Orthopedic Injuries in the Wilderness

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Outline

- General Information
- Assessing and Managing
  - Sprains and Strains
  - Fractures
  - Dislocations
- Evacuation Recommendations
Lower extremity injuries are among the most common accidents in the wilderness setting.

In the wilderness treatment varies depending on:

- The medical experience of the group
- The distance from definitive medical help

The goal is to make the patient as functional as possible thereby facilitating self rescue and eliminating outside assistance.

- The safety of the group takes precedence over optimal treatment of any individual.
General Information

- For instance if you suspect a fracture after a severe ankle injury
  - In a clinic setting you would immobilize and put on crutches and RICE with instructions to rest from weight bearing
  - In a remote setting one must weigh several factors when it comes to treatment
    - Desire of the patient to ambulate on a suspicious ankle injury
    - The availability of people to help transport
    - The type of terrain involved in transporting
  - Even though the best medical judgment is to prevent weight bearing, in the remote setting, the best decision would be to splint, and allow the patient to hobble along the good ankle using a wooden stick for balance
General Information - Splinting

• In an improvised system, if time allows, test on a non-injured person
• You might have to improvise with gear
  • Foam Pads
  • Straps
  • Rigid support structures from back packs
• Be mindful of your unconscious patient
  • Observe for pressure points
  • Potential for friction
• When in doubt extra padding
Sprains and Strains

• The most common backcountry injuries
  • Injuries to muscles, tendons, ligaments, and the supporting structures of joints

• Signs & Symptoms of a Sprain/Strain:
  • There is generalized pain and tenderness around the affected joint
  • There is pain with movement of the affected joint
  • There is pain with weight-bearing or use of the affected joint
  • Edema can be rapid and dramatic because of bleeding from the damaged blood vessels leading to ecchymosis over several hours
Sprains and Strains

- Evaluation of a sprain/strain:
  - Consider the mechanism of injury
  - Expose the injured area to look at the injury and the skin
    - You cannot properly evaluate an injury that is hidden by clothing
  - Gently palpate the area for pain, tenderness, and crepitation
  - Pain will most likely occur with active ROM
  - Perform passive ROM to help distinguish a sprain/strain vs. fracture/dislocation
    - No pain with passive ROM suggests Sprain/strain
    - Pain with passive ROM and
      - Loss of motion, a locked joint, indicates a dislocation
      - Crepitation indicates a fracture
Sprains and Strains

- **Treatment:**
  - The goal is to minimize swelling
  - **PRICE**
    - **Protect**
      - Consider splinting
    - **Rest**
      - Avoid painful stimuli allowing time to heal
    - **Ice**
      - Causes vasoconstriction thus reducing bleeding into the damaged tissues
    - **Compression**
      - An ACE wrap applies counter pressure to damaged tissues helping to control bleeding and pain
    - **Elevation**
      - Raise the affected area above the level of the heart to decrease edema
Guidelines for Assessing Suspected Fractures

• In the wilderness, without radiographs, assessment should include the following:
  
  • **Look:**
    • Look at possible fracture sites
    • Remove clothing, remove boots, and socks
    • Do you see any obvious signs of fractures
      • Wounds, deformities, angulation, discoloration, or swelling?
      • How does the injured side compare to the uninjured side?

  • **Listen**
  • **Feel**
Guidelines for Assessing Suspected Fractures

- In the wilderness, without radiographs, assessment should include the following:
  - **Look**
  - **Listen:**
    - What was the Mechanism of Injury (MOI)?
      - If the MOI indicates a possible fracture, treat as such
    - Did they feel anything break, snap, crack, or pop?
    - Is there decrease in normal function?
    - Is there guarding?
    - How willing is the patient to use the injured area?
      - Is the patient able to bear weight or load on the affected limb?
  - **Feel**
Guidelines for Assessing Suspected Fractures

- In the wilderness, without radiographs, assessment should include the following:
  - **Look**
  - **Listen**
  - **Feel:**
    - Check Circulation, Sensation, and Motion (CSM)?
    - Is there any point tenderness or crepitus?
    - Can the patient move the injury?
      - Assessing the joints one level above and below the injury
Guidelines for Treatment of Suspected Fractures

- Can the injury be immobilized in the position found?
  - If not, pull traction-in-line to slowly and gently move the extremity into proper anatomical alignment
  - This is to establish and maintain good circulation distal to the site of the injury

