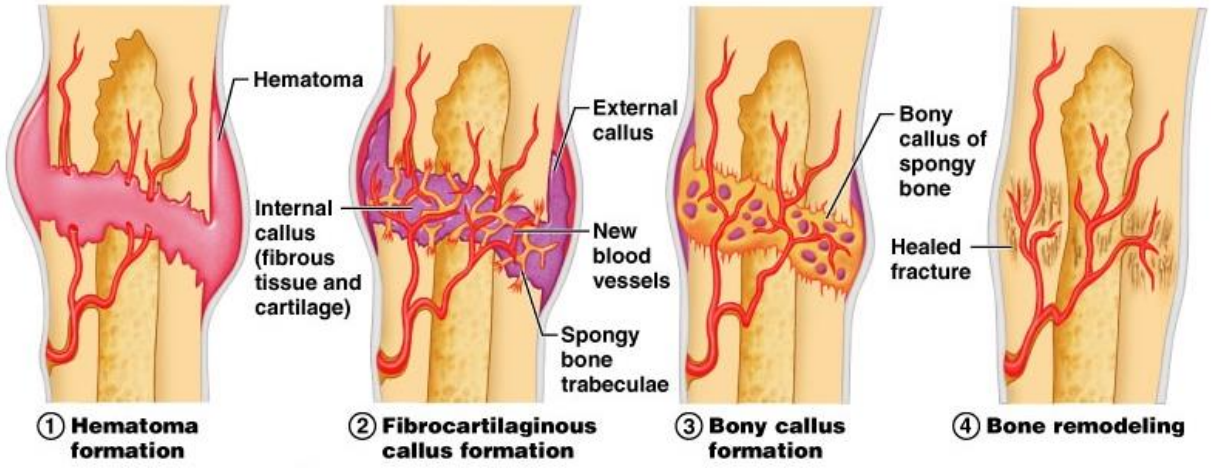
- Disease processes that affect bone development or maintenance
  - Tumours and other diseases
  - Radiation treatment
- Fracture not likely to heal well if at all

General Considerations

- Limited soft tissue surrounding joints
  - Compromised nerve and blood supply distal
- Blood vessels enter bone through diaphysis
  - Compromised blood supply to distal bone end
- Reduced stability
  - Damage to soft tissue, vascular and nerve involvement
- Muscle spasm
  - May cause bone ends to over-ride each other

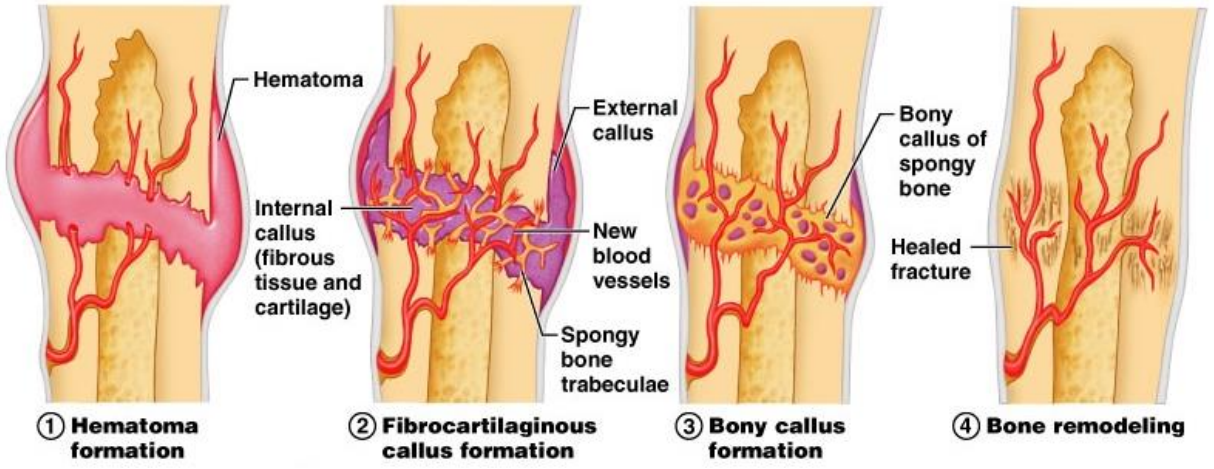
Bone Repair Cycle

- Hemorrhagic clot
  - Fracture tears periosteum
  - Blood fills area and congeals



