# Trauma Case Studies

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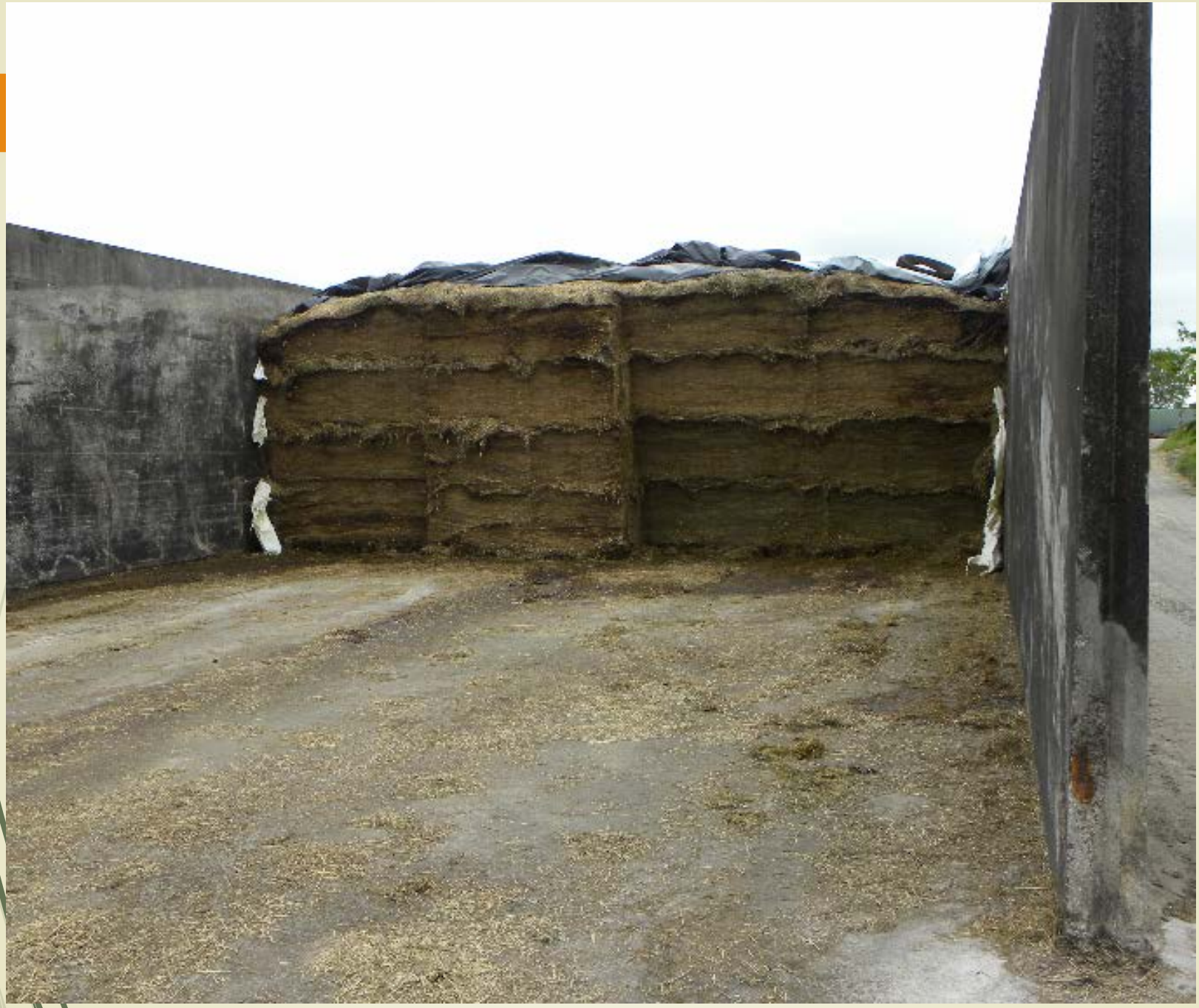
Avera McKennan Hospital

# Fall off Silo

# Fall

- 62 y/o male fell from a silo bunker. 12 hrs elapsed prior to family finding him (winter). He was alert but not able to move.
- ALS Ground
  - 1956: Pt found face down on concrete pad. C-spine manually stabilized. Placed on back board. Pt unable to move extremities. To ambulance.
  - 2010: En route to hospital.  150 - 18 - 80/P - 77% - GCS 15
  - O2 applied NRB @ 10 lpm. Warm blankets, hot packs
  - 2020: Arrive @ facility. O2 sat 80%



# Documentation

- Update with ICD-10
  - Coding of injuries
  - Coding of mechanism
    - Vehicle type
    - Fall from – landed on…
- Documentation
  - Respiratory rate
  - Time of injury

# Fall

- Transferring Facility (2027-2212)
  - Vitals: 84.9 - 35 - 22 - 135/108 - 97% 4L
  - GCS: 11- 4/4/3
  - C-collar placed
  - CT's: Head/C-spine/T-spine/L-spine Chest/Abd/Pelvis
    - Negative for acute spinal fracture
    - Positive for bilateral pulmonary embolisms (PE) causing R) heart strain
  - 2120: Air transport @ bedside
  - Pt remained bradycardic, normotensive, O2 sat 97%, temp 84.9 on discharge from ED
  - 1 liter NS infused

| Hgb | Potassium | Crt |
|---|---|---|
| 15.1 | 7.5 (3.5-5) | 2.5 (<1.3) |

# Priorities in Care

Severe hypothermia

Bradycardia

No spinal fracture

Pulmonary Embolism

High potassium

# Fall

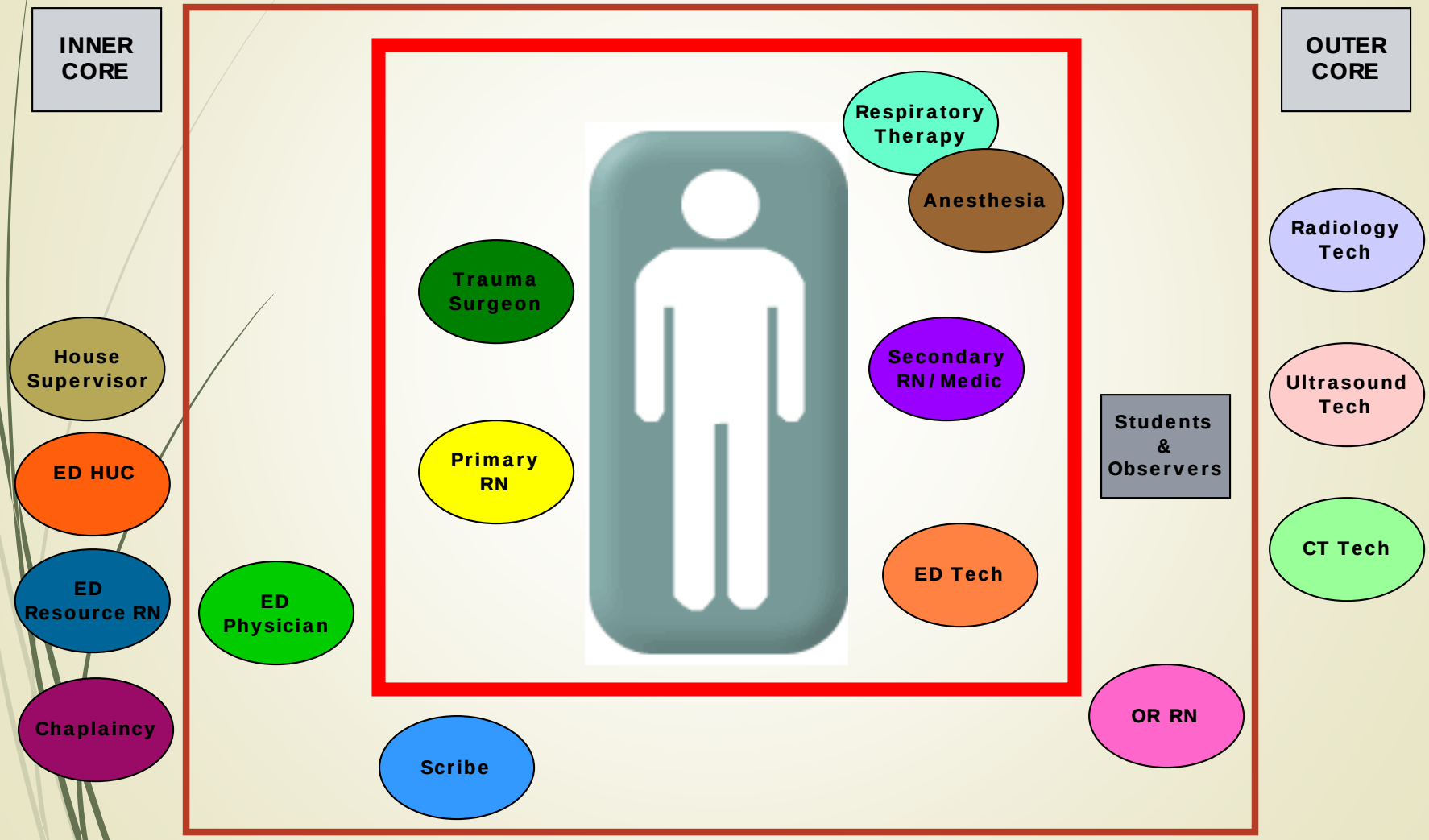
- Air Transport (2125-2240)
  - 2125: HR 30 – RR 14 - 134/98 – O2 sat 95% - GCS 15
  - 2135: “Unable to obtain BP with repeated attempts.”
  - 2207: Lift for Sioux Falls
  - Infused 1 liter NS during transport
  - HR 30s – O2 sat 99% - no further BPs obtained
  - 2240: Land @ Sioux Falls

**Criteria for Adult Level I Trauma Activation**

1. Glasgow Coma Scale < 10
2. Confirmed systolic B/P <90 at any time
3. Heart rate > systolic B/P
4. Airway and/or Respiratory Compromise with mechanism related to trauma or patients in need of an emergent airway including any intubated patients transferred from the scene
5. "Life or limb threatening" penetrating injury to head, neck, torso, groin, & extremities proximal to knee or elbow, including any GSW to these areas
6. Clinical flail chest
7. Paralysis, loss of sensation, and/or suspected spinal cord injury (related to traumatic injury)
8. Amputation proximal to wrist or ankle
9. Transfer patients from other hospital receiving blood to maintain vital signs
10. Burns >20% (partial or full thickness)
11. Uncontrolled arterial bleeding (to include use of tourniquet)
12. Any patient that the ED physician or pre-hospital provider deems necessary

**(Hangings are Level I if GCS <10 or intubated/airway compromise)**

# Avera McKennan Hospital Trauma Service
# Level I Trauma Team Response



# Fall

- Avera ED (2251-2323)
  - Level 1 Activation
  - 84.9 – HR 30 – RR 20 – 103/87 (79/52) - 97%  NC
  - Defibrillator pads placed
  - Warm blankets, increased room temperature, fluid warmer
  - GCS: 14
  - Able to move L)toe, able to flex at elbows
  - Treat high potassium: D50/Insulin/ NA HCO3/Calcium Gluconate
  - Transfer to ICU

# Hypothermia

| | Moderate |
|---|---|
| | Lethargy, hallucinations, loss of pupillary reflexes, EEG abnormalities |
| | Progressive bradycardia (unresponsive to atropine); decreased cardiac output and BP; atrial and ventricular arrhythmias, J (Osborn) wave on ECG |
| | Hypoventilation, decreased oxygen consumption and CO2 production, loss of cough reflex |
| | Cold diuresis |
| | Decreased shivering (<32°C; 89.6°F) muscle rigidity |
| | |
| | |
| | |

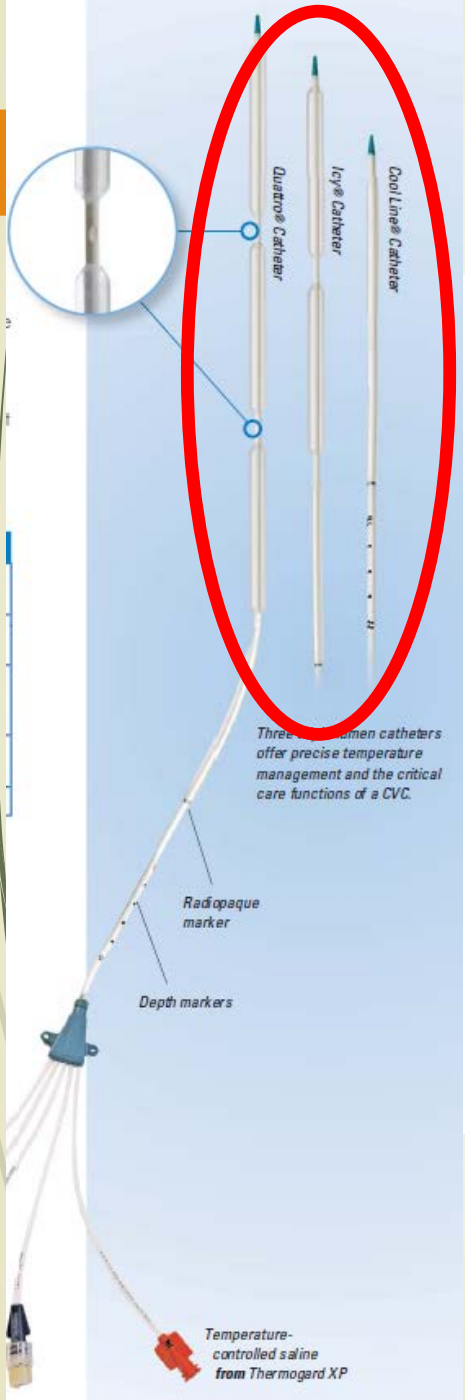
cardiogram; EEG: electroencephalogram.

