Trauma and Critical Care
Resuscitation

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UTMC-K Level 1 Trauma Center

- Regional Teaching Hospital
- Surgery Residency and Surgical Critical Care Fellowship
- 250 mile Radius Level 1 Trauma Center Service Area Covering 4 States
- 3425 Trauma Admissions 2004
- 24 Bed Dedicated Trauma/Neuro Intensive Care Unit
- 30% Trauma ICU Admission Rate
Epidemiology

- U.S. trauma related costs exceed $400 billion dollars annually
- MVC’s account for 70% of trauma morbidity and mortality
- Leading cause of death in persons aged 1 – 44 years
- 60 million injuries per year occurs in the U.S.
  - Results in an average of 36.8 million hospital visits per year (40% of all ED visits)
Epidemiology

- Injury is a disease
- It has a “host” and “vectors”
  - The patient is the host
  - Vectors include cars, motorcycles, ATVs, PWCs, et al
- The prevention, research and treatment of trauma is woefully under funded compared to infectious disease, heart disease and cancer
- Trauma continues to affect the most productive members of society and particularly our most valuable national resource, children
A Typical Day in the Trauma Center

- It’s a beautiful day in East Tennessee
- You have had 2 cups of coffee
- Your only patient is just waiting on a floor bed, has a PCA, foley and feeds themselves
- Your biggest decision so far today is…
  .....”Do I want the sirloin or grilled salmon from STEAKOUT Delivery”…..
- Finally, a nice QUIET day…and then it starts
13: Inbound Trauma
N432UT 1PT(S) Arrive
UT: 10:26 FULL ALERT
10:21AM 02/04/06
10: MOD ALERT GSW TO HEAD A % O, VSS/BLEED CONTROLLED ETA 7 MIN FEMALE
08: Inbound Trauma
N431UT 1PT(S) Arrive
UT: 13:23 MODIFIED
ALERT
The Trauma System & Notification

The Page Out
- Modified Alert
  - Stable VS, not intubated
- Arriving via LifeStar
- ETA is 5 minutes
- Today’s weather, 40 degrees/light rain

LifeStar’s Radio Call
- 34 y/o male
- MVC URD, ejected, + LOC, L femur deformity, decreased BS on the left, no visible movement of the lower extremities, responded to a fluid challenge
What are you thinking about possible injuries?

- Think head to toe
- Think worse case scenario and work backwards
- Maintain a high index of suspicion
- Never assume anything!
What did LifeStar See?
The Trauma Assessment

Getting the Trauma Bay Ready

- Staff at the bedside
  - Trauma Response Team (Attending, Resident, PA/NP, 2 RN’s)
  - X-ray, Lab, Respiratory Therapy

- Necessary Equipment
  - Airway Box/Ventilator/Oxygen
  - Pre-assembled IVF’s
  - Level 1 Infuser
  - Monitor/Manual BP cuff
  - Medications
**The Trauma Team**

**Diagram**

**Head – MD/MLP**
Team Leader, examines head to chest, Manages ABC’s

**Lead Trauma RN**
Assessment, Vitals, IV Access, Assist Team Leader, Documentation

**Right 1 – MD/MLP**
FAST U/S, upper extremity, soine & abdomen exam, chest tube

**Trauma Assist RN/Paramedic**
IV access, operate Level 1 infuser, blood products, meds

**Right 2 – MD/MLP**
Femoral access/blood, rectal, foley, lower extremity exam

**Left 1 – MD/MLP**
Extremity exam, chest tube, admit H&P

**Out of the box:**
X-ray, lab, security, chaplain, unit secretary, patient representative, bystanders

**Attending Trauma Surgeon**
Supervises all activities
The Trauma Assessment
The Trauma Assessment

Primary Assessment

Airway
  – Clear, talking

Airway

Airway

Airway

Airway

Airway

Airway
The Trauma Assessment

Primary Assessment

**Breathing**
- Absent breath sounds on left
- Rate >40/min, Pulse Ox 85%

**Circulation**
- HR 110 thready, SBP 100, distal pulses 1+
- No obvious bleeding, left thigh is swollen/firm
- IV Access
  - Minimum (2) 14 gauge sites or Central High Flow Line
  - Use Warmed LR
The Trauma Assessment

Primary Assessment

**Disability**
- Brief Neurologic Assessment
  - GCS is 13 (confused, sleepy)
  - Weak upper and no lower extremity movement
  - Pupils are 4mm, equal, reactive