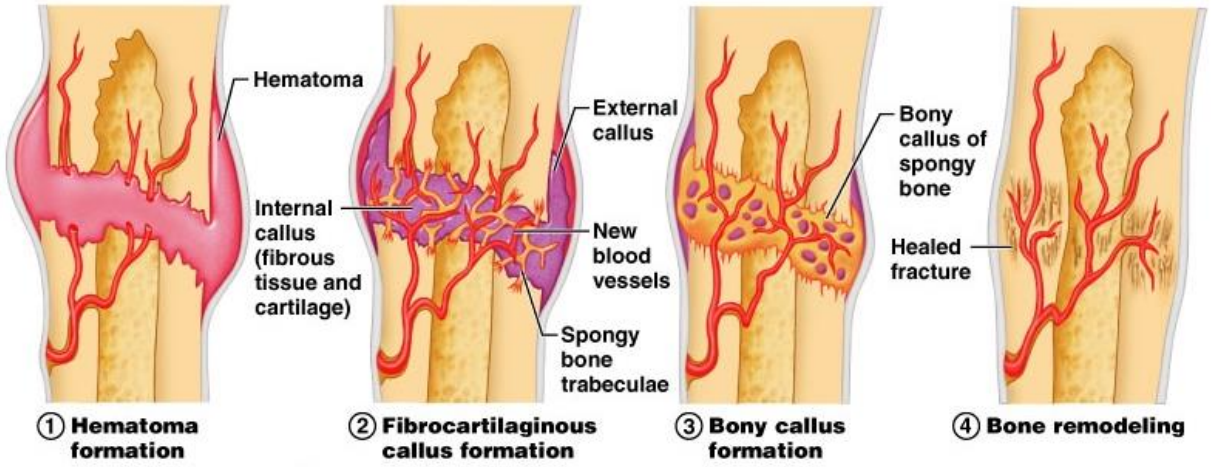
Bone Repair Cycle

- Bony callus formation
  - Osteocytes from bone ends multiply and produce osteoblasts
  - Lay down salt crystals with collagen clot fibres
  - Two ends join and form knob of cancellous bone



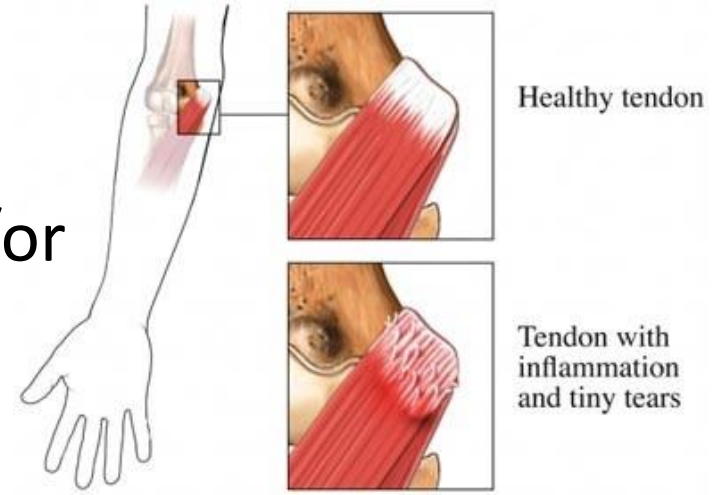
Bone Repair Cycle

- Remodelling
  - Continued deposition of salts/collage strengthens and stabilizes bone
  - Dissolved in low stress areas, added to high stress areas
  - Bone remodelled
  - If bone experiences interruption in healing, site may never return to normal



Inflammatory and Degenerative Conditions

- Bursitis
  - Acute or chronic inflammation of the small synovial sacs
- Tendonitis
  - Accumulation of small tears in the tendon that have not healed properly over time
  - Inflammation of a tendon and/or the protective sheath



Inflammatory and Degenerative Conditions

- Osteoarthritis
  - Inflammation of a joint from wearing down of the articular cartilage
- Rheumatoid arthritis
  - Chronic disease that causes deterioration of the peripheral joint capsule
  - Extreme cases causes flexion contractures
- Gout
  - Inflammation in joints and connective tissue produced by accumulation or uric acid crystals

Osteoarthritis vs Rheumatoid Arthritis

Musculoskeletal Trauma

ASSESSMENT

Assessment

- Scene assessment
  - Look for indications of severity of trauma forces
  - Kinetic energy forces may also cause internal and spinal injuries
  - Don’t let injuries be a distracter

Assessment

- As you begin the assessment, examine the patient quickly for MSK injuries; but remember that they are not often life threatening.

