Initial Management of the Injured Patient

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No Disclosures.
Why the ABCs?

• Trauma = leading cause of death for age 1-44 yrs

• ABCs during the Golden Hour
  – preventable deaths
  – problem recognition
  – management
Trimodal distribution of trauma deaths.

Sauaia et al., *J Trauma* 1994
Trimodal distribution of trauma deaths.

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The Golden Hour

- Treat the greatest threat to life
- Treat without a definitive dx
- Treat without a complete hx
- Rapid assessment
- Prompt resuscitation

ABC Approach
The Golden Hour

- **A** = Airway with c-spine protection
- **B** = Breathing
- **C** = Circulation, stop the bleeding
- **D** = Disability/Neurologic status
- **E** = Exposure and Environment
Starting with the ABCs

A = Airway
Airway: Problem Recognition

- Objective Signs – Airway Obstruction:
  - agitation, cyanosis = hypoxia
  - obtundation = hypercarbia
  - abnormal sounds
  - tracheal location
  - external trauma
Airway: Problem Recognition

- **Altered Consciousness**
  - closed head injury
  - intoxication

- **Maxillofacial Trauma**
  - hemorrhage
  - dislodged teeth
  - mandible fracture
Airway: Problem Recognition

• **Penetrating Neck Trauma**
  – laceration of trachea
  – hemorrhage with deviation
  – pt may initially maintain airway

• **Blunt Neck Trauma**
  – disruption of the larynx
    ➢ hoarseness
    ➢ subcutaneous emphysema
Penetrating Neck Injuries

Hemodynamically Unstable
Uncontrolled Hemorrhage
Hard Signs*

Penetrating Neck Injury

Operative Exploration

* Hard signs = expanding hematoma
  massive hemoptysis
Penetrating Neck Injuries

**Penetrating Neck Injury**

- Hemodynamically Unstable
  - Uncontrolled Hemorrhage
  - Hard Signs*

- Hemodynamically Stable
  - Soft Signs*

- Zone I
- Zone II
- Zone III

- CTA neck/chest

- Angioembolization for Zone III

* Hard signs = expanding hematoma
  massive hemoptysis

** Soft signs = dysphagia
  venous bleeding
  subcutaneous emphysema
  hoarseness

Operative Exploration

Angiography esophagram bronchoscopy
Penetrating Neck Injuries

PENETRATING NECK INJURY

Hemodynamically Unstable
Uncontrolled Hemorrhage
Hard Signs*

Hemodynamically Stable
Soft Signs*

Asymptomatic

Zone I
CTA neck/chest

Zone II
Angioembolization for Zone III

Zone III
Transcervical GSW
All Others

Operative Exploration

Observe

* Hard signs = expanding hematoma
massive hemoptysis

** Soft signs = dysphagia
venous bleeding
subcutaneous emphysema
hoarseness
KEY CONCEPT

A always includes C-spine immobilization!

Assume this. Do this.
Airway: Management

• Airway Maintenance Techniques:
  – chin lift
  – jaw thrust
  – oral airway
  – nasal trumpet

• Definitive Airway:
  – oral or nasal intubation
  – surgical airway
Airway: Cricothyroidotomy

Vertical skin incision – make it longer than you think you need....
Airway: Cricothyroidotomy

Incise the cricothyroid membrane.
Consider a trach hook to stabilize.
Airway: Cricothyroidotomy

Place a 6-0 endotracheal tube.
Airway: Take Home Points

- Suspect impending airway obstruction
- C-spine immobilization
- Provide definitive airway
- Check patency, tube position
- Intubation unsuccessful → surgical airway
Starting with the ABCs

B = Breathing
Breathing: Preventable Deaths

- **Assess** = “Look - Listen - Feel”

- **9 Thoracic Injuries:**
  - pneumothorax
  - hemothorax
  - flail chest/pulmonary contusion
  - cardiac tamponade
  - blunt cardiac injury
  - aortic disruption
  - diaphragm rupture
  - tracheobronchial injury
  - traversing mediastinal wounds
Breathing: Problem Recognition

- **Objective Signs – Inadequate Ventilation:**
  - asymmetric chest rise
  - labored breathing
  - absent breath sounds
  - tachypnea
  - pulse oximeter
    (indirect measure)
The patient’s hemodynamic status dictates imaging and management.