**Exposure**
- Completely Undress
- Warm blankets to prevent hypothermia
Trauma Assessment

Adjuncts to the Primary Survey

- Obtain ABG
  - Ph 7.25, PCO2 50, PO2 64, O2 Sat 90%, HCO3 17, Base -7
- Attach Cardiac Monitor
  - Sinus Tach
- Order initial labs and x-rays
  - CBC, UA, T & C, Coags, CXR, Trauma CT Scan, L femur xray
- Perform FAST U/S
- Reassess ABC’s
  - Airway clear
  - Breathing - more labored and shallow, O2 sat 89% on NRB
  - Circulation - HR120, SBP 95 (after 2 L fluid bolus)
Trauma Assessment

Secondary Survey & Management

- Finger and Tube in every hole & Flip
  - Foley, NG, Rectal
- Give pain and sedation medications as needed
- Head to Toe Examination
- History – PMH/PSH, meds/allergies
- Interventions
Chest X-rays
What happens if you forget your ABC’s?
Trauma Assessment

- Physical Exam findings
  - Posterior C-spine tenderness
  - Decreasing level of consciousness (GCS 8)
  - Seat belt sign over chest and abdomen
  - Bilateral breath sounds after the chest tube
  - Abdomen is distended and without tenderness, no rectal tone
  - Deformed mid thigh, cool to touch, delayed cap refill
  - Left DP/PT barely palpable
  - Minimal upper extremity flexion, flaccid lower extremities
Trauma Assessment

- Your lab results and X-Rays
  - H/H 6.9/20; UA trace blood; INR 2.5
  - FAST Exam showed splenic renal interface and pelvic free fluid
  - 2nd ABG – pH 7.19, pCO2 53, pO2 85, HCO3 15, Base -9

- Vital signs after the secondary survey
  - HR 130, SBP 80 (after 4L LR), O2 Sat 96%
  - RR more rapid and shallow, struggling on NRB
Without A, there is no B, Without B, there is no C

- Constantly recheck your ABC’s
- This patient is on the verge respiratory arrest due to:
  - Chest trauma, pneumothorax
  - Increased work of breathing due to C-spine injury and subsequent diaphragm paralysis
- Rapid Sequence Intubation
  - Analgesia – Morphine or Fentanyl
  - Sedation – Versed or Etomidate
  - Paralyzing Agent – Succinylcholine or Vecuronium
CT Scan and X-Rays
CT Scan and X-Rays
Identifying Injury

Let’s list the injuries

- Closed head injury w/decreasing GCS
- C-spine injury w/quadraplegia
- Left Pneumothorax
- Grade 2 spleen laceration
- Left femur fracture
- Hemodynamic Instability
Stabilization and Definitive Treatment

- Call the OR
- Notify orthopedic & neurosurgeon
- Give fluids/blood products through the high flow line
  - Continue LR
  - PRBC’s, FFP, Platelets
- Continue to warm to >97 degrees
- Transfer the patient to the OR for definitive hemostasis
  - Exploratory Laparotomy
  - Left Femur ORIF
What did the surgeons find?

- 2L blood in abdomen
- Splenectomy performed
- No other intraabdominal injuries
- 1L blood loss from femur intramedullary nail
- Received 8u PRBC’s, 8u FFP and 10,000cc crystalloid
Your patient arrives in the Surgical Critical Care Unit

- Abdomen is open and vac packed
- HR 125, SBP 82
- On full Vent Support
- End of case HCT 21
- Patient is starting to emerge from anesthesia
Critical Care Unit Assessment

The Critical Care Unit Team
- MD/MLP
- RN
- Respiratory Therapist
- Pharmacist

Review events & treatment to this point
Order new labs/chest x-ray
- CBC, BMP, ABG, COAGS, CXR
Tertiary Exam (Head to toe) Look for undiscovered injuries
Establish Care & Treatment Plans for 24 hours
Critical Care Unit Assessment

- Continue the resuscitation
  - Endpoints include:
    - UOP > 30cc (0.5cc/kg/hr)
    - Base Deficit < 3
    - Stabilized HCT and SBP without pressor support

- Sedation & Analgesia
  - Narcotics, PRN & Drips
    - Fentanyl, Morphine
  - Amnesics & Anxiolytics
    - Versed, Ativan, Propofol
Critical Care Unit Assessment