- Splinting is Key!
  - Adequate padding for comfort
  - Adequate rigidity for safety without compromise of distal circulation
  - It is more important for a splint to be well padded than rigid
  - Splints should be **BUFF**
    - Big, Ugly, Fat, and Fluffy

- Accomplished by formal splints or improvised
  - Clothing
  - Adhesive or athletic tape
  - Foam sleeping pads
  - Ice axes
  - Ski poles
  - Natural Material
Guidelines for Treatment of Suspected Fractures

- Immobilize the entire extremity, the joint above and below the site of the injury.
- Pre and post placement of splints should include the following assessments:
  - Check peripheral pulses
  - Capillary refills
  - Neurologic assessment for sensation, and movement distally from site of splint
- Recheck pulses, cap refill, and neuro assessment periodically to ensure splint wrap not too tight
  - Emphasize to the patient that the provider should be notified if there are any changes in sensation or level of pain.
Spinal Trauma

- **SPINE EXAMINATION & EVALUATION:**
  - Mechanism of injury (MOI):
    - The cervical vertebra are injured by flexion and axial loading
    - The thoracic vertebra by direct force
    - The lumbar vertebra by compression or rotation
  - Level of Consciousness (LOC):
    - GCS (Eye, Verbal, Motor responses)
      - Are they conscious, coherent, sober, or in any way obtunded
      - Monitor every 15 minutes until stable
      - If unconscious or obtunded, treat as if injured until AWAKE & ALERT.
Spinal Trauma

• **SPINE EXAMINATION & EVALUATION:**
  • **Pain & Guarding:**
    • Are they complaining of pain anywhere in the vertebral column
    • Is there radiating pain, numbness into the hands/arms.
  • **Tenderness:**
    • Is there pain on palpation over the vertebra or in the vertebral muscles
  • **Circulation, Sensation, & Motion (CSM):**
    • Can they feel and move all four extremities
Spinal Trauma

- Cervical spine
  - Due to mobility it is the most commonly injured portion of the spinal column in trauma.
- If you suspect cervical injury then you have to perform full spinal immobilization
  - Rigid vs. Semi-rigid cervical collar
  - Long board immobilization
Historically we “splint ‘em as they lie” approach

However transporting a patient not in anatomical position can be arduous

- Uncomfortable for the victim
- Difficult for the rescuer
- Increases risk for further injury

In general we can consider gentle axial traction back to anatomic position unless

- Return to anatomic position significantly increases pain or focal neurologic deficit
- Movement of head and neck results in any noticeable mechanical resistance.
Improvised Cervical Collars

• Rarely should be used alone
  • Always adjunct to full spinal immobilization
• A properly applied and fitted collar is a primary defense against axial loading of the cervical spine
• Works effectively only if it has the following features:
  • Rigid or semi-rigid
  • Fits properly
  • Doesn’t constrict or choke the victim
  • Allows the victim’s mouth to remain open if vomiting occurs
Improvised Cervical Collar

- A padded hip belt
- A fanny pack removed from a large internal- or external-frame backpack
- Wider is usually better
  - Take up excess circumference by overlapping the belt
  - Secure the excess material with duct tape
**Improvised Cervical Collar**

- Well-padded aluminum splints (e.g., SAM Splint) can be molded into various configurations to splint and protect.
- SAM splints can be adjusted to fit almost any size neck.
- One common mistake is to inadequately construct the anterior portion of the device.
  - Simply wrapping a SAM Splint in a circumferential manner provides an adequate chin-to-chest distance.
Two acceptable immobilization systems are:

- **Short-board immobilization**
  - Used for difficult or short-duration transport
- **Long-board immobilization**
  - Used for definitive immobilization during extensive transport
**Improvised Short Board Immobilization**

- **Internal-Frame Pack and Snow Shovel System**
  - Snow shovel through the centerline attachment points
  - The victim’s head is taped to the lightly padded shovel
  - This system incorporates the remainder of the pack suspension as designed
    - Shoulder and sternum straps with hip belt
  - Always assess the amount of cervical spine flexion or extension the system will cause; if it is unacceptable, the system must be modified appropriately
Continuous Loop System (Also Known as the Daisy Chain, Cocoon Wrap, or Mummy Litter)

To construct the continuous loop system, the following items are needed:
- Long climbing or rescue rope
- Large tarp (or tent fly)
- Sleeping pads
- Stiffeners (e.g., skis, poles, snowshoes, canoe paddles, or tree branches)
Shoulder Fractures