If unstable → U/S, chest tube
If stable → CXR
Tension Pneumothorax

- “One-way-valve” air leak
- Blunt or penetrating mechanism
- Absent breath sounds
- Hemodynamic instability

CLINICAL DIAGNOSIS
- immediate decompression
Simple Pneumothorax

- Lung laceration with air leakage
- Penetrating or blunt mechanism
- Decreased breath sounds
- Hyperresonance
- BP stable

- Tx = small chest tube
Open Pneumothorax

- Defect of chest wall
- Air passes preferentially through defect
- Hypoxia & hypercarbia

- Tx = occlusive dressing on 3 sides until CT placed
Hemothorax

- Lung laceration or intercostal vessel
- Diminished breath sounds
- Bleeding often self-limited
- <10% require thoracotomy

- Tx = 28 Fr chest tube

If > 1000cc (penetrating) or 1500cc (blunt) → thoracotomy
KEY POINT

Upright film – layering.
Supine film – generalized opacity.
Always check a follow-up film.
Make sure blood is evacuated.
Flail Chest / Pulmonary Contusion

- Segment without bony continuity
- Asymmetric movement
- Crepitus
- Contusion → cause of hypoxia

- Tx = pain control, intubation if marked hypoxia
Cardiac Tamponade

- Penetrating mechanism is most common
- Diagnosis with ultrasound
- CVP line if in question
- Tx = pericardiocentesis then OR
Blunt Cardiac Injury

- Contusion to any chamber
- Rarely rupture
- Tachycardia common
- EKG

Tx = 24° of telemetry, management of arrhythmias, cardiogenic shock
Descending Torn Aorta

- Incomplete tear near ligamentum arteriosum
- Contained hematoma
- **X-ray findings:**
  - wide mediastinum
  - obliterated aortic knob
  - deviation of trachea
  - depressed left bronchus
  - deviation of esophagus
  - apical capping
Descending Torn Aorta

- **Empiric treatment in ED**
  - esmolol gtt with goal
    - SBP < 100, HR ~ 60

- **Multislice helical CT scan**

- **Tx = operative repair vs. stent graft**
Diaphragm Rupture

- **Blunt** = radial tear, often on left
- **Penetrating** = linear lac
- **CXR** for diagnosis

- **Tx** = operative repair via the abdomen
Tracheobronchial Injury

- Within 1 inch of carina
- Hemoptysis, subQ emphysema
- Persistent PTX, continuous air leak
- Bronchoscopy

- Tx = watch vs. glue vs. operate
Transmediastinal Wounds

- Location of external wounds
- CXR and abdominal film
- ABCs, neuro exam
- Hemodynamics determines imaging:
  - stable – CTA, triple eval
  - unstable – OR
PITFALL

Injured space plus 1 above/below.
Breathing: Take Home Points

• Look, listen, feel

• Adequate airway $\neq$ adequate ventilation

• HD status determines imaging

• Tension PTX = clinical dx

• Chest tube is often definitive therapy
Starting with the ABCs

C = Circulation
Circulation: Causes of Shock

- **Hypovolemic = Hemorrhage:**
  - 5 spaces = scalp/street, chest, abdomen, pelvis, long-bones

**Fractures:**
- rib = 100-200 cc
- tibia = 300-500 cc
- femur = 800-1200 cc
- pelvis = 1500 cc and up
Circulation: Causes of Shock

- **Cardiogenic:**
  - tension PTX
  - cardiac tamponade
  - blunt cardiac injury
  - air embolism
  - primary cardiac disease

- **Neurogenic:**
  - spinal cord injury

- **Septic**

Differentiate these with PE, FAST, EKG, films
FAST Exam

- 4 views of abdomen
- >200cc of fluid
- Single snapshot
If persistent or recurrent hypotension, remember FAST isn’t 100% accurate!
Circulation: Preventable Deaths