# Rewarming

| Treatment |
| --- |
| Endotracheal intubation may be necessary in obtunded patients and those with bronchorrhea |
| Treat hypotension with warmed crystalloid (42°C) initially, dopamine if necessary |
| Avoid rough movements and activity, which may induce ventricular fibrillation |
| Rewarming techniques are based on degree of hypothermia |
| • Mild hypothermia: passive external rewarming |
| Remove wet clothing, cover with blankets |
| • Moderate hypothermia: active external and internal rewarming |
| Warmed humidified oxygen, forced air warming systems |
| Beware of initial paradoxical drop in core temperature due to return of cold blood from extremities to core circulation |
| Rewarm trunk first to minimize risk of core temperature afterdrop |
| • Severe hypothermia: active internal rewarming (active core rewarming) and active external rewarming |
| Warmed humidified oxygen, warmed IV fluids (42°C) |
| Pleural and peritoneal irrigation with warm saline (40-42°C) |
| Extracorporeal options: continuous venovenous rewarming, hemodialysis, continuous arteriovenous rewarming, and cardiopulmonary bypass |
| Treatment of arrhythmias |
| • Arrhythmias may persist until patient rewarmed |
| • Ignore atrial arrhythmias with slow ventricular response |
| • Ventricular fibrillation a common rhythm |
| May be precipitated by physical jostling |
| Manage according to ACLS protocol |
| Electrical defibrillation may be attempted but is rarely successful until core temperature is above 30°C |

# Fall

- PTD #1
  - 0030: Zoll rewarming catheter placed
  - Neurosurgery consult
  - MRI
    - Brain/cervical spine/lumbar/thoracic spine
    - Venous dopplers (-)
  - 0200: Heparin gtt started
  - Hypotension-Levophed
  - Normothermic by 0900

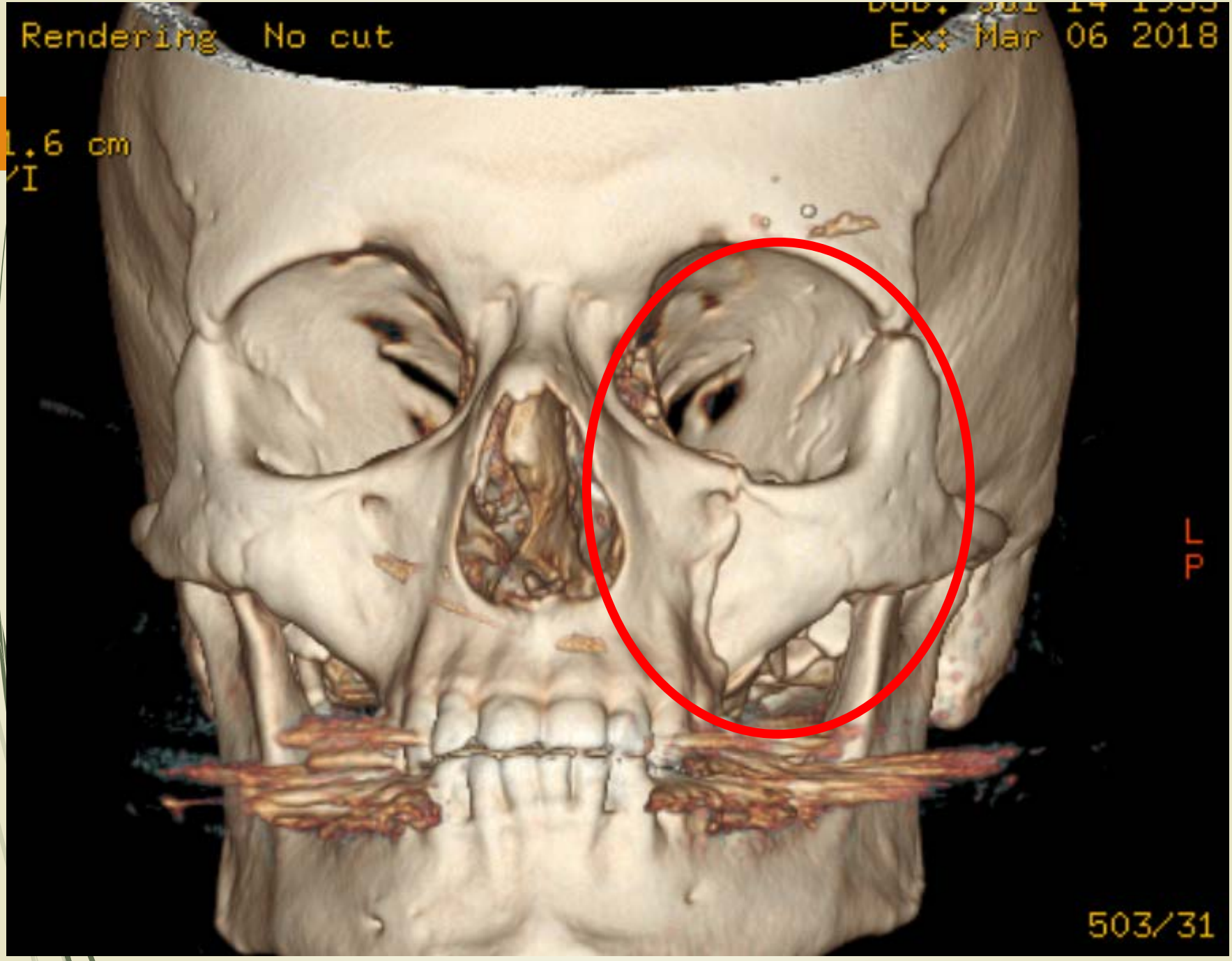

Quattro® Catheter
Icy® Catheter
Cool Line® Catheter
Radiopaque marker
Depth markers
Temperature-controlled saline from Thermogard XP


Important data are clearly displayed on the large screen
Set upper and lower patient temperature alarm limits
Set the target temperature between 31°C and 38°C
Toggle between Standby and Run modes
Visual alarm indicator
Clearly visible coolant temperature indicator
Control mode, target temperature, and rate setting all on one screen.
Choose a cooling/ warming rate
PATIENT TEMP
33.0°C
MAX WARMING
MAX COOLING
TARGET TEMP
RATE
33.0°C
MAX
Target Temp
Rate Deg/Hr
Press for Menu / Enter
Standby / Run
ZOLL

# Fall

- Injuries:
  - 5cm Eyebrow laceration
  - Central cord syndrome w/quadraparesis secondary to C3/4 stenosis
  - Lt orbit fracture
  - Lt maxillary sinus fracture
- Co-morbidities:
  - HTN

**ISS:36**
**Ps: 0.5946**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1.6 cm
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503/31

# Central Cord Syndrome

- Incomplete traumatic injury to spinal cord
  - Hyperextension injury
  - Usually NO obvious associated spinal column fx
  - Anterior and posterior compression d/t edema, hemorrhage or ischemia
- Symptoms
  - More profound motor weakness of the upper extremities & less severe weakness of lower extremities
  - Varying degree of sensory loss
  - Bladder symptoms
- More commonly affects patients >50

AANS.org (2019)

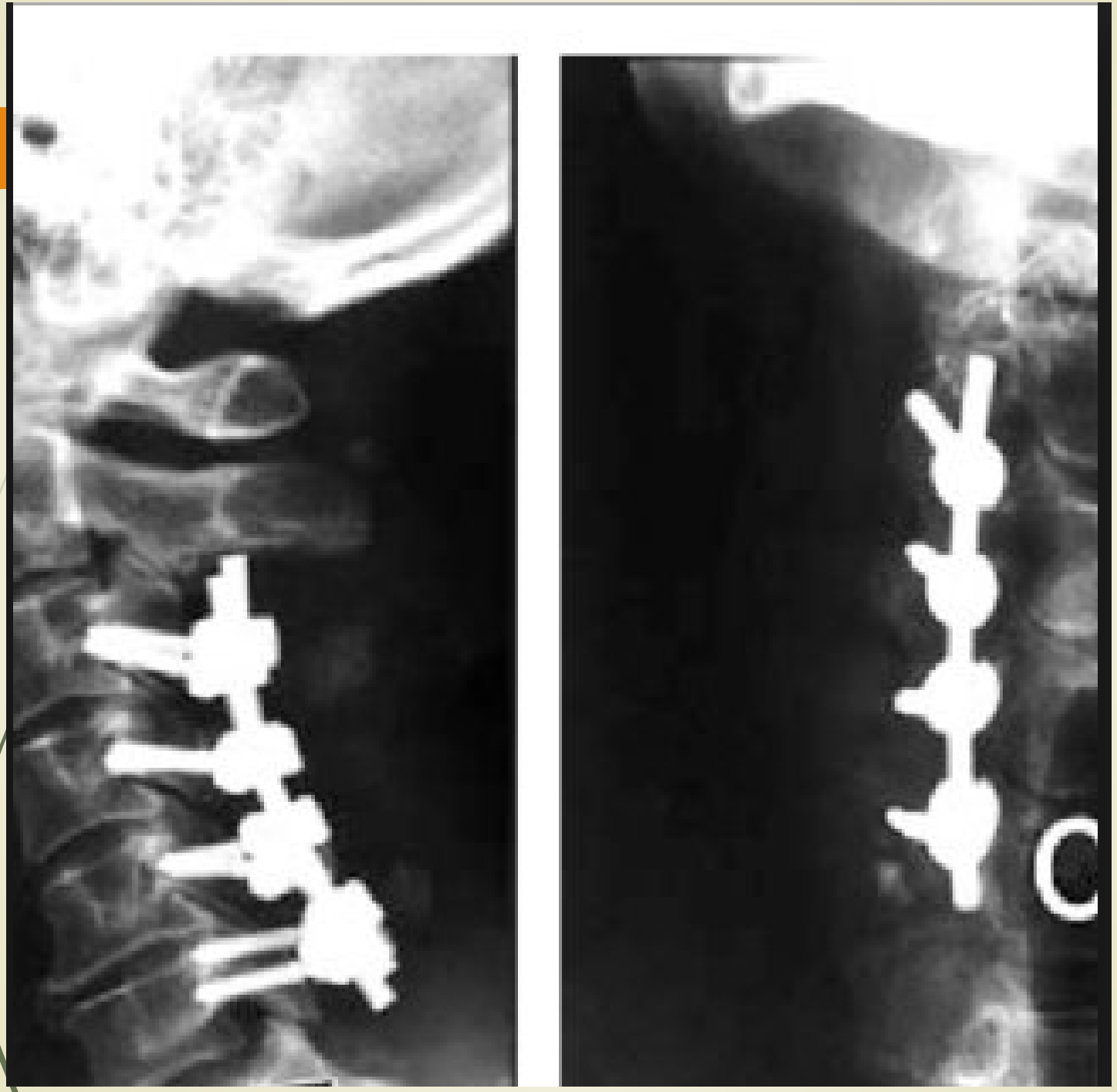
# Central Cord Syndrome

- Diagnosis
  - MRI
  - CT
- Outcomes
  - Many patients spontaneous recovery or considerable recovery in first 6 weeks s/p injury
  - More favorable recovery in younger vs. older patients

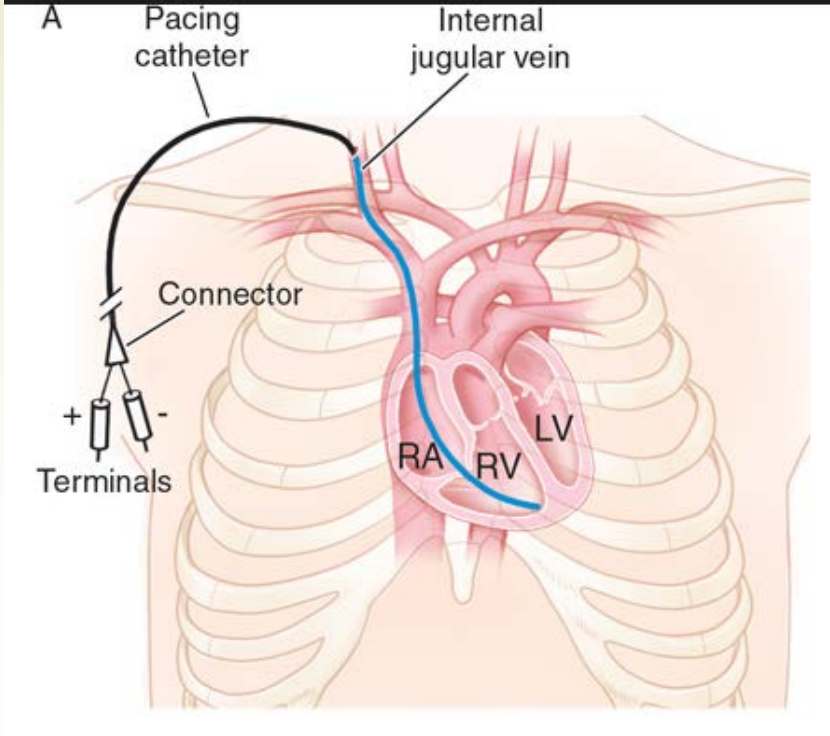
AANS.org (2019)

# Fall

- PTD #2
  - Junctional rhythm (Mg bolus with some improvement)
    - Cardiology consult
  - Surgery (1401-1533)
    - C3-C5 Cervical Laminectomy



# Fall




PTD #3

- Pressors off
- Ok to start activity - PT/OT
- Sitting edge of bed

- PTD #4
  - Extubated
  - Bradycardia - 30's, junctional rhythm
    - Placement of a transvenous pacer
    - Very weak grasp to bilateral hands
    - States he feels like he is getting some strength back to upper extremities

# Fall

- PTD #6
  - I&D with closure of Lt  eye laceration
  - Able to shoulder shrug
  - Very slight movement to RLL
  - Levophed PRN for MAP goal >80
- PTD #7
  - Near normal strength of  bilateral upper extremities from shoulder to elbow
  - Sensation to all extremities, can wiggle bilateral toes
  - Electrophysiologist (EP) to see for possible pacemaker

# Fall

- PTD # 9
  - Bradycardia 30-50’s but asymptomatic
  - Levophed off
  - Plastics to see for facial fractures
  - Physiatry consult
  - Pacing wire pulled
  - Tolerating total lift chair, sitting at edge of bed

# Fall

PTD #10

- 1030-Code Blue
  - Numerous arrhythmias after bedside therapy
  - Bradycardia 20's
  - CPR for 25 minutes, rhythm returned
  - 5 minutes later PEA-code x30 minutes
  - Bedside U/S with Cardiology-RV very dilated and essentially non-functional
  - Labs unremarkable
  - Bedside U/S with no evidence of pneumo or cardiac tamponade

# Fall

- PTD #10 (Con't)
  - 1116-Time of death
  - Family declined autopsy
    - Heparin gtt remained on during his entire stay
      - Off  (for a short period )prior to cervical lami and cardiac wire placement

