Orthopedic Trauma

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Musculoskeletal Trauma

- Introduction
- Primary Assessment
- Secondary Survey
- Musculoskeletal assessment
- Life threatening injuries
- Limb threatening injuries
- Other extremity injuries
- Immobilization
- Analgesia

Introduction

- Occurs in 70-80% of patients with blunt trauma
- Rarely causes immediate threat to life or limb
### Morbidity and Mortality

- Long bone fracture associated with higher incidence torso injuries
- Crush injuries can cause renal failure
- Fat emboli from long bone fractures can cause cardiac arrest

### Morbidity and Mortality

- Upper extremity
  - Rarely life threatening
  - Can cause significant long term impairment
- Lower extremity
  - More severe injuries
  - Can cause significant blood loss
  - Femur and pelvic injuries can be life threatening

### Morbidity and Mortality

- Remember FEW musculoskeletal injuries are life threatening
- Do NOT be distracted from primary survey by musculoskeletal injury
Primary Assessment

• Airway

• Breathing

• Circulation
  – Musculoskeletal injury can lead to major vessel injury

Primary Assessment (cont)

  – Major vessel injury can lead to exsanguination
  – Control can usually be obtained by direct pressure
  – Long bone fractures can cause significant hemorrhage into soft tissues
    • Femur fractures can have 1.2 L hemorrhage
    • Tibia/Fibula fractures 500ml
    • Pelvis fractures 2L
  – Can cause hemorrhagic shock and hemodynamic instability

Primary Assessment (cont)

  – Open fractures require direct pressure to control hemorrhage
  – Splinting and anatomic alignment of fractures can decrease hemorrhage
  – Do NOT slow down resuscitation to apply splints

• Disability

• Exposure
Secondary Survey

• History/Observation
  – Mechanism of injury can predict injuries
  – Pain and decreased ROM main symptoms

• Physical exam
  – Look
  – Feel

Musculoskeletal Assessment

• Look at extremities
  – Color and perfusion
  – Wounds
  – Deformity
  – Swelling
  – Bruising/Discoloration
  – Spontaneous movement

Musculoskeletal Assessment

• Feel
  – Check sensation (neurological function)
  – Pain (localize injury)
  – Pulses (circulation)
Life threatening injuries

- Pelvic disruption and hemorrhage
- Arterial hemorrhage
- Crush Syndrome

Pelvic disruption and hemorrhage

- Pelvis is a ring
  - Disruption of the ring leads to instability
  - Large vascular structures pass through the pelvis
  - Instability can lead to venous and arterial injury and significant hemorrhage

Pelvic disruption and hemorrhage

- Diagnosis
  - Mechanism with significant trauma
  - Flank, scrotal or perineal bruising/swelling
  - Pelvic instability
- Hemodynamic instability may be only presenting symptom initially
Pelvic disruption and hemorrhage

• Management
  – Stabilization of pelvis
  • Prevents recurrent bleeding
  • Tamponads active bleeding
  – Mast pants
  – Sheet wrap
  – Open fracture require pressure dressings
Arterial Hemorrhage

- Management
  - Direct pressure
  - Hemorrhage tourniquet can be applied to limb
  - Fluid resuscitation if hemodynamic unstable
  - If associated fracture, splint in place

Arterial Hemorrhage

- Significant arterial injury caused by
  - Penetrating trauma to extremity
  - Blunt trauma leading to dislocation or fracture

- Hemorrhage can be into soft tissues or external

Crush Syndrome

- Significant muscle injury from a crush injury or prolonged compression

- Muscle breakdown leads to release of toxic chemicals

- Can lead to renal failure, hyperkalemia
Crush Syndrome

- Diagnosis
  - Hospital based
  - CK in blood, myoglobin in urine

- Management
  - IV fluid resuscitation
  - Sodium bicarbonate

Limb threatening injuries

- Open fractures and joint injuries
- Vascular injuries
- Compartment syndrome
- Traumatic nerve injury

Open fractures and joint injuries

- Fracture with laceration leading to bone exposure to external environment
- Can lead to infection and problems healing
- Laceration near joint or fracture is considered open joint/fracture
Open Fractures

- An open (or compound) fracture occurs when the skin overlying a fracture is broken, allowing communication between the fracture and the external environment.