- Hypotension = Hemorrhage

- Assess:
  - level of consciousness
  - pulse / skin color

- Address:
  - massive hemothorax
  - cardiac tamponade
  - external bleeding
  - massive hemoperitoneum
  - unstable pelvic fracture
KEY CONCEPT

Patient in shock →
crystalloid infusing?
massive transfusion protocol?
External Hemorrhage

- Apply direct manual pressure
- Don’t indiscriminately use clamps
- Tourniquet if amputation
Massive Hemoperitoneum

- Consider mechanism
  - X-rays if penetrating
- FAST is often diagnostic
- DPA if patient remains unstable
- Tx = emergent OR
Blunt Abdominal Trauma

Hemodynamically Stable
Blunt Abdominal Trauma

- Hemodynamically Stable
  - No
  - FAST +
    - Yes
      - LAPAROTOMY
Blunt Abdominal Trauma

Hemodynamically Stable

FAST +

No

Equivocal

Yes

DPA

+ LAPAROTOMY
Blunt Abdominal Trauma

- Hemodynamically Stable
  - No
  - Yes

- FAST +
  - No
  - Yes
    - Equivocal
      - Yes
        - LAPAROTOMY
      - No
        - DPA
          - +

- Peritonitis?
  - Yes
  - No
Blunt Abdominal Trauma

Hemodynamically Stable

- Yes
- No

FAST +

- Yes
- No

Peritonitis?

- Yes
- No

Equivocal

- Yes
- No

DPA

- LAPAROTOMY
- FAST +
Hemodynamically Stable

**FAST +**

Equivocal

**DPA**

**LAPAROTOMY**

Peritonitis?

**FAST +**

Abdominal CT
Blunt Abdominal Trauma

Hemodynamically Stable

- Yes
- No

FAST +

- Yes
- No

Equivocal

DPA

- Yes
- No

LAPAROTOMY

Peritonitis?

- Yes
- No

FAST +

- Yes
- No

Abdominal CT

Indications for CT:
- Altered mental status
- Confounding injury
- Gross hematuria
- Pelvic fracture
- Abdominal tenderness
- Unexplained Hct<35%
Blunt Abdominal Trauma

Hemodynamically Stable

- Yes
  - Peritonitis?
    - Yes
      - FAST +
    - No
      - Repeat FAST in 30 minutes

- No
  - FAST +
    - Equivocal
      - DPA
        +
          - LAPAROTOMY
    - FAST +
      - Yes
        - Abdominal CT
      - No
        - Repeat FAST in 30 minutes

Indications for CT:
- Altered mental status
- Confounding injury
- Gross hematuria
- Pelvic fracture
- Abdominal tenderness
- Unexplained Hct<35%
Penetrating Abdominal Trauma

Hemodynamically Unstable

Penetrating Abdominal Trauma

Operating Room
Penetrating Abdominal Trauma

Penetrating Abdominal Trauma

Hemodynamically Unstable

Hemodynamically Stable

Operating Room
Penetrating Abdominal Trauma

Hemodynamically Unstable

Penetrating Abdominal Trauma

Hemodynamically Stable

GSW

Anterior Abdomen

RUQ

Tangential* Back/Flank

CT Scan

Operating Room

*Tangential GSWs may also be evaluated with diagnostic laparoscopy.
Penetrating Abdominal Trauma

Penetrating Abdominal Trauma

Hemodynamically Unstable

Hemodynamically Stable

GSW

Anterior Abdomen

RUQ

Tangential* Back/Flank

CT Scan

Operating Room

SW

Back/Flank

RUQ

AASW with + LWE

CT Scan

Serial Exams and Labs

*Tangential GSWs may also be evaluated with diagnostic laparoscopy.
Penetrating Abdominal Trauma