# How could we improve care?

# Crush Injury

# Crush Injury

- 65 y/o male struck by a fork-lift while @ work. In refrigerator section.
- EMS (1416 - 1442)
  - 69 – 24 – 81% on RA, NRB placed – 150/ - GCS 15
  - C-collar placed, long board
  - Coat/shirt removed
  - 1436: To hospital
  - 1438: IV

# Report to Hospital

Call back #: _____

Patient information: Name: _____ DOB: _____ Age: 50

Sex: (M) / F Wt: _____ Allergies: _____

Chief complaint/HPI: forklift accident
to LOC
back pain immobilized

PMH: _____

Physical exam:

Vitals: BP: _____ Pulse: 66 RR: _____ Sat: 80% O2@: _____ Temp: _____ GCS: 14

# Crush Injury

- McKennan ED (1446 - 1650)
  - 1447: Chest x-ray
  - 99.1 – 82 – **40** – 78% NRB – 73/53 – GCS 14
  - R) flail chest
  - 1450: Level I Trauma Activation

https://www.reddit.com/r/WTF/comments/at9k9i/a_flail_chest_which_can_happen_if_you_break_two/

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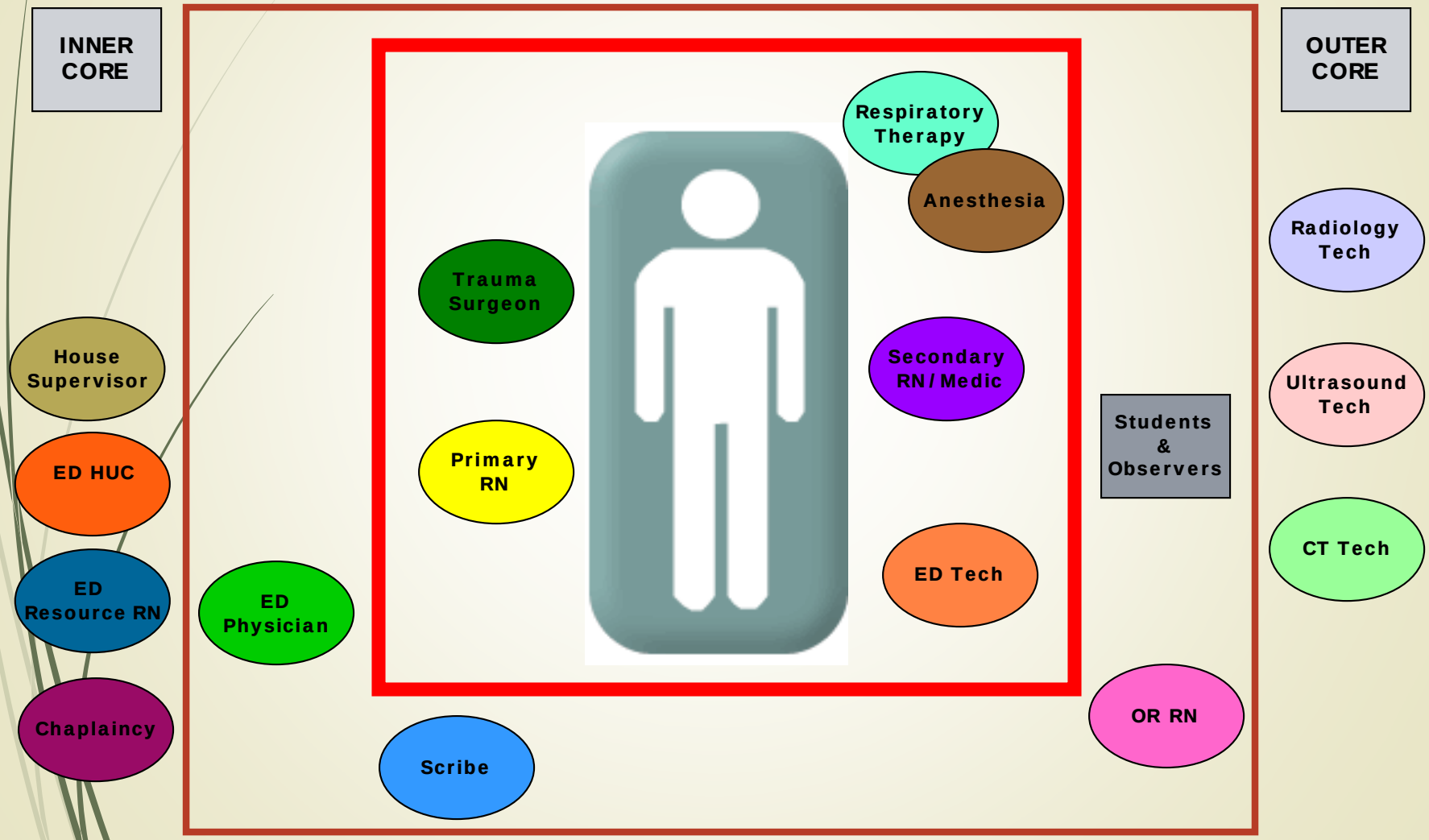

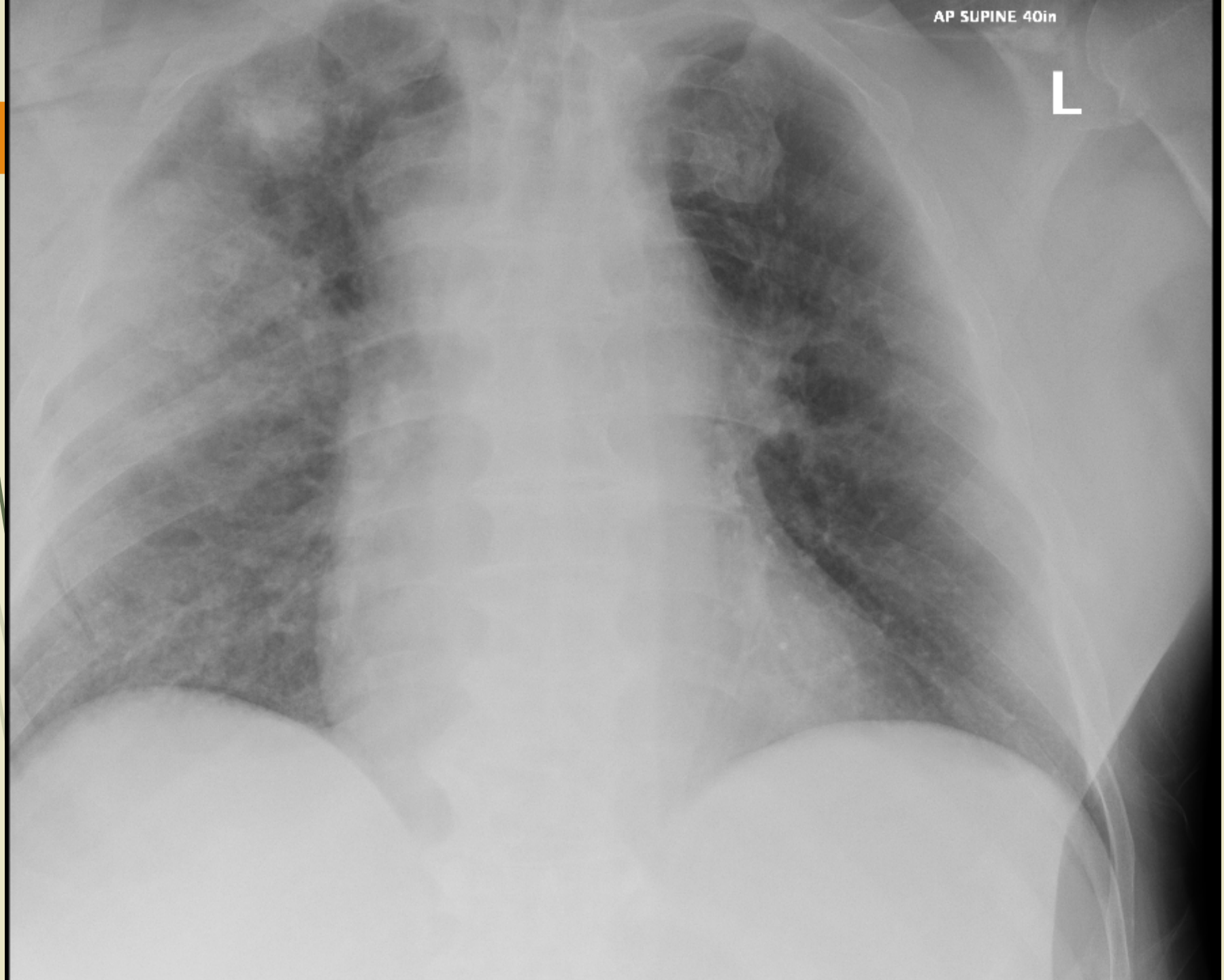
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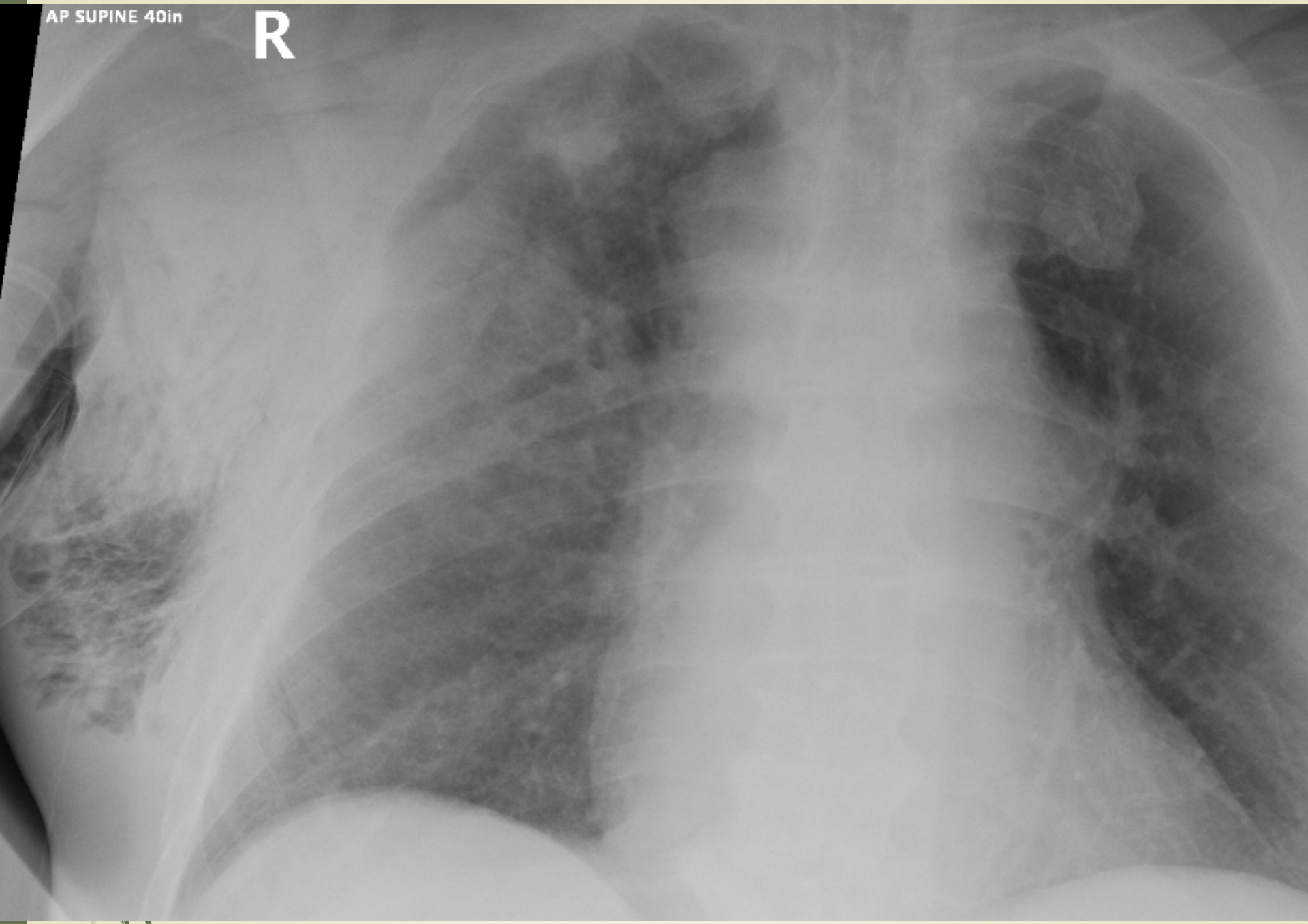
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R

# Crush Injury

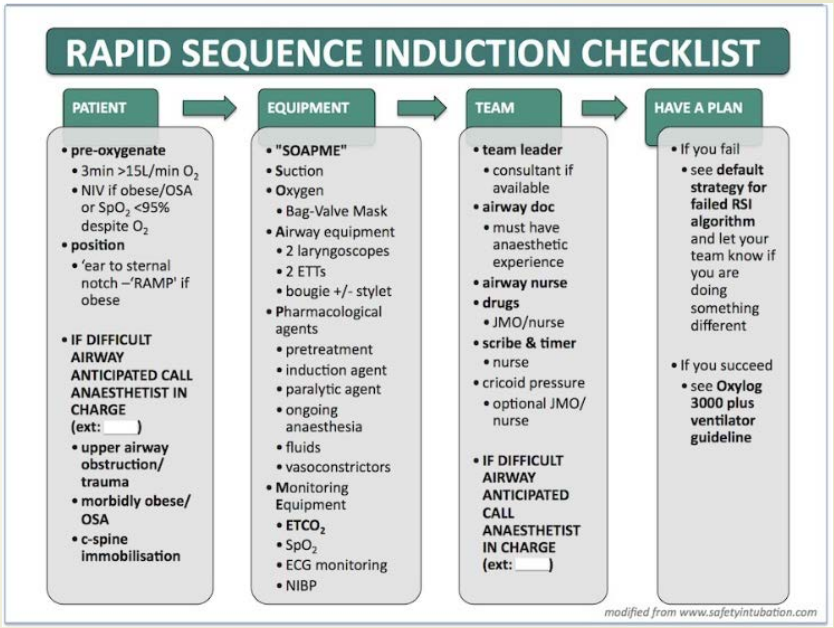
- McKennan ED (1446 - 1650)
  - 1505: 110/62 – HR 85 – RR 55
  - 1509: Chest tube placed R)
  - 1515: RR 50
  - 1521: RSI Initiated