- Often are stable and require
  - Sling immobilization
  - Cold compresses (if available)
  - Allowing gentle motion of the forearm and hand
- A fracture of the clavicle may be treated with a sling and swathe
  - The hand and wrist must be accessible for feeling pulses
  - Monitor for shortness of breath for possible pneumothorax.
Upper Arm Fractures

- Humeral shaft is palpable on the medial side throughout its entire length
  - When you suspect a fracture palpate either proximal or distal to the patient’s area of complaint
    - This way very small non-displaced fractures may be identified
- Ask patient to extend wrist, digits, and thumb to check radial nerve function and document for future reference
- If angulated straighten out with traction-in-line
- Immobilizing the arm against the body is nature's best splint
  - Sling and swathe
  - For comfort leave the elbow free and dependent on gravity for gentle traction to the fracture site which is splinted to the thorax
Lower Arm Fractures

- Fractures with deformity arm are common (Colles’ and Smith’s deformities)
  - May need to straighten if circulation is impaired, but this is rare
  - Gentle traction with an assistant applying counter-traction to the upper arm results in an overall improvement, with a negligible risk of creating further vascular or neurologic compromise
  - Move slowly and stop if force is required for further movement
- Most common carpal fracture is of the scaphoid
  - Fall on out stretched hand (FOOSH)
  - Pain in the anatomical snuffbox
Lower Arm Fractures

- Adequately splint fractures of the elbow, forearm, and wrist
  - Incorporating joints above and below
  - If possible splint the elbow at 80-90 degrees of flexion to elevate the forearm and hand to reduce swelling
- Splint fractures of the distal ulna and radius with the hand placed in the position of function with a rolled up sock, glove, or other soft material tucked into the palm
  - Immobilize the hand, wrist, and forearm in a splint
  - Active exercise of the hand is helpful in promoting circulation
Hand Fractures

- Often associated with dislocations of the PIP or DIP
  - Reduce the phalangeal fractures and splint in a position of function (slightly flexed like holding a soda can)
  - Immediately after injury, these fractures can be reduced with minimal discomfort
  - Hours after the injury, swelling, and pain make reduction more difficult
  - Consider immobilizing the digits with buddy taping
    - Place gauze between the buddy taped fingers to absorb moisture and prevent ulceration
  - Suitable hand splints
    - Place the entire hand in a functional position and then wrap the whole with an elastic wrap, roller gauze, or torn strips of clothing
Hip Fractures

- Typical position of external rotation and shortened limb may or may not be present
- Fractures may impact femoral neck or acetabulum and makes diagnosis difficult
  - High index of suspicion when patient sustains significant trauma with painful motion in the hip and weight bearing
- Carry patient on a litter or sled
- Do not place on hip traction
- Splint to the uninjured leg
Pelvic Fractures

**Signs and Symptoms:**
- Typically in severe pain and unable to walk.
- They will have guarding, in that they will not be willing to move their legs or try to sit up.

**Physical Exam (Open and closed book):**
- Place your hands on the sides of the iliac wings and gently lean on the pelvis pushing it towards the floor or ground.
- Then with you hands in the same position compress the pelvis by pushing your hands towards each other.
- Any motion and/or pain indicates a fractured pelvis.
- Check for hematuria which can suggest bladder trauma.
  - High riding prostate on rectal exam can also suggests a urologic insult.
- You can only move a fractured pelvis once due to the risk of internal bleeding.
Pelvic Fractures

- Treatment involves ATLS guidelines (IV, O₂, Monitor)
  - Treat for shock due to massive blood loss associated with this injury
  - Pelvic binder – Prevent it from falling open
    - Gentle constricting wraps placed around the pelvic region may provide temporary comfort and stability preventing further circulatory compromise
    - 6” – 8” wide piece of fabric that is wrapped around the pelvis and then secured
      - Improvised or commercialized binders
  - Patient requires stabilization on a rigid backboard, litter, or sled and urgent evacuation
Femur Fractures

- Pain improves with initial manual traction
  - However traction splints are technically difficult and can result in complications from tissue necrosis
    - Pressure points
    - Compromised circulation
    - Complications of extraction due to the length of traction device
- A traction splint is no more efficacious than a good packaging technique
  - Immobilize the fractured extremity to the uninjured leg with adequate padding
  - When long transport is anticipated place padding behind the knee to create 5-10 percent knee flexion
    - More comfortable for patient if knee is fully extended
Patellar Fractures