Penetrating Abdominal Trauma

Hemodynamically Unstable

Hemodynamically Stable

GSW

Anterior Abdomen

RUQ

Tangential* Back/Flank

CT Scan

Operating Room

Left-sided thoracoabdominal

DPL vs. laparoscopy

SW

Back/Flank

RUQ

AASW with + LWE

CT Scan

Serial Exams and Labs

*Tangential GSWs may also be evaluated with diagnostic laparoscopy.
Unstable Pelvic Fracture

- Exam/film PLUS shock
- "Sheet" the pelvis
- R/O associated injuries:
  - rectal exam → bone? blood?
  - vaginal exam → lacerations?
  - GU exam → bladder/urethral injury?
  - perineal exam → degloving? open fx?
Pelvic Fracture Protocol

CT scan of abdomen/pelvis

Hemodynamically Stable?

Yes
Pelvic Fracture Protocol

CT scan of abdomen/pelvis

Hemodynamically Stable?

Yes

Massive Transfusion Protocol
R/O Thoracic Source
“Sheet the Pelvis”

No

FAST Exam / DPA
Pelvic Fracture Protocol

CT scan of abdomen/pelvis

Hemodynamically Stable?

Yes

Massive Transfusion Protocol
R/O Thoracic Source
“Sheet the Pelvis”

No

FAST Exam / DPA

Positive

Operating Room
Pelvic Fracture Protocol

CT scan of abdomen/pelvis

Hemodynamically Stable?

Yes

Massive Transfusion Protocol
R/O Thoracic Source
“Sheet the Pelvis”

No

FAST Exam / DPA

Positive

Operating Room

Negative

Control of pelvic fracture bleeding
Pelvic Fracture Protocol

CT scan of abdomen/pelvis

Hemodynamically Stable?
Yes
No

Massive Transfusion Protocol
R/O Thoracic Source
“Sheet the Pelvis”

FAST Exam / DPA

Positive
Operating Room

Negative

angioembolization or pelvic packing
Pelvic Fracture Protocol

CT scan of abdomen/pelvis

Hemodynamically Stable?
- Yes
- No

Massive Transfusion Protocol
R/O Thoracic Source
“Sheet the Pelvis”

FAST Exam / DPA
- Positive
- Negative

Operating Room

2 units pRBCs in the ED
- HD Stable
- HD Unstable

SICU +/- CT scans**

Operating Room:
- Pelvic Fixation
- Pelvic Packing
- Re-ultrasound Abdomen
- Assess Chest Tube Output

** normalize coagulation status, abdominal CT scan if no laparotomy done.
PITFALLS

• Elderly – limited reserve

• Children – abundant reserve, decompensate late

• Athletes – “relative” tachycardia

• Drugs – Rx and illegal

• Be wary of the transient responder…..
Resuscitative Thoracotomy

Patient Undergoing CPR
---
No Signs of Life*

Profound Refractory Shock

Blunt Trauma
CPR < 10 min

Penetrating Torso Trauma
CPR < 15 min

Penetrating Non-Torso Trauma
CPR < 5 min

Resuscitative Thoracotomy

*no respiratory or motor effort, electrical activity, or pupillary activity

Dead
Resuscitative Thoracotomy

- Arm over head
- Generous incision
- Curve into axilla
- Correct position of rib spreader
Resuscitative Thoracotomy

Patient Undergoing CPR — No Signs of Life*

Profound Refractory Shock

Blunt Trauma
CPR < 10 min

Penetrating Torso Trauma
CPR < 15 min

Penetrating Non-Torso Trauma
CPR < 5 min

Yes

Resuscitative Thoracotomy

Cardiac Activity?

No

Tamponade?

No

Dead

No

Yes
Patient Undergoing CPR
---
No Signs of Life*

Profound Refractory Shock

Resuscitative Thoracotomy

Blunt Trauma
CPR < 10 min
--------
Penetrating Torso Trauma
CPR < 15 min
--------
Penetrating Non-Torso Trauma
CPR < 5 min

Resuscitative Thoracotomy

Cardiac Activity?

Tamponade?