# RSI (Rapid Sequence Intubation)

- Preparation is key
  - Oxygenation
  - Position
  - Suction
  - Equipment (ETT, stylet, etCO2 detector)
  - Ambu bag
  - Back-up airway
  - Monitor
  - Medications
    - Induction & Paralytic

**Intubation Meds**

| Drug | Normotensive Dose | Normotensive Dose (70 kg Pt) | Hypotensive Dose |
|---|---|---|---|
| Ketamine | 2 mg/kg | 140 mg | 0.5 mg/kg |
| Ketofol (100 mg ketamine, 100 mg propofol to make 20 ml) | 0.2 ml/kg | 14 ml | [redacted] |
| Etomidate | 0.3 mg/kg | 20 mg | 10 mg |
| Propofol | 1.5-3 mg/kg | 150 mg | 15 mg |
| Succinylcholine | 1.5-2 mg/kg | 140 mg | 2 mg/kg |
| Rocuronium | 1.2 mg/kg | 80 mg | 1.6 mg/kg |
| Vecuronium | 0.3 mg/kg | 20 mg | [redacted] |

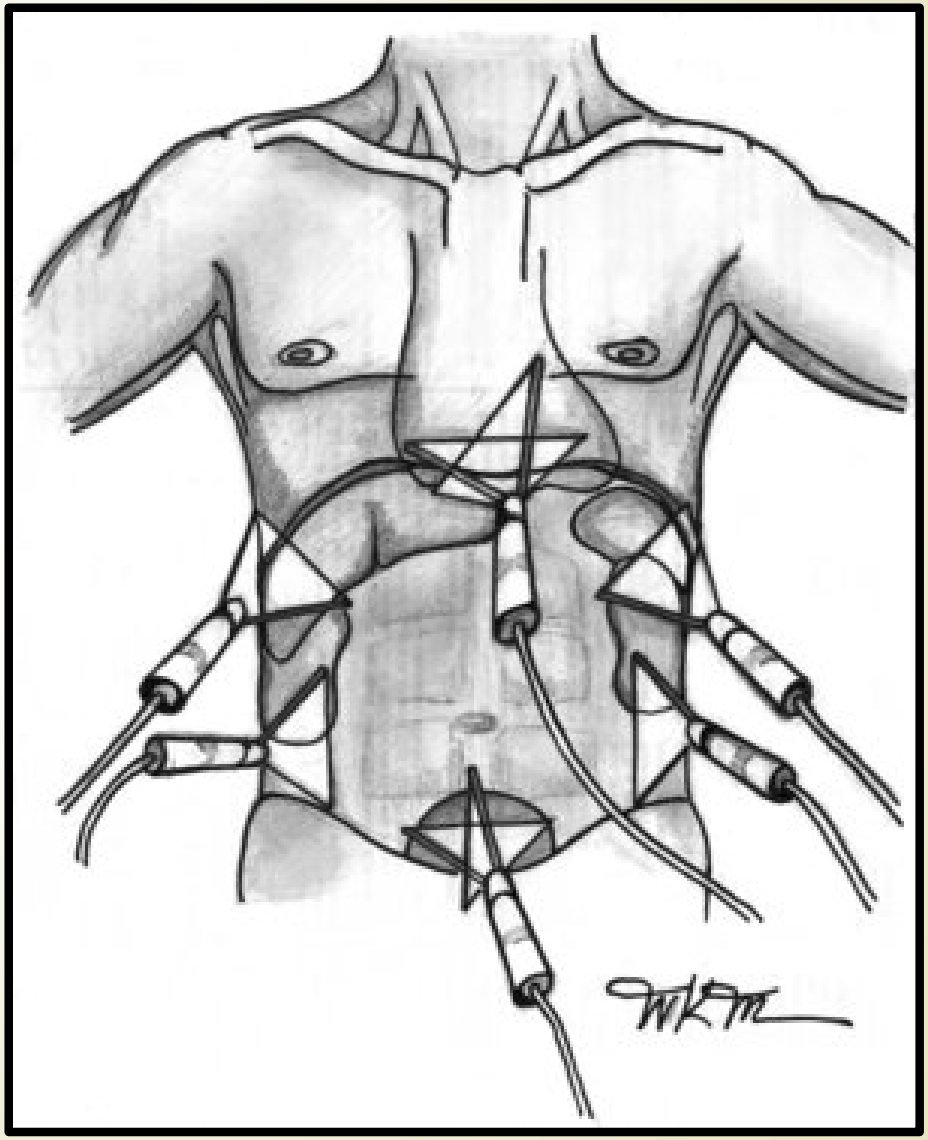


# Crush Injury

- McKennan ED (1446 - 1650)
  - 1525: FAST exam (negative)
  - 1530: 79/64
  - 1533: NS bolus, 1 unit PRBC initiated
  - 1534: Unable to palpate pulses > CPR

# FAST Ultrasound

- ***FAST***
- Focused assessment with sonography for trauma - free fluid in abd
- 5 areas of focus:
  - Perihepatic
  - Perisplenic
  - Pelvic (bilateral)
  - Pericardial



# Why the cardiac arrest?

# What happens in trauma??

- 2001-2011 review of battlefield casualties:
- 24.3% deemed potentially survivable
- Largely associated with major hemorrhage
- 1/3 of the cases were nontruncal bleeding

STOP THE BLEED

# Traumatic Cardiac Arrest

- American Heart Association:
  - BLS and ACLS for the trauma patient are fundamentally the same as that for the patient with primary cardiac arrest…
- ATLS (American College of Surgeons):
  - Hypotension following injury must be considered to be hypovolemic in origin until proved otherwise.

ECC Guidelines, Part 10. American Heart Association.

ATLS, 10th Edition.

# Should we or shouldn't we?

- More recent data shows Traumatic CA survival comparable or better than traditional cardiac arrest (2013)
  - ROSC was obtained in 49.1%
  - Good neurologic function 6.6%
  - Nearly all survivors had reversible cause, short transport time
- American Heart Association 2015 rates for out of hospital cardiac arrest (all cause)
  - Survival rate 10.6%
  - Good neurologic function 8.3%

J Trauma Acute Care Surg. 2013 Feb;74(2):634-8

# Crush Injury

- McKennan ED (1446 - 1605)
  - 1534 - 1535: CPR (no medications)
  - 1541: 64/38 – HR 66, 2nd unit PRBC
  - 1545: Massive Transfusion Protocol activated
  - 1549: Central line placed
  - 1550: EKG changes - ST elevation. Dopamine initiated
  - 1555: Identified pt on oral anticoagulation: K-centra
  - 1605: To CT

# Kcentra

- **Prothrombin Complex Concentrate (PCC)**
  - Indicated for urgent reversal of acquired coagulation factor deficiency induced by warfarin therapy in adult patients with major bleeding

- **Contraindications**
  - Known anaphylactic reaction
  - Patients with DIC
  - Patients with heparin-induced thrombocytopenia
  - Relative: Recent thromboembolic event (within 3 months)

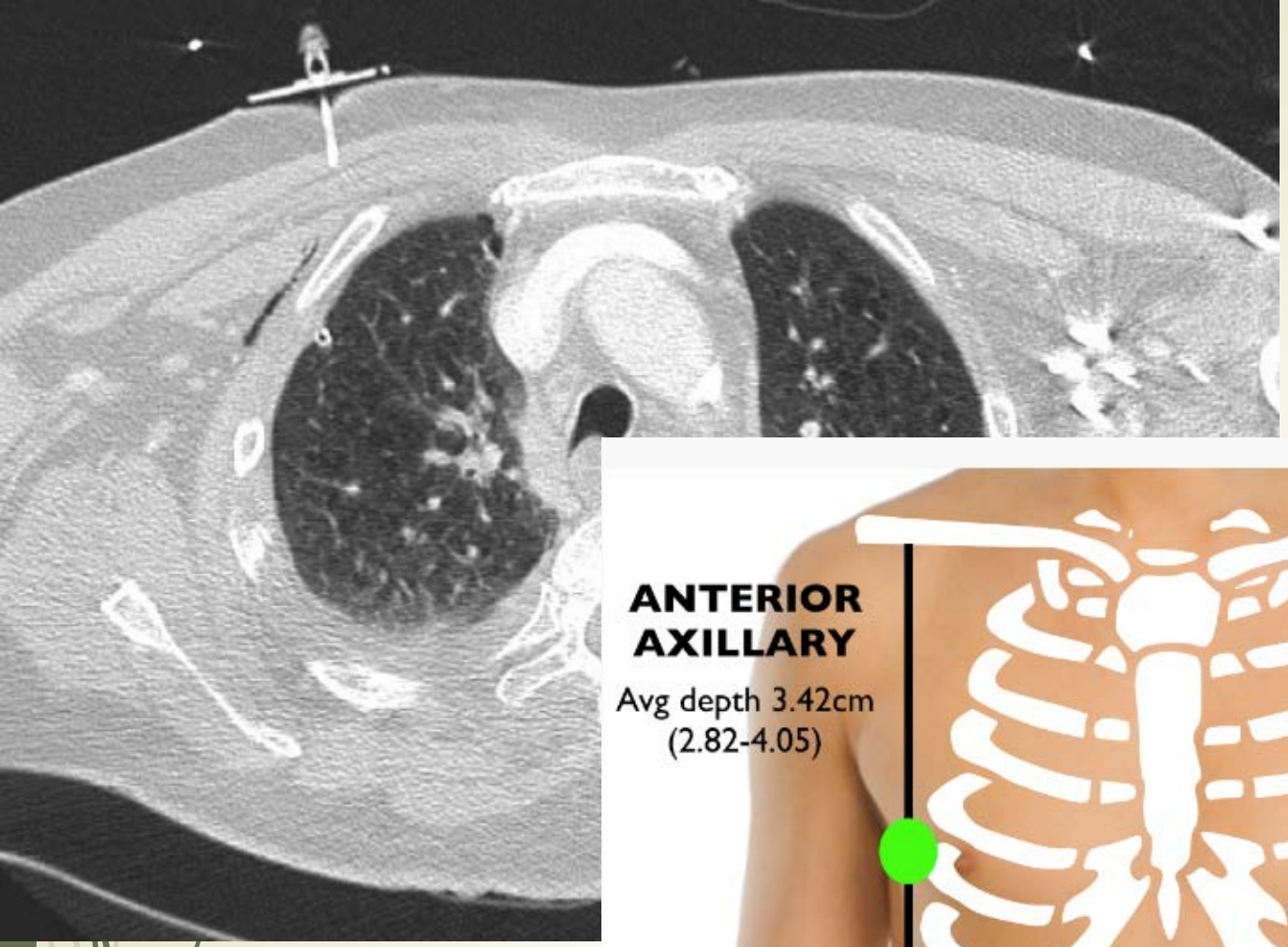
Fda.gov (2018).

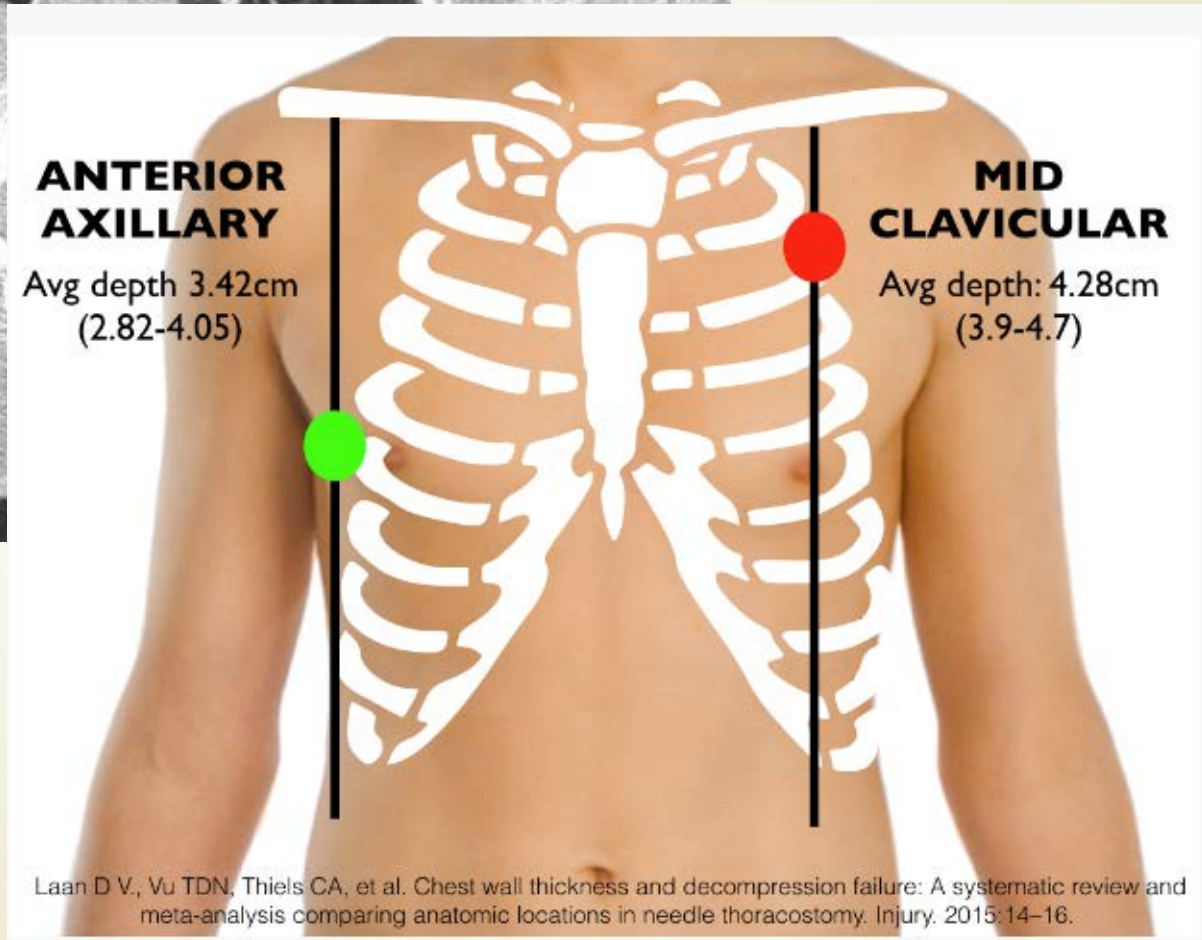
# Crush Injury

- CT Scan
  - Acutely hypotensive, High peak pressures, L) breath sounds absent > needle decompression
  - 3rd unit PRBCs
  - Abort scans & to ICU
- ICU (1650 – 1830)
  - Labile BP
  - L) chest tube
  - R) 2nd chest tube
  - To OR for R) thoracotomy