Open Fractures - Management

- ABCDE – check neurovascular status (pulses, cap. refill, sensation, motor), fluid resuscitation, blood
- Antibiotics, tetanus prophylaxis – 48-72 hrs
- Surgical debridement – removal of de-vitalised tissue, irrigation
- Stabilization of fracture – internal/external, if closure delayed then external preferred
- Early definitive wound cover – split skin grafts, local/distant flaps (involve plastics)
Open Fractures - Complications

- Wound infection – 2% in Type I, >10% in Type III
- Osteomyelitis – staph aureus, pseudomona sp.
- Gas gangrene
- Tetanus
- Non-union/malunion

Vascular injuries

- Diagnosis
  - Significant extremity trauma
  - Diminished peripheral pulses
  - Cool extremity
  - Prolonged capillary refill
  - Complete vascular injury → Cold, Pale, Pulseless
Vascular injuries

- Management
  - Time dependent → longer ischemic worse outcome
  - Fracture and deformity → traction and splint
  - Dislocation → Splint

Traumatic amputation

- Severe open fracture that leads to loss of extremity
- Patient with multiple traumatic injuries poor candidate for reimplantation
- Reimplantation only in isolated digit or distal amputations

Traumatic amputation

- Management
  - Wash in LR or NS
  - Wrap in sterile gauze moistened with NS/LR
  - Place in plastic bag
  - Place plastic bag on ice
  - Transport with patient for possible reimplantation
Compartment syndrome

- Muscle swelling in extremity secondary to trauma
- Swelling limited by tight muscle fascia
- Limited space and increased swelling leads to increased pressure
- Increased pressure causes ischemia and muscle breakdown
- Most common in crush injuries and tibial/forearm fractures
- Can occur with tight fitting casts

Compartment syndrome

- Diagnosis
  - Pain greater than predicted
  - Pain with passive muscle stretch
  - Decreased sensation
  - Tense swelling
  - Loss pulses
- Ultimate diagnosis via compartment pressures

Compartment syndrome

- Management
  - Immobilize fracture
  - Prompt recognition and transport to hospital
Compartment Syndrome
- Crush injury
- Circumferential burns
- Snake bites
- Fractures – 75%
- Tourniquets, constrictive dressings/plasters
- Hematoma – pt with coagulopathy at increased risk

Traumatic nerve injury
- Fracture or dislocation can cause nerve injury
- Nerve injury can cause permanent disability
- Diagnosis
  - Extremity deformity or fracture
  - Assessment of nerve function (movement and sensation)
- Management
  - Traction and immobilize

Other extremity injuries
- Contusions and lacerations
- Closed Fractures
- Joint injuries
Contusions and lacerations

- Management
  - Cold packs
  - Sterile bandage if laceration/skin breakdown
  - Degloved skin should be placed over wound
  - Pressure can be applied for homeostasis
  - Elevation of injured limb

Joint injuries

- Non dislocated joint injuries
  - Not a limb threatening injury
  - Can decrease function of a limb
- Diagnosis
  - Pain at joint, no deformity
  - Hx of abnormal stress to joint
- Management
  - Hard to differentiate initially from a fracture
  - Immobilize prior to transport
Dislocation - Shoulder

- Most common major joint dislocation
- Anterior (95%) - Usually caused by fall on hand
- Posterior (2-4%) - ElectrocuGton/Seizure
- May be associated with:
  - Fracture dislocation
  - Rotator cuff tear

Dislocation - Knee

- Injury to popliteal artery and vein is common
- Peroneal nerve injury in 20-40% of knee dislocations
- Associated with ligamentous injury
- Anterior (31%)
- Posterior (25%)
- Lateral (13%)
- Medial (3%)

Dislocation - Hip

- Usually high-energy trauma
- More frequent in young patients
- Posterior hip in internal rotation, most common
- Anterior hip in external rotation
- Central - acetabular fracture
- May result in avascular necrosis of femoral head
- Sciatic nerve injury in 10-35%
Closed Fractures