Primary Assessment

- Classification of patients with musculoskeletal injuries:
  - Life and limb threatening injuries
  - Life-threatening and minor musculoskeletal injuries
  - Non-life-threatening but serious limb threatening injuries
  - Non-life-threatening and only isolated minor musculoskeletal injuries

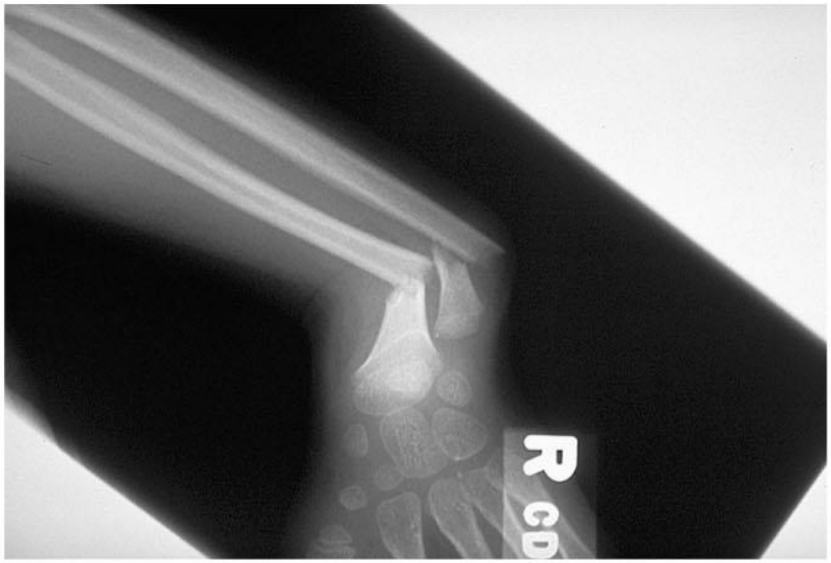
Rapid Trauma Assessment

- 80% of patients with multi-system trauma have associated musculoskeletal trauma
- Look for specific fractures
  - Pelvis: up to 2000 mL of blood loss
  - Femur: up to 1500 mL of blood loss

Focused History and Secondary

- Six P's of evaluating a limb injury
  - Pain
  - Pallor
  - Paralysis
  - Paraesthesia
  - Pressure
  - Pulses

a. A fracture will often present with deformity.



b. An x-ray of the fracture.

FIGURE 22-5 Presentation of a forearm fracture.

Focused History and Secondary

- Palpation
  - Instability
  - Deformity
  - Crepitus
  - Muscle tone
  - Temperature
- Evaluate distal sensation, circulation and mobility