# Tension Pneumothorax

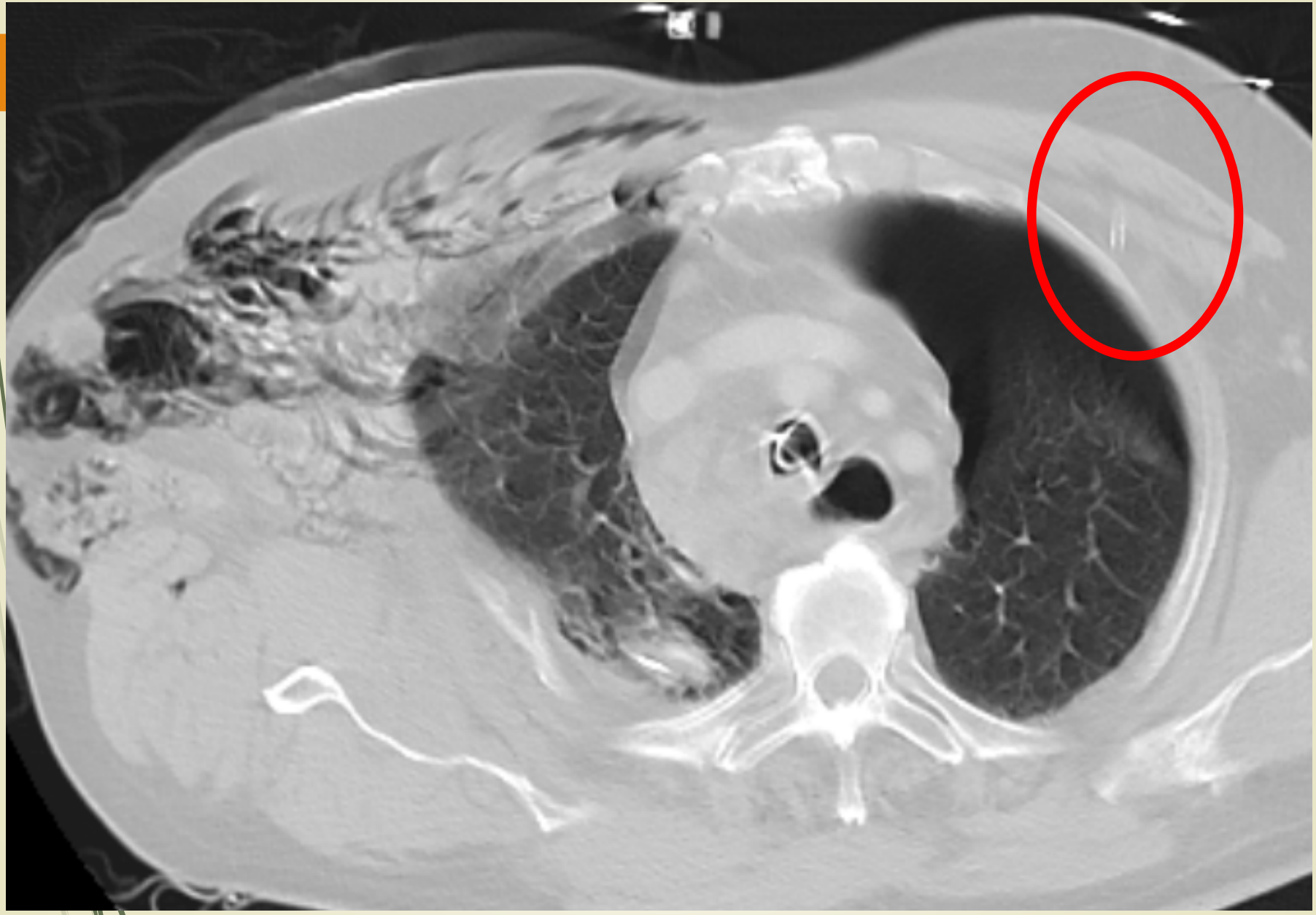
- **Signs / Symptoms**
  - Anxiety
  - Acute respiratory distress
  - Subcutaneous emphysema
  - Absent unilateral breath sounds
  - Hypotension
  - Distended neck veins
  - Tracheal shift (late sign)
  - Cyanosis
- **Goal Directed Therapy**
  - Relieve the obstruction > needle decompression or chest tube insertion






Laan D V., Vu TDN, Thiels CA, et al. Chest wall thickness and decompression failure: A systematic review and meta-analysis comparing anatomic locations in needle thoracostomy. Injury. 2015:14–16.

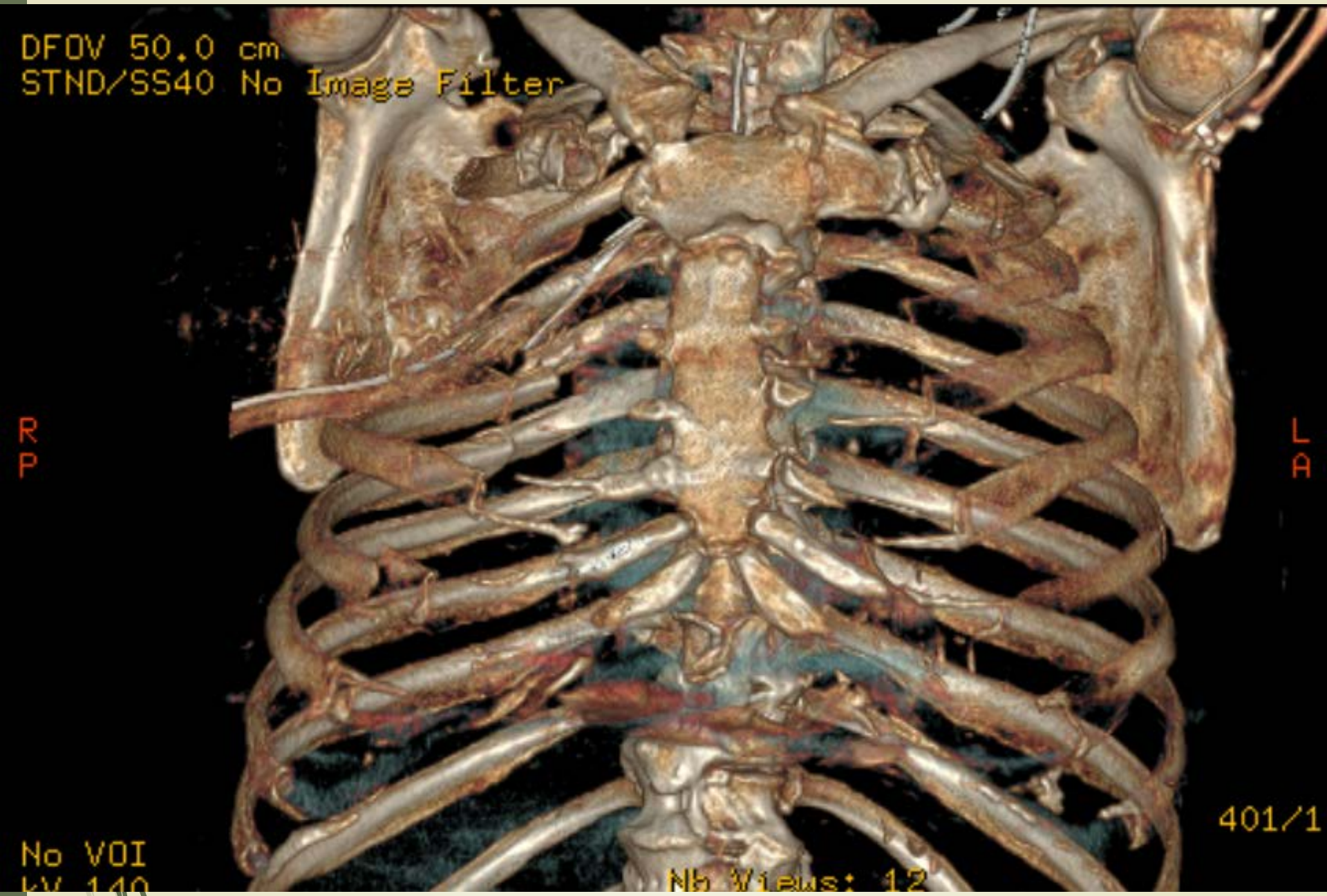
Needle Thoracostomy: 5th ICS Anterior Axillary Line = Less Likely to Fail



# Crush Injury

- Injuries:
  - R) tension pneumothorax
  - Bilateral pulmonary contusions
  - Rib fx L)3-6, R)2-8 (flail)
  - L) tension pneumothorax
  - Pneumomediastinum
  - Mediastinum contusion
  - T6 fxs (multiple)
  - T7 spinous process fx
- Co-Morbidites:
  - Anticoagulant therapy, DM, COPD (former smoker)

**ISS: 26**
**Ps: 0.6354**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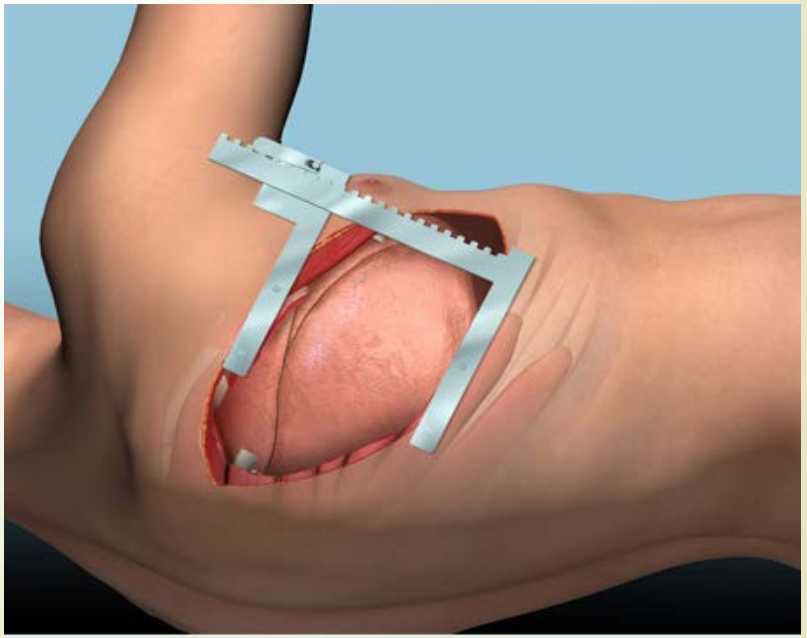
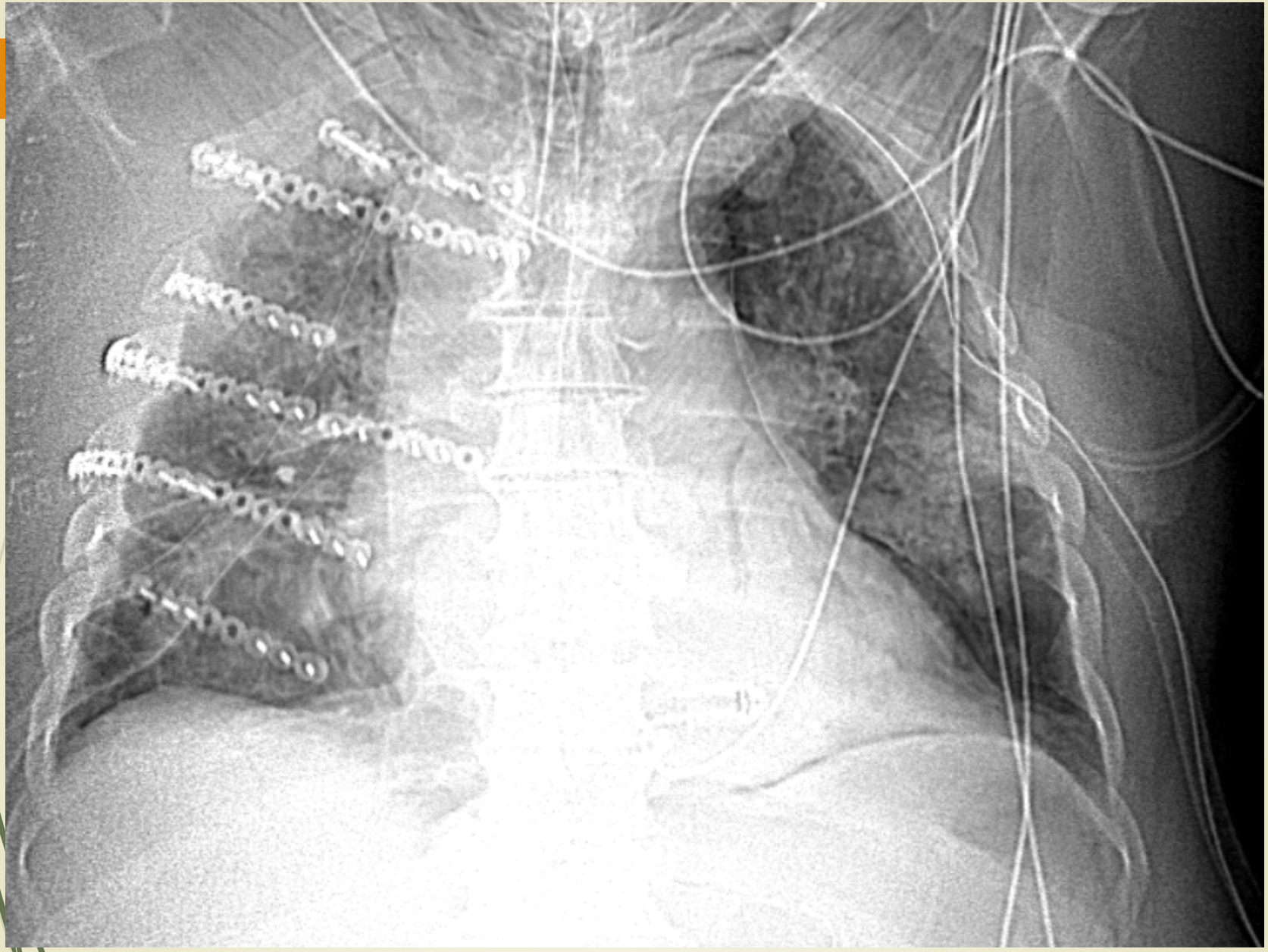
# Crush Injury