- Difficult to differentiate from severe contusions unless there is obvious crepitus or deformity
- Patients with comminuted patellar fractures are unable to extend the knee
- Immobilize a patient, with severe knee pain, with a cylinder splint that stabilizes the knee and allows patient to walk with assistance
- Improvise a cane or crutch
  - Once splinted straight, patient can walk a short distance relatively pain-free
  - A fractured patella can make it difficult to walk, but not impossible
Lower leg Fractures

- May be an angulated fractures with impairment of circulation distal to the site of the fracture
  - Can be easily reduced into proper anatomical alignment with gentle Traction-In-Line (TIL)
  - After splinting reassess distal pulses every 15-30 minutes
- Suspected tibia alone or both fibula and tibia fractures require splinting the knee and ankle
- Isolated fibula fractures require only an ankle splint and patient can ambulate with a crutch
- Improvise splints with:
  - Ensolite pad
  - Well-padded sticks held in place with cravats
  - Splint with the foot held at 90 degrees
- Traction splinting is not required
Ankle Fractures

- Difficult to Assess
  - Ottawa Ankle Rules assist with indicating a fracture might exist
    - Tenderness over the inferior or posterior pole of either malleolus
  - Early exam and treatment are important
    - Immobilize adequately and then elevate and apply cold to the injured extremity
    - A well wrapped compression dressing is helpful
  - Improvised equipment for splinting
    - Parkas
    - Foam sleeping pads
    - Arranged in a U shape around the foot and lower leg
Foot Fractures

- Forefoot injuries
  - March Fracture
    - Stress fracture of the 5th metatarsal that is caused by a long march or hike
    - Pain and tenderness over the center of the lateral arch of the foot
    - Treatment is to support the foot well with a firm boot
  - Jones Fracture
    - Usual MOI is inversion ankle injury with plantar flexion
    - Similar exam to march fractures but has an acute MOI with obvious ecchymosis and edema
- Splinting is similar as for ankle fractures
- Ambulation may be possible for self evacuation especially if aided by a cane or crutch
Toe Fractures

- May be angulated
  - Apply in line traction to straighten and move into proper anatomical position
  - Splint the injured, by “buddy taping,” to the adjacent toe
    - Apply padding in between the toes for comfort and support
  - Support the fractured toes by wearing a stiff-soled shoe to prevent flexion of the toes
Guidelines for Assessing and Treating Dislocations

• It is important to diagnose and reduce quickly after it occurs
  • However if there is a nearby medical facility then evacuate

• Examine and document motor, sensory, and circulatory status distal to the dislocation before and after attempted reduction
Guidelines for Assessing and Treating Dislocations

- **Signs of dislocation**
  - Restriction of motion
  - Deformity compared to uninvolved side
  - The patient maintaining a typical identifiable posture to minimize pain

- **Advantages of early reduction**
  - Easier immediately after the injury before swelling and muscle spasms occur
  - Transportation of the patient is easier post reduction
  - Reduction usually results in relief of pain
  - Immobilizing injured joint is easier and stable after reduction
  - Safety of the entire party might be compromised attempting an evacuation of a patient with a major joint dislocation
  - Reduces the circulatory and neurological risks for extremity
Anterior Shoulder Dislocations

- >90% are anterior-inferior dislocations
- Mechanism of injury is usually in external rotation and abduction
- Patient cannot bring the involved extremity across the chest
- Upper arm is held away from the body in various positions
  - Differs from a humerus fracture when the patient splints the upper arm against the chest wall for comfort
- Check circulation, motor, and sensory function to the hand and sensory function along the outer aspect of the shoulder (axillary nerve)
Anterior Shoulder Dislocation Reduction Methods

- **Method 1**
  - Steady traction with the arm abducted 90 degrees pulling away from the body with counter traction provided in the region of the axilla by an assistant.
  - Use pads at the axilla and the antecubital region to protect nerve and vascular structures during traction.

- **Method 2**
  - Place the patient prone and let the arm hang down toward the ground with 10 to 15 pounds of weight secured to the hand.
  - This method may be slow and relaxation is critical.
    - Muscles will generally fatigue in time and manual assistance by manipulation of the shoulder is helpful.

