Initial Evaluation of the Orthopedic Trauma Patient

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AH MSKI Cabarrus – Orthopedic Trauma
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Outline

• Evaluation
  • ATLS/ABCDE
    • Primary, Secondary, Tertiary Exams
• Urgencies & Emergencies
• Damage Control Orthopedics
• PEARLS
Trauma

- Major public health issue with high disability, death, and societal cost
- Three peak times of death after trauma
  - 50% within the first few minutes - massive hemorrhage/neuro injury
  - 30% within the first few days - shock, hypoxia, neurologic injury
  - 20% within days to weeks – multisystem organ failure, infection
- With evolution of safety, decreased rates of
  - Closed head injury
  - Thoracolumbar injuries
  - Need for extraction
The Golden Hour

- Golden Hour
  - Period of time when life/limb threatening injuries should be treated to decrease mortality
  - Estimated 60% of preventable deaths can occur during this time
Initial Evaluation

- Advanced Trauma Life Support (ATLS) protocol
  - Primary survey
  - Secondary survey
  - Tertiary survey
Primary Survey

A: AIRWAY
B: BREATHING
C: CIRCULATION
D: DISABILITY
E: EXPOSURE
A: Airway

- Evaluation:
  - Maintain C-spine precautions
  - Integrity of airway
    - Traumatic obstruction
      - Ex: facial fractures, tracheal injury, foreign body, aspiration
    - Unable to protect airway due to altered consciousness
    - Cervical spine injuries (C3-5)

- Intervention:
  - Endotracheal intubation or cricothyrotomy with mechanical intervention
B: Breathing

- Evaluation
  - Chest x-ray
    - Pneumothorax, hemothorax, fractures (rib, sternum, flail chest), pulmonary contusion
  - Arterial blood gas
- Intervention:
  - Respiratory support if not already established
  - Management of contributing / chronic conditions
    - Chest tubes, pain management
C: Circulation

- Evaluation:
  - Pulses, capillary refill, peripheral perfusion
  - AP chest, AP pelvis
- Intervention:
  - Pressure to any obvious hemorrhage
    - Tourniquets, pelvic binder/sheet
  - Resuscitation
    - Packed red blood cells
    - Massive transfusion protocol
D: Disability

• Evaluation:
  • Neurologic
    • Pupillary exam
    • Glasgow Coma scale
    • Rectal exam
    • Sensory / motor / reflexes

• Intervention:
  • Maintain log roll
  • Maintain spinal precautions
E: Exposure with environmental control

• Evaluation:
  • Completely undress the patient
• Intervention:
  • Prevention of hypothermia
    • Warmed fluids
    • Bair hugger / blankets
Assessment of Shock

• Vital signs
  • Hypovolemic: ↑ heart rate ↓ blood pressure
  • Neurogenic: ↓ heart rate ↓ blood pressure
• Labs
  • Metabolic Acidosis
  • Lactate > 2.5
  • Base excess > 8
  • Coagulopathic
  • Hypothermic < 35°C
Hemorrhagic Shock

• Evaluation:
  • Identification of source:
    • Physical examination / inspection
    • Radiographs
    • Focused assessment with sonography for trauma (FAST) scan
  • Intervention
    • Bleeding control – tourniquet, direct pressure, pelvic binder, etc
    • Resuscitation
Resuscitation

- Intravenous fluids
  - Crystalloid isotonic solution → lactated ringers preferred
- Blood products
  - Emergency release blood – O negative
  - Packed red blood cells
  - Massive transfusion protocol
    - 1:1:1 ratio of pRBC : plasma : platelets
- Continued evaluation
  - Urine output (goal: ≥ 30 cc/h)
  - Lactate (goal: < 2.5 mmol/L)
  - Base deficit (goal: -2 to +2)
Secondary Survey

- Follows completion of primary survey
  - Once resuscitation efforts are underway, hemodynamic improvement
- Head to toe evaluation of the patient including repeat vital signs
- Obtain as much of a history as possible
- Obtain all necessary diagnostic studies
  - Labs
  - Imaging
    - ± Lateral view C-spine
    - “Pan Scan”
      - CT Head, CT C-spine, CT Chest, CT Abdomen/Pelvis
        - Contrasted studies
        - Thoracic / lumbar spine on CT A/P
Tertiary Survey

• Full, repeated head-to-toe examination within 24 hours of injury
  • 12% of injuries missed in polytrauma missed in first 24 hours
    • 36% decrease in missed injuries with use of standardized tertiary survey
• Workup any new or different findings
Orthopedic Injuries

- Life > limb
  - Especially in the setting of polytrauma patient
- Many orthopedic injuries affect patient mortality
Ortho Trauma Urgencies & Emergencies

• Fractures / dislocations
  • Open
    • Associated with vascular compromise
      • Unstable pelvis
      • Knee dislocation
• Compartment syndrome
• Traumatic amputation
• Spine Injury with neurologic Deficit
Open Fractures