- OR
  - R) thoracotomy, Placement of chest tubes x 2
- PTD #1 – 3
  - Paralyzed for ventilation
  - Levophed gtt, Propofol & Fentanyl
  - PTD #3 Rib plating R) ribs 1-6
  - Antibiotics initiated





# Crush Injury

- PTD #5: Weaned off paralytic
- PTD #8
  - UCAF – rate 150s
  - Sedation vacation, L) side no movement, LOC decreased
  - CT head

# Crush Injury

- PTD #11
  - MRI brain: R) posterior frontal/superior parietal area CVA

# Crush Injury

- PTD #11 - 16
  - Heparin gtt initiated
  - Multiple bronchoscopies
  - PTD #14: Trach/peg
  - PTD #16: CO2 160s – emergent bronchoscopy, trach up against posterior tracheal wall
  - Antibiotics continue
  - GCS remains low

# Crush Injury

- PTD #20 - 34
  - Chest tubes removed
  - Weaning sedation, CPAP trials
  - PTD #26: OR for expanding chest wall hematoma
  - Palliative care consult
  - PTD #34: To Select: CPAP > PEEP 6

# Crush Injury

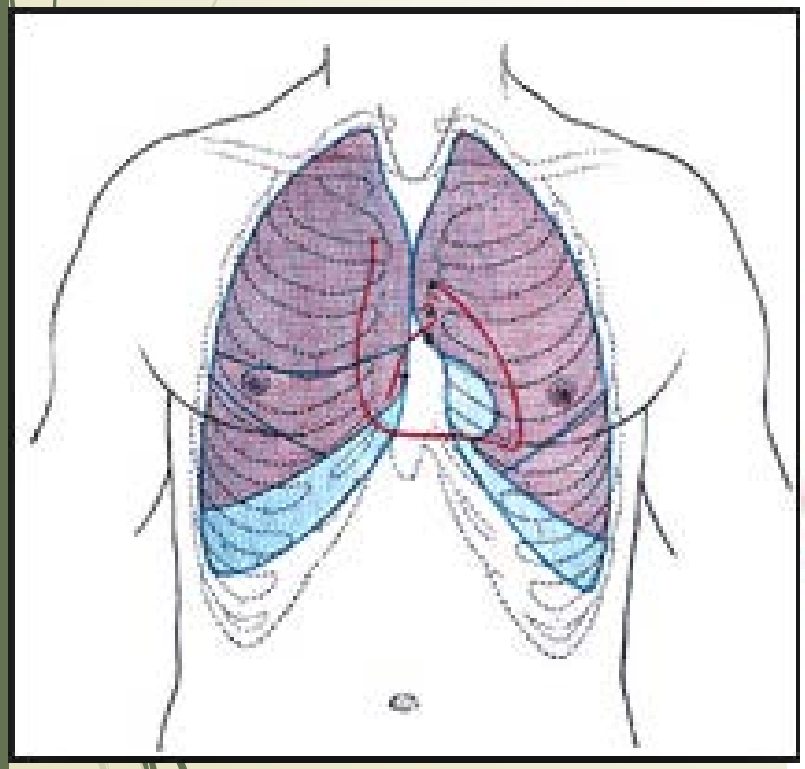
- Follow-up
  - Admitted to Avera Rehab 2 months s/p trauma
  - Rehab x 1 month, discharged home with home health care
  - Residuals to L)arm d/t CVA (frozen shoulder, numbness/tingling)

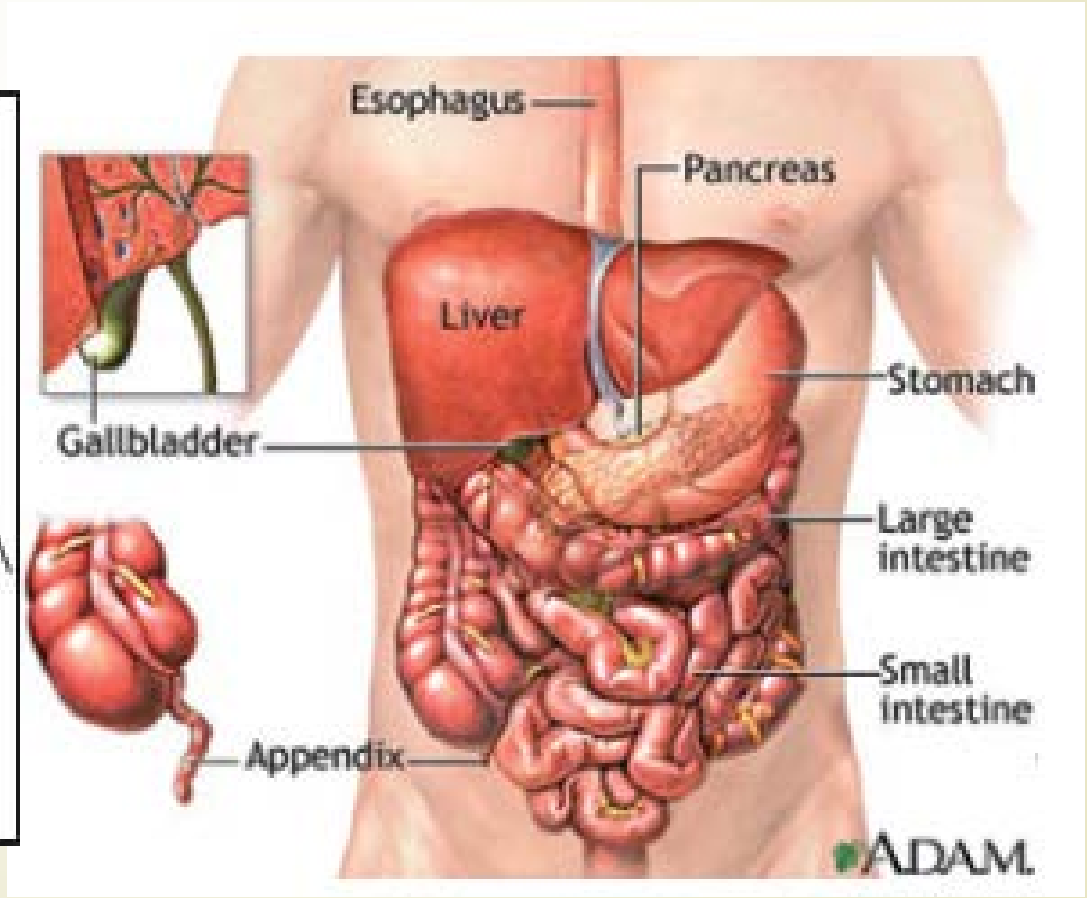
# GSW

# GSW

- 46 y/o male
  - Patient was shot to the L) lower chest (under nipple) w/ a 40 caliber handgun
  - PD first on scene
  - Occlusive dressing applied to chest wound
  - Scene secured, EMS at patient

# Chest or Abdominal Injury??





# GSW

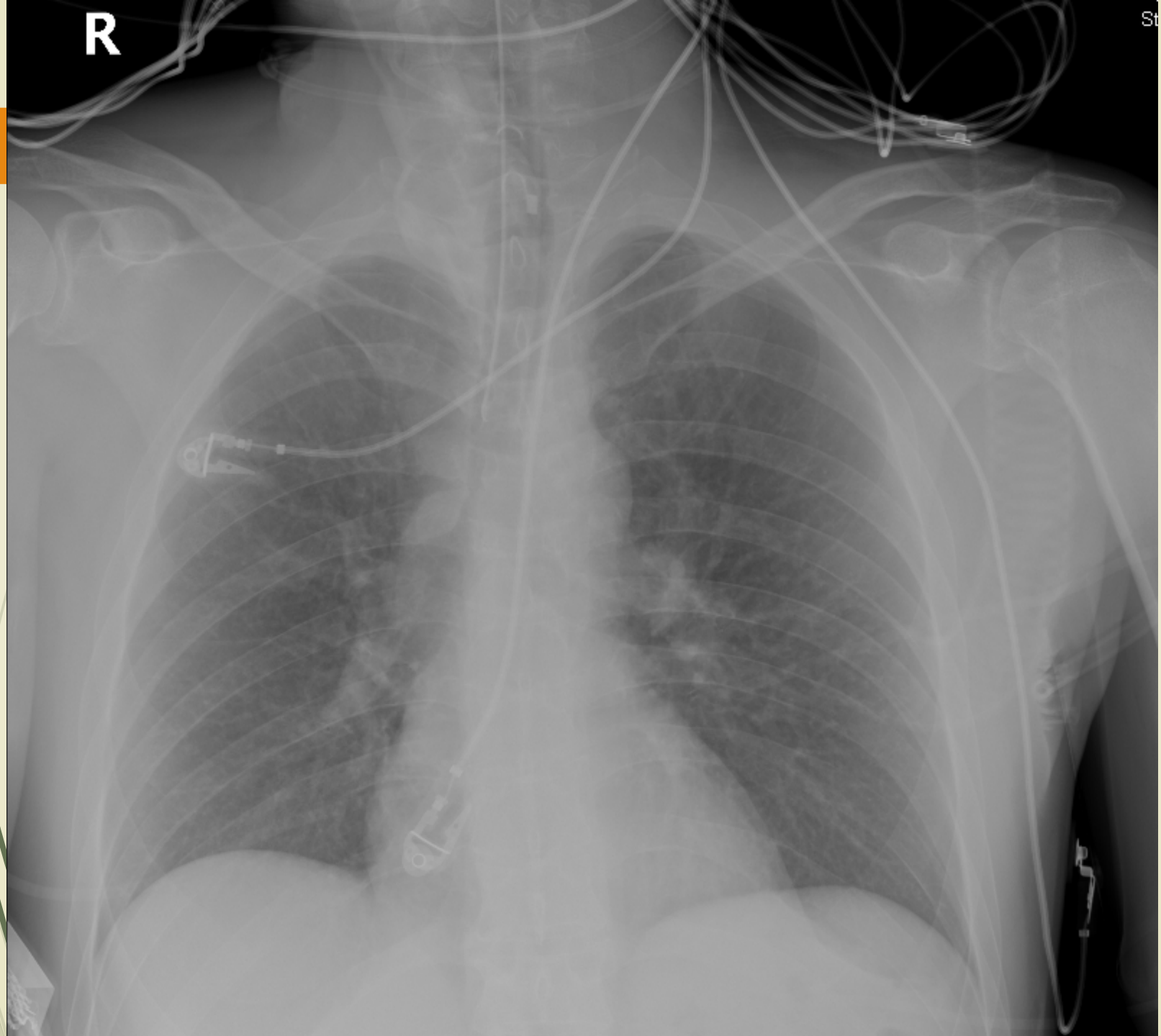
- Ground EMS (0151 – 0202)
  - **Vitals: 65 – 158 / 113 – 15 – 98% BVM**
  - GCS: 3
  - Continue w/ BVM
  - L) AC IV placed
  - Avera McKennan ED notified

# GSW

- Avera McKennan ED (0205 – 0322)
  - **Level 1 Trauma Activation**
  - 0205: arrives via EMS
    - Small open wound to the L) chest 3 cm below the nipple
    - No injuries or wound noted to back side
    - Unresponsive

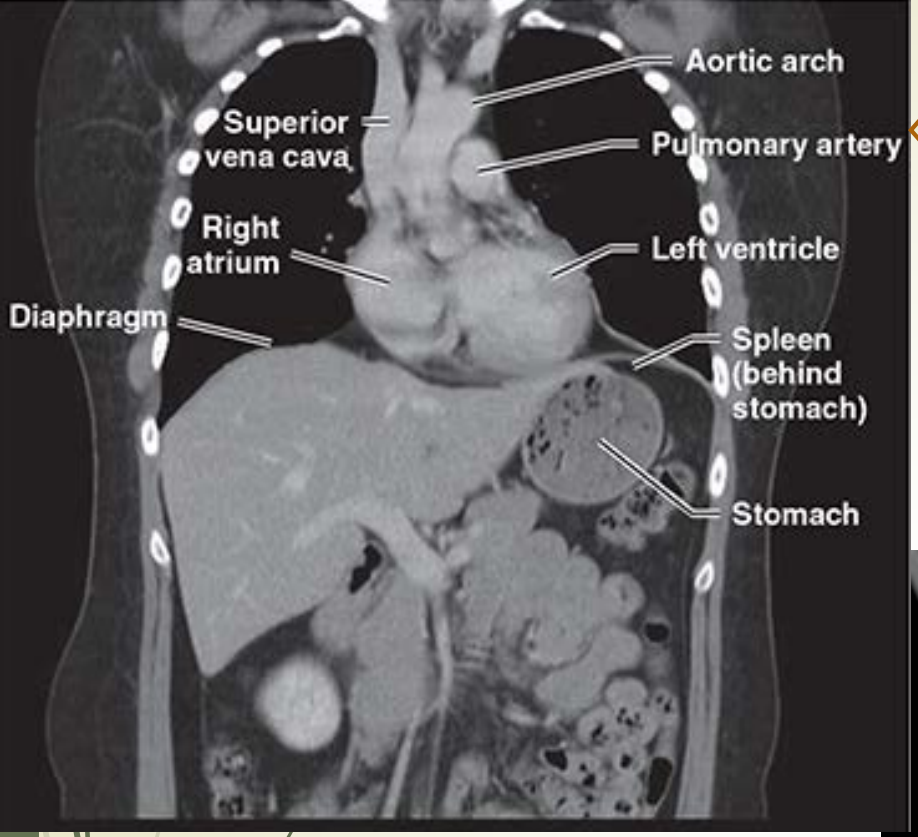
# GSW

- Avera McKennan ED
  - **95.3 – 91/64 – 83 – 15 – 98% ambu bag**
  - GCS 3
  - 0207: FAST (negative)
  - 0210: 2L NS hung on pressure bags
  - 0211: Rapid Sequence Intubation
  - 0213: Chest x-ray