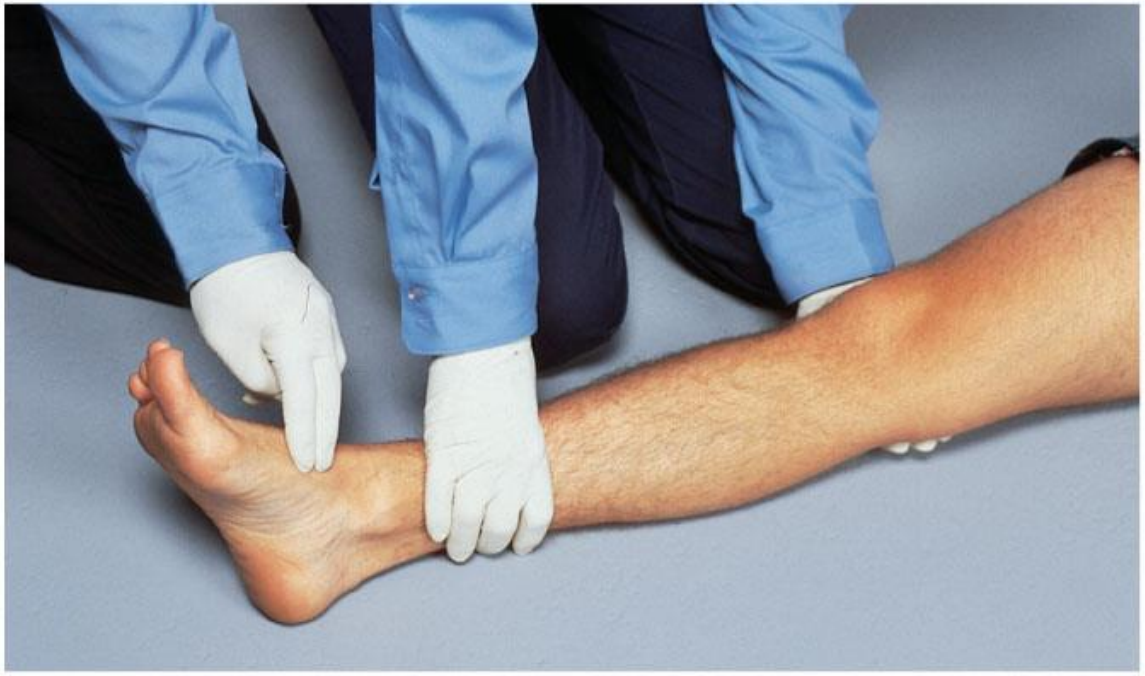


FIGURE 22-6 Evaluate the distal extremity for pulse, temperature, colour, sensation, and capillary refill.

Early Indicators of Compartment Syndrome

- Feelings of tension within limb
- Loss of distal sensation
  - Especially in webs of fingers and toes
- Complaints of pain
- Condition more severe than mechanism of injury would indicate
- Pain on passive extension of extremity
- Pulse deficit (late sign)

Injury Management

- Protect open wounds
- Proper positioning
- Immobilize the injury
- Monitor neurovascular function

Protecting Open Wounds

- Any open wound in close proximity to a fracture
  - Open fracture
- Cover with a sterile dressing
- Realignment/splinting may draw bone ends back into skin
  - Report to receiving physician

Positioning of the Limb

- When possible place injured limbs in position of function or a neutral position
  - Ensure patient comfort
  - Reduce chances of further injury
  - Encourage venous drainage
  - Stop realignment if there is any pain or resistance
- Do not attempt alignment of dislocations or serious injuries within 7 cm of a joint

Positioning of the Limb

- Gently position the limb in the position of function, unless:
  - Your attempts meet resistance
  - Or a significant increase in pain
  - Or the injury is within 7 cm of a joint

Immobilization

- Prevents further injury
- Above the joint above and below joint below
- Wrap from distal to proximal
- Reassess distal properties before, during and after immobilization

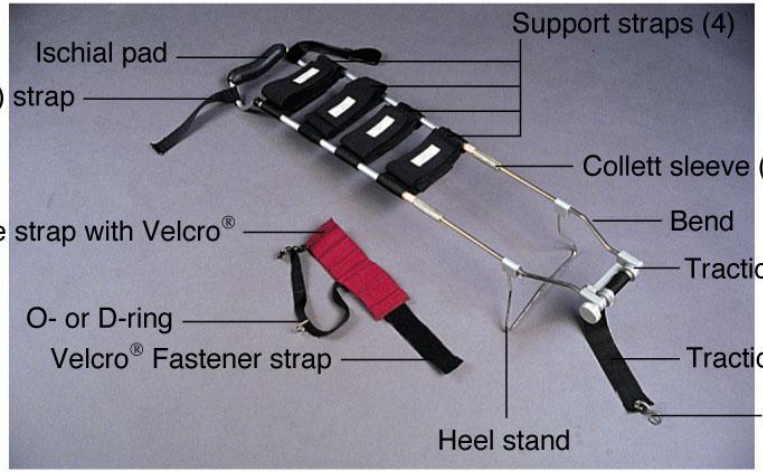
Splinting Devices

- Rigid splints
- Formable splints
- Soft splints
- Traction splints
- Other splinting aids
  - Vacuum splints
  - Air sprints
  - Cravats or velcro splints