• Break in bone without communication to external environment
• Diagnosis
  – Pain, swelling, deformity, abnormal rotation/position
  – Hip fractures → external rotation and shortening
• Management
  – Immobilization

Immobilization

• Goals
  – Prevent closed fractures from becoming open fractures
  – Prevent further damage to nerves/blood vessels
  – Decreases bleeding and edema
  – Decreases pain

Immobilization

• General principles
  – To immobilize bone/joint, immobilize 1 joint above and below injury
  – Long board provides total body splint
  – ALWAYS check neurovascular status after splint
    • Check pulses
    • Check color
    • Check movement
    • Check sensation
Immobilization

- Femur fractures
  - Ideal method is traction splint
  - Contraindicated in
    - Pelvic fractures
    - Hip injuries with gross displacement
    - Any significant injury to the knee
    - Avulsion or amputation of the ankle/foot

Splinting Wars?

- Cadaver Study: Comparison: Emergency Traction Splints
  
  Traction splint with Sager Emergency Traction Splint in place with 15lbs of traction. Note how the alignment of fracture occurs and that pressure on the critical structures below the Femoral shaft is absent.

  Hare Traction Splint in place with rope, 15 lbs. weight and pulley for traction. Note how the femur is pushed up into malalignment and that the Sciatic Nerve and Vascular structures are pushed into the fracture site.

Immobilization

- Avoid excessive traction which can lead to skin and soft tissue damage
- Hip fractures
  - Traction splint as before
  - Foam boot traction with knee flexion
- Other methods for femur/hip fractures include
  - Securing to other leg
  - Board splint
### Immobilization

- **Tibia/Fibula Fx**
  - Cardboard or metal gutter splint
  - Include ankle and knee in splint
  - Can use vacuum splint or pillow

- **Ankle fractures**
  - Pillow splint
  - Padded cardboard splint
  - Cardboard or board splint

- **Knee dislocation/Injury**
  - Knee immobilizer
  - Metal gutter splint
  - Can apply gentle traction if loss pulses distally to fracture

### Immobilization

- **Upper Extremity**
  - Hand → splint with wrist flexed and short arm splint
  - Wrist and forearm → padded or pillow splints
  - Elbow → Padded splint and sling and swath
  - Humerus → long arm in extension or sling and swath
  - Shoulder → Sling and swath
  - Clavicle → Sling and swath
ALS considerations - Analgesia

• Benefits
  – Analgesia makes transport, splinting easier
  – Analgesia improves patient comfort

• Concerns
  – Can cause respiratory depression in some patients, however reversible (narcan) or treatable (intubation)
  – Can cause hypotension (worse when volume depleted)

Summary

• Musculoskeletal injuries can cause significant blood loss and lead to abnormal vitals/instability
• Do NOT allow noncritical musculoskeletal injury to distract you from ABC’s
• Immobilization decreases pain, decreases hemorrhage and prevents closed fractures from becoming open
• Always check pulses and movement after splinting and your patient will feel………?

Thank You!

Questions?
POST-TEST

1. All below can be used to stabilize the pelvis fracture except.
   A. Mast pants
   B. Sieger splint
   C. Pelvic sling
   D. Blanket

2. You can lose over half your blood volume with a pelvic fracture and femur fracture?
   A. True
   B. False

3. All the below are Contra indications to using traction splinting for a femur except.
   A. Pelvic instability
   B. Ankle subluxation
   C. No pedal pulses
   D. Tibial fracture

POST-TEST

4. All good below are possible causes of compartment syndrome except
   A. Snake bite
   B. circumferential Burns
   C. Stab wounds
   D. crush syndrome
   E. No of the above

5. Turn it gets should only be applied after direct pressure, pulse pressure, trauma bandaging, and elevation have all failed to cease active bleeding?
   A. True
   B. False

Secret Question

All are possible complications from an open fracture except

• A. Osteomyelitis
• B. Gas gangrene
• C. Tetanus
• D. Fat embolism
EMS Questions?

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Updates Please

• Starting with the March EMS Live@Nite presentation, all certificates will be printed by participants or their agency. The certificate template will be available through the health training website at the same location as all presentation downloads. It will be posted the day after each monthly presentation and be available for 1 week.

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For providing our Secret Question prize