R

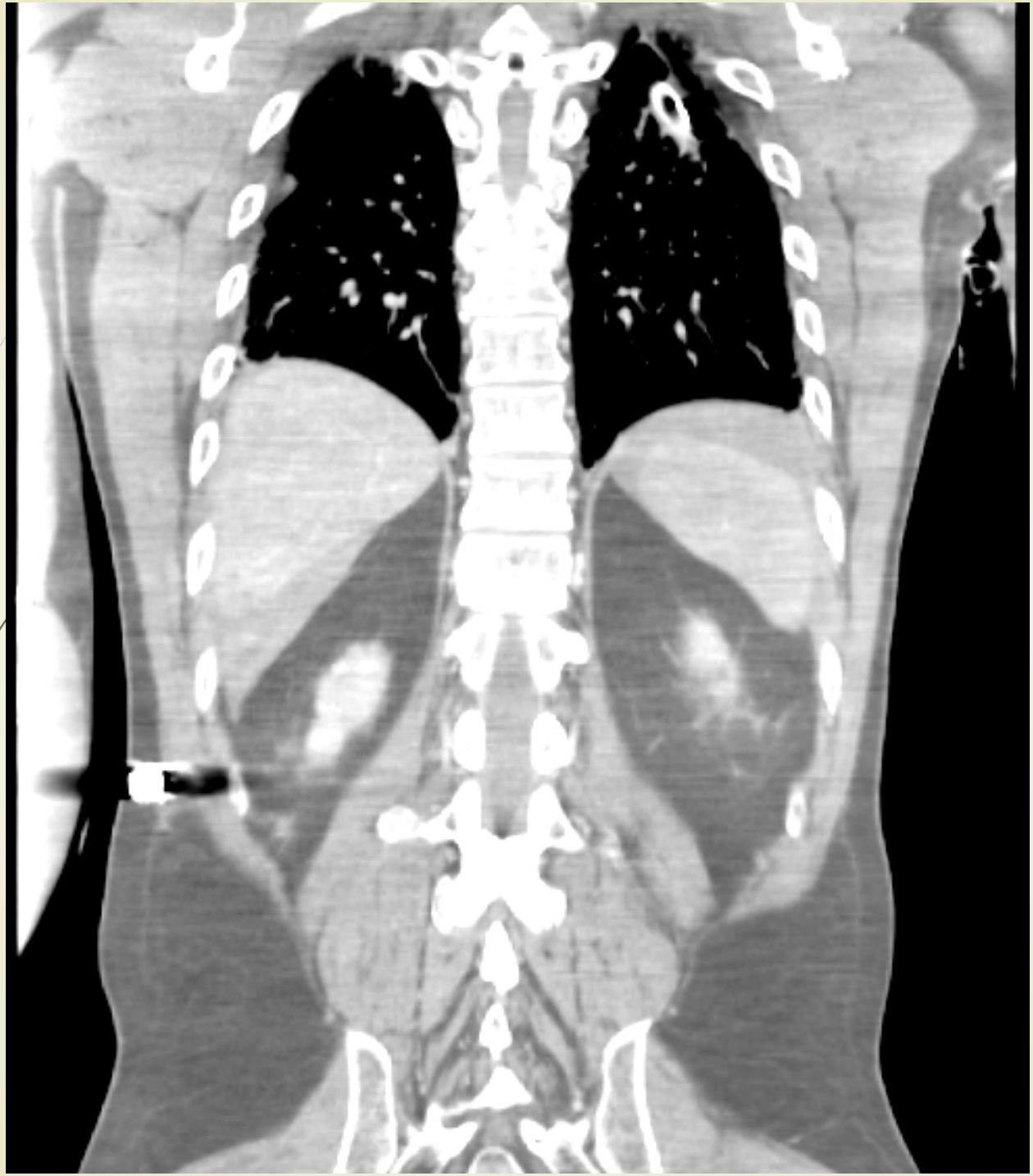
# GSW (0203-0322)

- 0230: L) chest tube placed
- 0237: To CT (vitals stable)
  - Fentanyl & Versed PRN during CT
- Labs:
  - Hgb/Hct: 13.9/40.7
  - PT/INR: 15.1 / 1.2
  - ETOH: 257
  - Lactic Acid: 3.0




# Normal anatomy
# Patient's CT


H



# GSW

- Identified Injuries:
  - GSW to L) chest
  - Pneumothorax
  - L) pulmonary contusion
  - Grade III liver laceration
  - Grade III kidney laceration w/hematoma
  - Grade V pancreas laceration
  - Lacerations to stomach, diaphragm and duodenum

**ISS: 34**
**P(s): 0.3357**

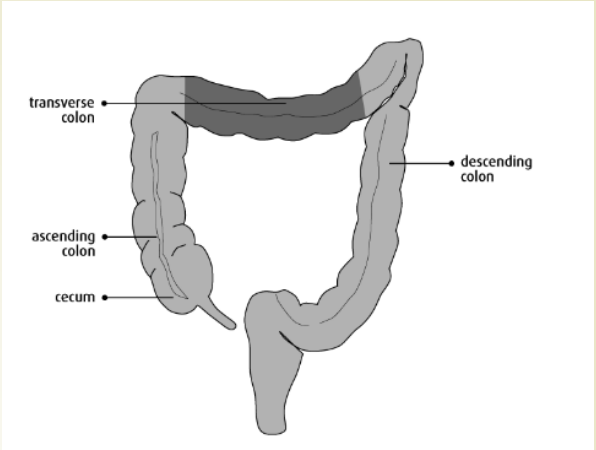
# GSW

- Co-Morbidities:
  - Legally blind
  - ETOH abuse (7 DUI's)
  - Smoker
  - Mental / Personality disorder
  - Substance abuse disorder

# GSW

- OR- Exploratory lap (0353-0435)
  - Gastrectomy
  - Diaphragm repair
  - Duodenum repair
  - Packed R) kidney and pancreas
  - Wound vac placement to abdomen
  - 2u PRBC’s

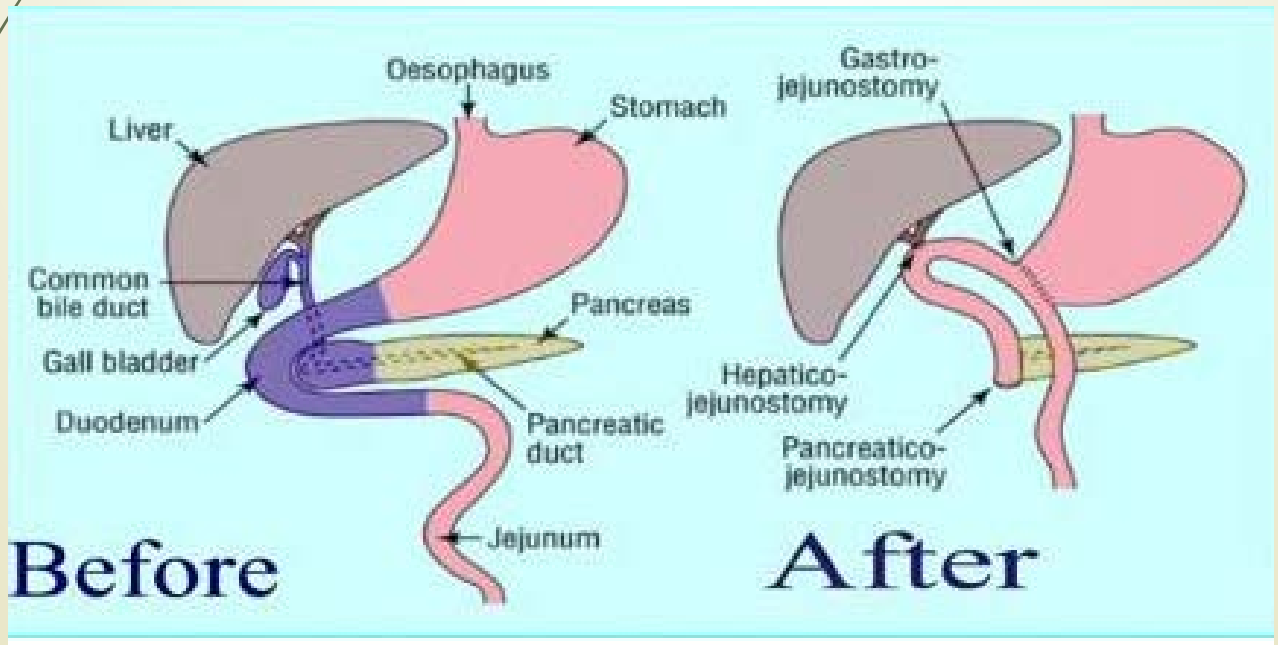
# GSW




- PTD #0
  - Admitted to the ICU from OR
  - Hemodynamically stable
  - 500cc bloody drainage from wound vac over 6 hours
  - Labs stable
- PTD #1
  - OR (1726-1752)
    - Transverse colectomy, removal of packing w/ wound vac change

# GSW

- PTD #3
  - OR (0749-1219)
    - Trauma Whipple
    - Feeding J-tube



# GSW

- PTD #4
  - CPAP trials going well
  - 0930: extubated
    - 4L nasal cannula in place
    - PCA for pain control
    - Pain team following
  - 1520: transferred to medical sub-acute unit
    - NG pulled by patient, strict NPO

# GSW

- PTD #5-7
  - Working with PT/OT
  - Confusion at night
  - Pain control
  - L) chest tube remains in place
  - NG replaced, pulled out 12 hrs later. Did not replace
  - J-tube feedings, advancing to goal

# GSW

- PTD #8
  - Sips of clear liquids
  - J-tube feedings at goal
  - Chest tube to water seal for short period, placed back to suction
- PTD #9
  - Advanced to full liquids
  - J-tube found pulled out (by patient), will leave out with tolerating full liquids

# GSW

- PTD #10
  - Chest tube placed to water seal. CXR in 4 hrs
  - Continues to work with PT/OT
  - Tolerating a regular diet
  - Chest tube dc'd
  - CT abdomen - small abscess collection
  - Psych consult - ? suicidal
  - Working on discharge disposition

# GSW

- PTD #11
  - Low grade fevers
  - Positive fluid cultures
    - On PO antibiotic coverage
  - Chemical dependency consult
- PTD #12
  - Patient placed under arrest. Discharge disposition to jail

# GSW

- PTD #13-21
  - Continued with pain control
  - Increasing activity and diet
  - Repeat CT of abd/pelvis on PTD #20 with decreased fluid collection
- PTD #22
  - Discharged to jail

# How could we improve care?

# Diving Injury

# Diving Injury

- 18 y/o running into shallow water and dove. Pt. in water for ~ 1 minute. Patient fully recalls event.
- EMS (1846 - 1908)
  - Awake, initially unable to obtain BP
  - Pacing initiated
  - 44 – 22 – 95% on RA – 118/92 – GCS 15
  - No feeling below shoulders, c/o “can’t breathe”

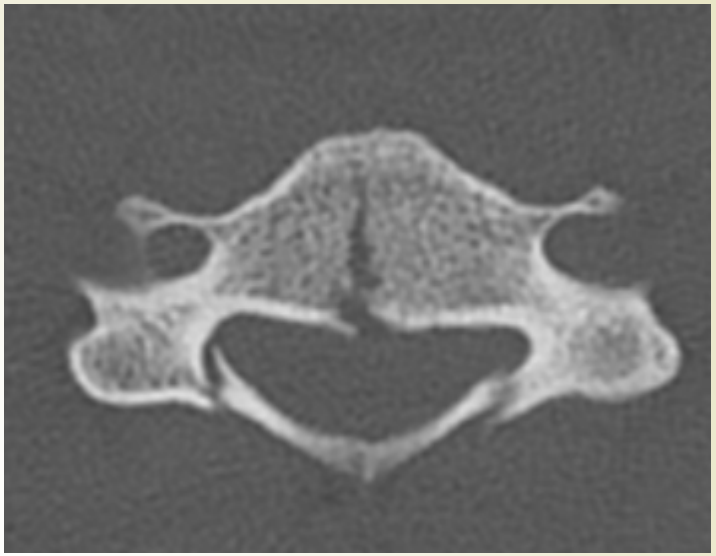
# Diving Injury

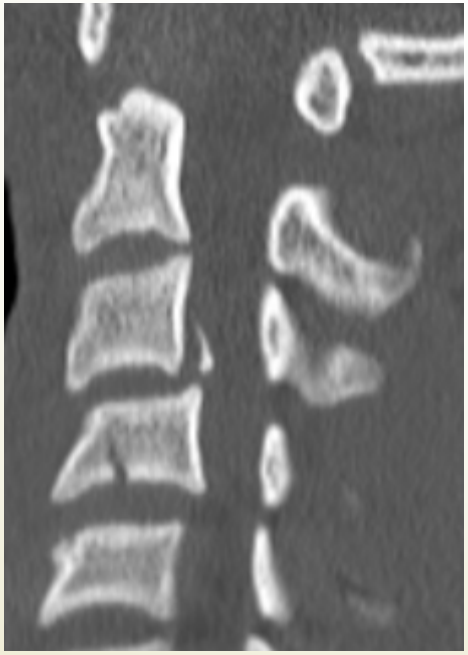
- McKennan ED (1913 - 2010)
  - Level 1 Activation
  - 40s – 20 – 87% on RA, NC placed – 184/130
  - Pacing stopped
  - 1918: Atropine > HR 60s -110s
  - 1929: CT – head, neck (CTA), chest/abd/pelvis, T&L spine
  - 2010: MRI c-spine