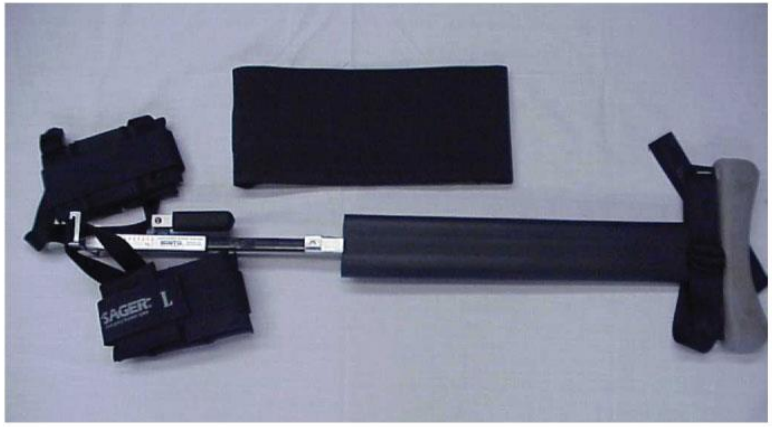
Splinting Devices

FIGURE 22-8 A variety of splints are available for musculoskeletal injuries.

Traction Splints



a. A bipolar frame traction splint



b. A unipolar frame traction splint

FIGURE 22-9 Traction splints.

FIGURE 22-10 Suction the air out of a vacuum splint until the device is rigid. Reassess pulse, motor function, and sensation in the extremity after application.

Fracture Care

- Assess neurovascular status
  - Correct compromise with traction/realignment
- Use gentle traction to realign limb
  - Immobilize proximal limb and apply traction to distal
- Splint with appropriate device
- Secure limb
- Constant reassessment of distal neurovascular status

Joint Care

- Assess neurovascular status
  - If compromised, consider moving limb to re-establish it
  - Rapid transport
- Immobilize joint in position found
- Reduction
  - Return displaced bone to normal position

Muscle and Connective Tissue Care

- Rest the extremity
- Ice for the first 48 hours
- Compress with elastic bandage
- Elevate the extremity

Pelvic Fractures

- Pelvic ring fractures are serious life-threatening injuries
  - Hemorrhage
  - Fat emboli
- Significant kinetic forces
- Stabilize fracture
  - Wrap, scoop stretcher
- Hemodynamic support

Femur Fracture

- Usually the result of violent forces
- Severe pain
  - May result in muscle spasms
  - Cause bone ends to over-ride
  - Traction splint
- Proximal fractures
  - Differentiate from fractured hip

Femur Fracture

- Align limb
- Determine neurovascular status
  - Mid-shaft - Apply traction splint
  - Proximal/distal – Apply splint
- Reassess patient
- Consider other injuries/transport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Tibia/Fibula Fractures

- Can occur separately or together
- Tibia is more commonly fractured
- If only fibula is broken, limb may be stable
- Generally air or rigid splints are most effective