- **After Reduction** immobielize the shoulder with sling and swathe and monitor circulation.
Posterior Shoulder Dislocations

- Diagnosis is difficult to make
- Not common
- Occur mainly with electrical injuries or tonic-clonic seizures
- Upper arm and forearm are held across the anterior chest wall
- Attempts at externally rotating the involved limb is restricted and painful
Elbow Dislocations

- Fractures and dislocations very painful
- Look for obvious deformity compared to the uninvolved side and usually restricted in flexion and extension
- Usually olecranon dislocates toward the rear and there is bone prominence posteriorly
- May have to straighten if circulation impaired distal to injury
  - Apply slow traction to the forearm in a partially flexed position with counter-traction applied to the upper arm by an assistant
  - The ability for the patient to fully flex the elbow is a sign of reduction
  - The joint may be displaced medially and laterally requiring side pressure for realignment
- After reduction immobilize in a sling and swathe
- If reduction is not possible then splint in the position found
Wrist Dislocations

- Very difficult to differentiate from a fracture
- Difficult to reduce
- Circulation and neurologic function to the hand are usually not compromised
  - However if they are then attempt reduction with gentle in line traction
- Splint immobilize in the function position
Finger Dislocations

- Obvious deformity and limited function are the diagnostic factors
- DIP/PIP reduction
  - Keep digit in partial flexion
  - Push dislocated base of the phalanx back in place
  - While maintaining traction
- MCP thumb and index finger
  - Difficult if not impossible
  - Make one attempt and then immobilize the joint in a functional position
  - Will most likely require open reduction
    - Especially the index MCP
Hip Dislocations

- The majority are posterior
  - Hip will be moderately flexed and internally rotated
  - Hip extension is restricted
  - Ideally requires 2 people for reduction
    - Patient in the supine position with hip and knee flexed at 90 degrees
    - One provider applies pelvic counter traction
    - The other provider straddles the patient and applies traction in the upward direction
  - If only one person available to attempt reduction
    - The patient can be placed prone over a log, bench, or rock
    - Hip and knee flexed at 90 degrees
    - Apply downward traction
  - Once reduced the injured hip must be immobilized to the uninvolved extremity and transported in the supine position
Patellar Dislocations

- Injury is often recurrent
- Most commonly lateral displaced with knee held in flexion for comfort
- Mechanism is usually caused by a pivoting injury with a partially flexed knee
- The patella is immobile and obviously out of place
- Reduction
  - Passively flex the hip to relax the quadriceps and then apply gentle traction to extend the knee
    - In most cases the patella will slip back into its groove
  - Applying direct but gentle pressure from the lateral aspect of the patella may be necessary to attain reduction
- Immobilize the extremity with a cylinder splint
  - With the knee extended and immobilized
  - The patient may be able to walk well enough for self evacuation
Knee Dislocations

- Will have underlying major ligamentous disruption
- Extremely painful
- Gross instability and deformities are present
- Typically the tibia is pushed posterior to the femur
  - Pressure on the arteries behind the knee can compromise the circulation to the lower leg
- Vascular impairment is an important risk
  - Check pulses and motor function in ankle and foot
- Gentle reduction of the joint benefits damaged neurovascular structures
  - Because the supporting ligaments have been torn, it is usually simple to reduce the dislocation
  - Gently place knee in proper anatomical position
  - Splint in position of comfort with a well-padded, posterior splint usually bent at about 20 – 30 degrees without compromising circulation to the foot
  - Ace wrap to control swelling
- The patient must be carried out
- All dislocated knees are surgical knees
Ankle dislocations

- Most commonly associated with fractures
- Obviously deformed with crepitus
- Reduce the deformity as much as possible
  - To prevent necrosis from tight stretched overlying skin
- Usually not difficult to reduce because of the gross instability from the associated fractures

Reduction

- Hold the forefoot
- Allow the remainder of the extremity to act as the counter traction
- Gentle traction of the heel and foot also helps
- Immobilize with a splint and carry patient out
Guidelines for evacuation

- The type of trip and injury dictates whether the trip gets premature terminated and how rapidly the patient needs to be evacuated.

- Urgent evacuation is indicated in:
  - Open fractures
  - Injuries with vascular compromise not relieved by reduction
  - Spinal Injuries with neurologic deficits
  - Injuries associated with significant blood loss
  - Multiple major fractures
  - Digit injuries

- With adequate splinting, delays in reaching definitive medical care often result in no permanent harm.
Resources