• Emergent management
  • **Antibiotics**
  • Bedside irrigation
  • Absorptive dressing
  • Reduction & immobilization
  • Tetanus

• Definitive management
  • Consensus is to take to OR *as soon as possible* after life threatening conditions stabilized
    • Timing of debridement has NOT been associated with infection
    • Early administration of antibiotics leads to decreased rates of infections
  • Continue antibiotics until operating room
Knee Dislocation

- Emergent management
  - Control hemorrhage if present
  - Reduction & knee immobilizer
    - Neurovascular exam
      - ABI < 0.9 – CT angiogram / consult vascular
      - ABI > 0.9 – serial examinations
Unstable Pelvic Fractures

• Emergent management
  • Identification and bleeding control
    • Pelvic binder / sheet
  • Resuscitation
    • Associated with blood loss (up to 4L)
    • Nonresponsive: angiography, ORIF
• Evaluation of concurrent injury
  • Genitourinary
  • Reproductive
  • Neuro / vascular
Compartment Syndrome

- Emergent management
  - Remove splint or dressing
  - Clinical assessment
    - Intra-compartment pressure monitor
  - OR for fasciotomy **NOW**
Traumatic Amputation / Mangled Extremity

- Emergent management
  - Control bleeding
Spine Injury with Neurologic Deficit

• Emergent management
  • Prevention of further injury
    • Spine precautions
    • Log roll procedures
    • Cervical spine collar
    • ± bedside traction
  • CT ± MRI if time allows
• Complete and thorough, well documented assessment
  • Repeat assessments
Damage Control Orthopaedics

• Concept of delaying definitive treatment until physiology has improved
• Staging definitive management to avoid additional trauma to patient during a vulnerable physiologic period
  • Still controversial timing decision

• Replaced the 1980’s philosophy of Early Total Care (ETC)—fixing long bone and complex fractures as soon as possible because patients were “too sick not to operate”
  • ETC led to exacerbation of “second hit” in subset of patient with instability
• Injury Severity Score (ISS)
  • Three highest AIS values (from different anatomic areas)
    • Each value squared then added (sum)
  • Bilateral injuries are counted once
New Injury Severity Score (NISS)

• Three highest AIS values regardless of anatomic region are utilized
• May be a better predictor of morbidity and mortality
Damage Control Orthopaedics

- Indicated if:
  - ISS > 20 with thoracic trauma or ISS > 40 without thoracic trauma
  - GCS ≤ 8
  - Multiple injuries in setting of severe pelvic/abdominal trauma and hemorrhage
  - Bilateral femur fractures
  - Hypothermia < 35°C
  - Pulmonary contusion
  - AIS ≥ 3 with head injury
  - IL-6 values > 500 pg/dL
- Stabilization with plans for staged definitive management
  - External fixation
  - Skeletal traction
Acute Inflammatory Window

• 2 – 5 days after trauma
• Surge in inflammatory markers → ↑ acute respiratory distress syndrome and multisystem organ failure

• Only life-threatening injuries should be treated in this period:
  • Includes unstable pelvic fractures, compartment syndrome, fractures with vascular injuries, unreduced dislocations, traumatic amputations, unstable spine fractures, cauda equina syndrome, open fractures
Early Appropriate Care

- Identifies trauma patients and timing of most critical injuries while appreciating and minimizing secondary inflammatory response
- Guided by laboratory data
  - Lactate < 4.0 mmol/L
  - pH > 7.25
  - Base Excess > 5.5 mmol/L
- Optimal timing to OR within 36 hours
- Goals:
  - Decrease complications
  - Early mobilization
Multi-System Organ Failure

- Many theories surrounding etiology
- High incidence of mortality
- May be related to imbalance between inflammatory mediators
Acute Respiratory Distress Syndrome

• Clinical manifestations
  • Acute onset
  • Fever
  • Tachycardia
  • Hyperventilation
  • Diagnostics
    • Leukocytosis
    • Bilateral infiltrates on chest XR
• High incidence of mortality
  • Predictive of disseminated intravascular coagulation, acute renal failure, shock,

• Physiologic response to trauma
  • Systemic Inflammatory Response Syndrome (SIRS)
  • “First Hit” phenomena
  • Pro-inflammatory cytokine response

• Diagnostics
  • Leukocytosis
  • Bilateral infiltrates on chest XR

• High incidence of mortality
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PEARLS

• Evaluation of polytrauma patient guided by ATLS protocol
• Collaborative approach with emergency department, trauma/general Surgery, vascular, neurosurgery, intensivists, and orthopedics from start to finish
• Recognition of indications for and implementation of damage control orthopedics
  • Address time sensitive urgencies and emergencies to ↓ morbidity/mortality
• Examine your patients the same way EVERY time
  • Don’t skip portions of exam based upon diagnosis “called for”
  • Take off splints – see with your own eyes!
• Know your resources and protocols for your hospital
• Remember, you are the orthopedic expert


OTA educational lectures.