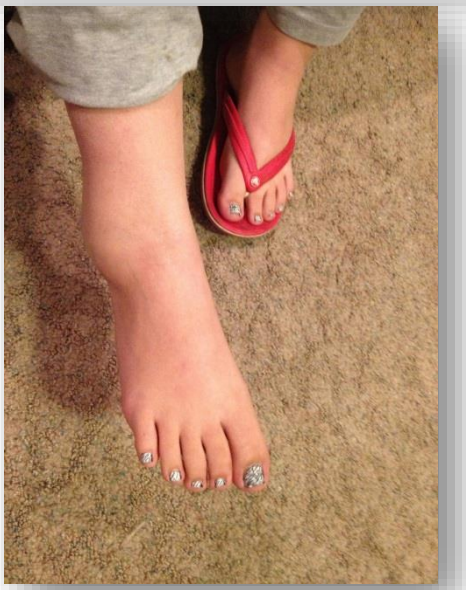


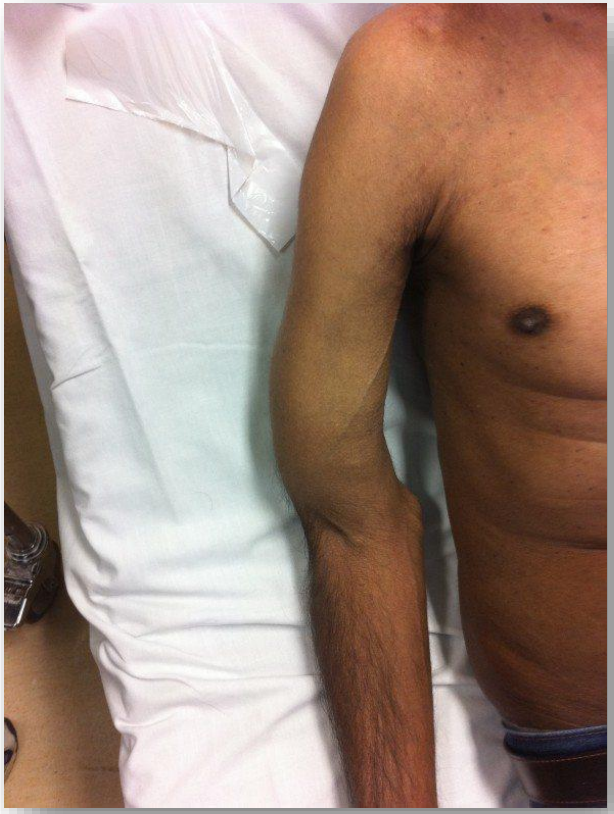
FIGURE 22-12 Placement of long padded board splints laterally and medially can effectively splint tibia/fibula fractures.

Clavicle Fractures

- Most commonly fractured bone
- Usually the result of transmitted forces directed along the upper extremity
- Sling and swathe or figure eight bandage
- Monitor for risk of internal hemorrhage or respiratory compromise

Humerus Fractures

- Difficult to immobilize at proximal end
  - Bone buried deep within muscle and shoulder joint
- Sling and swathe tends to be most effective method



Radius/Ulna Fractures

- Most commonly fractured at distal end
  - Colles' fracture, silver fork deformity
- Major concern is neurovascular compromise
- Short padded rigid splint
  - Leave at least one digit exposed

FIGURE 22-13 A malleable splint can effectively splint fractures of the radius and/or ulna.

Hip Injuries

- Anterior dislocation
  - Head of femur palpable in inguinal area
  - Externally rotated
  - Minimally flexed
  - Abducted
  - Generally cannot be reduced prehospital
- Posterior dislocation
  - Most common
  - Knee flexed and foot rotated inwardly
  - Adducted
  - Reduce only if there is neurovascular compromise
- Otherwise secure with fracture board or scoop stretcher

Knee Injuries

- May include:
  - Fractures of femur, tibia or both
  - Patellar dislocations
  - Frank dislocations
- Immobilize in position found
  - Unless there is neurovascular compromise
- Patellar dislocations very painful
  - Occasionally reduced in prehospital setting (according to local protocol)

FIGURE 22-14 Angulated knee dislocations can be immobilized with two padded rigid splints.

Ankle and Foot Injuries

- Often produce distal lower limb that is grossly deformed
- Dislocations may be anterior, posterior or lateral
- Pillow splint is often most effective

FIGURE 22-15 A pillow splint can be used for injuries to the ankles and feet.

Shoulder Injuries

- Most commonly involve proximal humerus, lateral scapula and distal clavicle
- Immobilize in position found
- Reduction often occurs as a result of patient body position

Shoulder Injuries

- Anterior dislocation
  - Humeral head displaced forward
- Posterior dislocation
  - Rotate arm internally, displaced away from chest
- Inferior dislocation
  - Humeral head displaced downward, arm locked over shoulder

Elbow Injuries

- High incidence of neurovascular involvement
- Blood vessels running through elbow are held firmly in place
- Careful and minimal movement required to restore distal function
- Elbow dislocations should not be reduced in the prehospital setting

FIGURE 22-16 Use a corrugated board splint such as a Speedsplint to immobilize angulated fractures or dislocations of the elbow.

Pediatric Injury

- At risk due to high activity levels and incompletely developed coordination
- Greenstick fracture
  - Stable but angulated limb
  - Do not realign
- Epiphyseal fracture
  - Endangers future growth
  - Treat as a potentially limb-threatening injury

Athletic Injuries

- Higher incidence of injuries in contact sports
- Establish rapport with athletic trainers
  - Patient becomes part of EMS system
- RICE

Summary

- Pathophysiology
- Musculoskeletal injury assessment
- Musculoskeletal injury management