- Communicate with your secondary patient
  - Have the MD/MLP present if possible
  - Give the family a brief “what to expect” summary before they reach the bedside
  - Identify the next of kin/decision maker
  - “Speak the local language”
  - It’s o.k. to care
Critical Care Unit Assessment

Preventive Measures

- DVT Prophylaxis
  - PAS
  - Lovenox, heparin, IVC filter
  - Ambulation

- PUD Prophylaxis
  - Diet
  - Enteral Feeding
  - H2 blockers & Proton Pump Inhibitors
Critical Care Unit Assessment

- Ventilator Associated Pneumonia Bundle
  - HOB at 30 degrees
  - Oral Care
  - DVT & PUD prophylaxis

- Patient Positioning
  - Reposition every 2 hours
  - Utilize Skin Protection Bed Systems
    - KinAire, RotaRest
The Physiologic Effects of Trauma: CHI/SAH/IPH

**Central Nervous System**
- Sensory/Motor/cognitive deficits
- Loss of basic reflexes

**Cardiovascular**
- Arrhythmias

**Respiratory**
- Impaired respiratory drive

**Renal**
- Electrolyte disorders
- Large volume diuresis

**Gastrointestinal**
- Increased incidence of PUD

**Coagulation**
- Increased bleeding and elevated INR

**Acid Base**
- Impaired respiratory and perfusion causes acidosis

**Common Complications**
- Increased ICP, herniation, brain death
The Physiologic Effects of Trauma

Spinal Cord Injury

Cardiovascular
- Loss of sympathetic vascular tone
- Hypotension
- Bradyarrythmias

Respiratory
- Loss of innervation to diaphragm, abdominal and intercostals
- Increased pCO2, work of breathing
- Prolonged vent support and possible tracheostomy

Renal
- Hypotension causes hypoperfusion and ARF
- Incontinence/Catheterization

Gastrointestinal
- Inability to self feed, requiring enteral feeding
- Hypoalbuminemia, malnutrition

Coagulation
- High risk for DVT/PE
- Requires IVC filter

Common Complications
- Muscle wasting syndrome
- Skin breakdown/decubitus
- Infection
The Physiologic Effects of Trauma

Chest Trauma/Pneumothorax

- Central Nervous System
  - Altered MS due to elevated pCO2
- Cardiovascular
  - Hypoxemia
  - Impaired function with tension PTX
- Respiratory
  - Decreased pO2, elevated pCO2
  - Increased work of breathing
  - Elevated Airway pressures
  - Altered tissue perfusion
- Renal
  - Compensates for elevated pCO2, holds on to HCO3
- Common Complications
  - Atelectasis
  - Respiratory failure
  - Empyema
  - ARDS
  - VAP
The Physiologic Effects of Trauma

Spleen Laceration

Central Nervous System
- Shunting preserves function until late stage

Cardiovascular
- Hypotension
- Hyperdynamic cardiac function
- Decreased tissue perfusion

Respiratory
- Compensatory increased respiratory rate

Renal
- Hypoperfusion causes ARF/CRF (elevated BUN/Cr)

Gastrointestinal
- Decreased gastric pH and increased risk for PUD
- NPO period can cause malnutrition/failure to heal

Coagulation
- Large volume blood loss leads to consumptive coagulopathy and further hemorrhage

Acid-Base
- Blood loss leads to anaerobic metabolism
- Build up of lactic acid and increased base deficit

Common Complications
- High risk for encapsulated bacterial infections
- At risk for OPSS (Overwhelming Post Splenectomy Sepsis)
- Must give H. flu, Meningococcal & S. Pneumo vaccines
The Physiologic Effects of Trauma
Femur Fracture

Central Nervous System
- Alerted MS, seizure coma due to fat emboli

Cardiovascular
- Tachycardia, hypotension due to blood loss
- Blood loss can be 1-2L in the thigh
- Possible arterial occlusion around fracture site

Respiratory
- Fat Emboli Syndrome
  - Inflammatory and obstructive mechanism
- High risk for DVT, PE
The Physiologic Effects of Trauma

Hypothermia

- Central Nervous System
  - CNS depression
- Cardiovascular
  - Bradycardia (not vagal mediated)
  - Hypotension
- Coagulation
  - Increased bleeding due to cold related factor dysfunction
- Acid – Base
  - Worsening acidosis
Questions or Comments?
Contact Information

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