Yes

Repair Heart

No

Dead

Yes

No

No

Yes

Repair Heart
Cardiac Injuries in the ED

- Suture repair
- Pledgets optimal
- Staple repair LV if linear wound
- Avoid ligating a coronary

- If asystole → repair then defibrillate
Don’t forget:
  – proper hand position for cardiac massage
  – internal cardioversion paddles
  – intracardiac epi
Resuscitative Thoracotomy

Patient Undergoing CPR – No Signs of Life*

Profound Refractory Shock

Resuscitative Thoracotomy

Blunt Trauma
CPR < 10 min

Penetrating Torso Trauma
CPR < 15 min

Penetrating Non-Torso Trauma
CPR < 5 min

Cardiac Activity?

Yes

Tamponade

Thoracic Hemorrhage

Air Emboli

No

Tamponade?

Yes

Repair Heart

No

Control

No

Hilar X-clamp

Dead

Yes
Resuscitative Thoracotomy

Patient Undergoing CPR — No Signs of Life*

Profound Refractory Shock

Blunt Trauma
CPR < 10 min
———
Penetrating Torso Trauma
CPR < 15 min
———
Penetrating Non-Torso Trauma
CPR < 5 min

Yes

Cardiac Activity?

No

Tamponade?

Yes

Tamponade

No

Thoracic Hemorrhage

Air Emboli

No

SBP < 70, apply Aortic X-clamp

Resuscitative Thoracotomy

Yes

Repair Heart

No

Control

Hilar X-clamp

Dead

No

SBP < 70, apply Aortic X-clamp
Aortic Cross-Clamp

- Below pulmonary hilum
- Can use digital control or Satinsky
Resuscitative Thoracotomy

Patient Undergoing CPR – No Signs of Life*

Profound Refractory Shock

Blunt Trauma
CPR < 10 min

Penetrating Torso Trauma
CPR < 15 min

Penetrating Non-Torso Trauma
CPR < 5 min

Yes

Resuscitative Thoracotomy

Cardiac Activity?

No

Tamponade?

No

SBP < 70, apply Aortic X-clamp

Assess Viability

Tamponade

Repair Heart

Control

Hilar X-clamp

Yes

Thoracic Hemorrhage

Air Emboli

Extrathoracic Hemorrhage

Yes

Tamponade

Repair Heart

Control

Hilar X-clamp

No

Dead
Resuscitative Thoracotomy

Patient Undergoing CPR
- No Signs of Life*

Profound Refractory Shock

Blunt Trauma
CPR < 10 min

Penetrating Torso Trauma
CPR < 15 min

Penetrating Non-Torso Trauma
CPR < 5 min

Yes

Resuscitative Thoracotomy

Cardiac Activity? 
No

Tamponade?
No

Thoracic Hemorrhage
Air Emboli
Extrathoracic Hemorrhage

Yes

Tamponade
Repair Heart
Control
Hilar X-clamp

SBP < 70, apply Aortic X-clamp
Assess Viability
OR

Dead

No
Circulation: Take Home Points

• Hypotension = hemorrhage
• 5 spaces for blood loss
• IV access is key!
  – 2 large-bore peripheral IVs
  – IO needle
  – central line
  – saphenous cut down
Starting with the ABCs

D = Disability
Disability: Brain Injury

- Quick neuro exam
- GCS < 8 severe head injury
- Consider empiric mannitol
- Concern for antithrombotics
- CT imaging

- Tx = ICP monitor and management, OR
Disability: Spine Injury

- Always protect the spine
- Log roll off the backboard
- If one fx, look for another!
- Sensory/motor loss = injury
- Neurogenic shock
  - Bradycardia
  - Tx with pressors
ABCs: Take Home Points

• Systematic evaluation
• Concurrent resuscitation
• Management based upon hemodynamics
• Address life threatening injuries
  – airway obstruction
  – tension/open PTX
  – massive hemoperitoneum
  – cardiac tamponade
  - external hemorrhage
  - massive hemothorax
  - unstable pelvis
Questions?