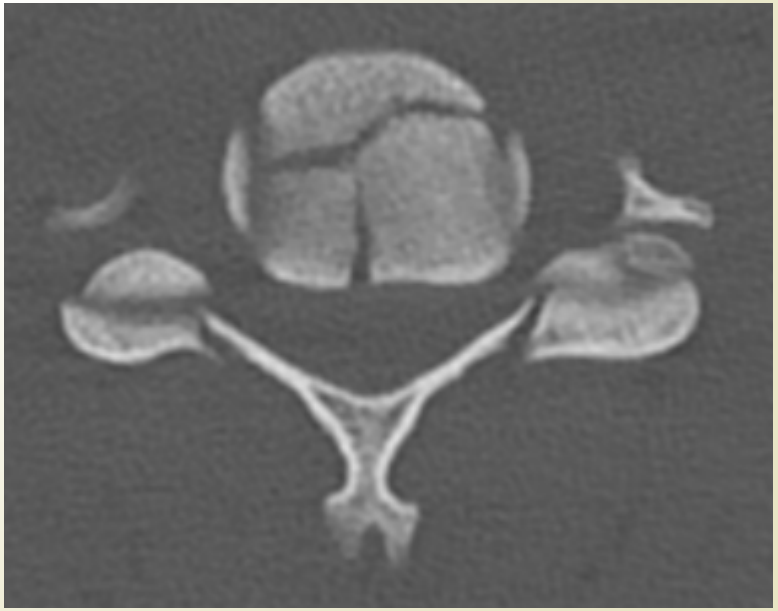
# Diving Injury

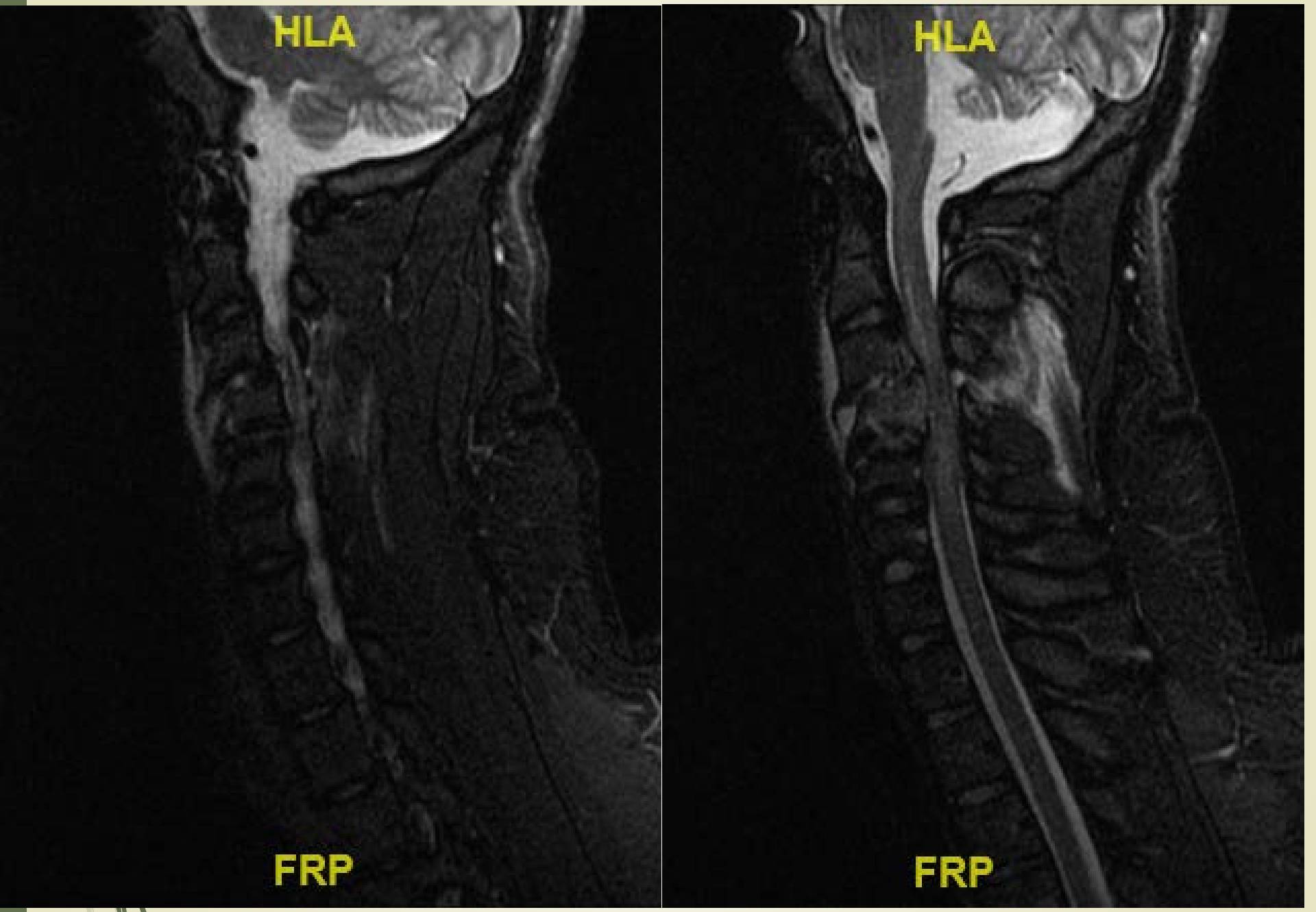
- Injuries:
  - C3-4 subluxation & fx
  - C4 burst fx
  - Disruption of interspinous ligament
  - C5 chip fx
- Co-Morbidities:
  - ?? smoker

**ISS: 25**
**Ps: 0.9782**








HLA
FRP
HLA
FRP

# Neurogenic Shock

- **Signs/Symptoms**
  - Hypotension
  - Bradycardia
  - Poikilothermia
  - Hypoventilation
  - Warm skin
  - Bounding pulses
- **Treatment**
  - Ventilatory support
  - Judicious IV fluids
  - Inotropic support
  - Avoid hypothermia
  - CONTINUOUS reassess

TNCC 8th ed.(2019), pg 172-179.

# Neurogenic vs Spinal Shock

**TABLE 9-5** Neurogenic and Spinal Shock

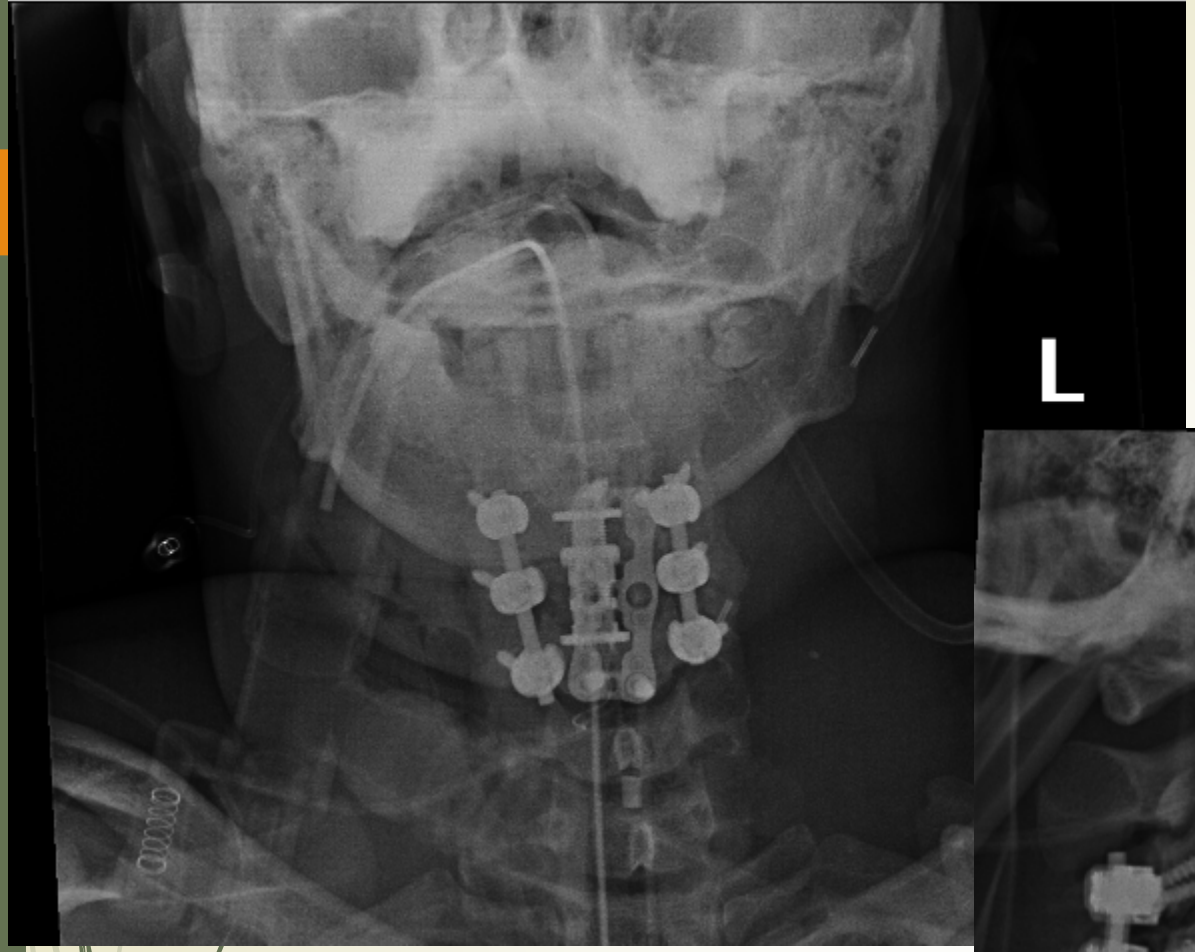
| | Neurogenic Shock | Spinal Shock |
|---|---|---|
| Precipitating injury | Spinal cord injury at T6 or above | Spinal cord injury at any level |
| Pathophysiology | Temporary loss of vasomotor tone and sympathetic innervation | Transient loss of reflex (flaccidity) below the level of injury |
| Duration | Temporary, often lasting less than 72 hours | Variable |
| Signs/symptoms | › Hypotension<br>› Bradycardia<br>› Loss of ability to sweat below level of injury | › Flaccidity<br>› Loss of reflexes<br>› Bowel and bladder dysfunction |

Modified from American College of Surgeons. (2018). Spine and spinal cord trauma. In *Advanced trauma life support: Student course manual* (10th ed., pp. 128–147). Chicago, IL: Author. Data from Fox, A. D. (2014). Spinal shock: Assessment and treatment of spinal cord injuries and neurogenic shock. *Journal of Emergency Medical Services, 39*(11), 64–67.

TNCC 8th ed.(2019), pg 172.

# Diving Injury

- OR PTD# 1 (0003 - 0428)
  - C4 corpectomy with placement of anterior interbody cage & anterior cervical plate. C4 decompressive laminectomy and instrumented lateral mass fusion from C3-C5.
- Post OR
  - To ICU, remains intubated
  - Dopamine goal MAP >80
  - Atropine PRN > bradycardia into 30s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# Diving Injury

- PTD #1 - 11
  - Con’t. on dopamine until PTD #8
  - PM & R consult
  - Developed fevers, thick secretions
  - (+) sputum cultures – antibiotics
  - Multiple bronchoscopies
  - High ventilator support

# Diving Injury

- PTD #12: PEG & bronch
- PTD #13: Cardiac arrest
  - O2 decreased to 84%, HR 20, then asystole
  - 30 seconds CPR, pulses returned – brady, atropine
- Emergent bronch > no obstructive mucous plug
- Chest x-ray > no acute changes
- Echo – EF 60-65%
- CTA chest > no PE, pneumonia
- Dopplers (-) DVT

# Diving Injury

- PTD #14-18
  - Decreasing vent support
  - Trach placed PTD #18
- PTD #20 – Tx out of ICU to neuro acute unit
- PTD #21 - 40
  - Fevers intermittently
  - PT/OT/ST
  - Psych following
  - Discharge to rehab facility

# MVC – 10 month old

# MVC

- 3 units (2 ALS, 1 BLS) dispatched for multiple severely injured MVC patients.
- 10 month old male involved in a semi vs. car crash at a low rate of speed on icy roads. Found outside of vehicle in car seat, ? ejected or removed from vehicle.

| Age Group | Respiratory Rate | Heart Rate | Systolic Blood Pressure | Weight in kilos | Weight in pounds |
|---|---|---|---|---|---|
| Newborn | 30 - 50 | 120 - 160 | 50 - 70 | 2 - 3 | 4.5 - 7 |
| Infant (1-12 months) | 20 - 30 | 80 - 140 | 70 - 100 | 4 - 10 | 9 - 22 |
| Toddler (1-3 yrs.) | 20 - 30 | 80 - 130 | 80 - 110 | 10 - 14 | 22 - 31 |
| Preschooler (3-5 yrs.) | 20 - 30 | 80 - 120 | 80 - 110 | 14 - 18 | 31 - 40 |
| School Age (6-12 yrs.) | 20 - 30 | 70 - 110 | 80 - 120 | 20 - 42 | 41 - 92 |
| Adolescent (13+ yrs.) | 12 - 20 | 55 - 105 | 110 - 120 | >50 | >110 |

# Car Seat Use after Crash

- https://www.nhtsa.gov/car-seats-and-booster-seats/car-seat-use-after-crash

# Car Seat Use After a Crash

NHTSA recommends that car seats be replaced following a moderate or severe crash in order to ensure a continued high level of crash protection for child passengers. Car seats do not automatically need to be replaced following a minor crash.

## What defines a minor crash?

**A minor crash is one in which ALL of the following apply:**

- The vehicle was able to be driven away from the crash site.
- The vehicle door nearest the car seat was not damaged.
- None of the passengers in the vehicle sustained any injuries in the crash.
- If the vehicle has air bags, the air bags did not deploy during the crash; and
- There is no visible damage to the car seat.

**NEVER** use a car seat that has been involved in a moderate to severe crash. Always follow manufacturer's instructions.

# MVC

- ALS Ground (1813-1826)
  - Found in car seat in 1st unit on scene, tx to ambulance transferring patient
    - Responds to deep painful stimuli
    - Breathing slow & labored
    - Skin pale, cool & dry; brachial pulse present

# MVC

- C-spine precautions manually held, removed from car seat – c-collar applied
- 1820: HR 86 - RR 14 - 82/45 - 96% RA – GCS 7
- Suction – minimal results
- Respirations assisted BVM
- Lung sounds clear
- Abdomen soft, non-distended
- Pelvis stable
- Pupils unequal R>L

# MVC

- Transferring Facility (1826-1925) **Estimated weight 10 kg**
  - 1826: 97.7 - 131 - 41 – 110/46 – 91% BVM – GCS 3
  - Extremities limp, dried blood in R)nare
  - 1833: IO to LLE, NS @ controlled rate
  - Warm blanket, bair hugger, warm IV fluids, room temp increased
  - 1838: IV to R)hand
  - 1840: Seizure like activity, Ativan 1 mg
  - 1846: BP 92/34 – HR 170 – RR 50 – O2 sat 100%
  - NS increased rate to bolus 20 ml/kg

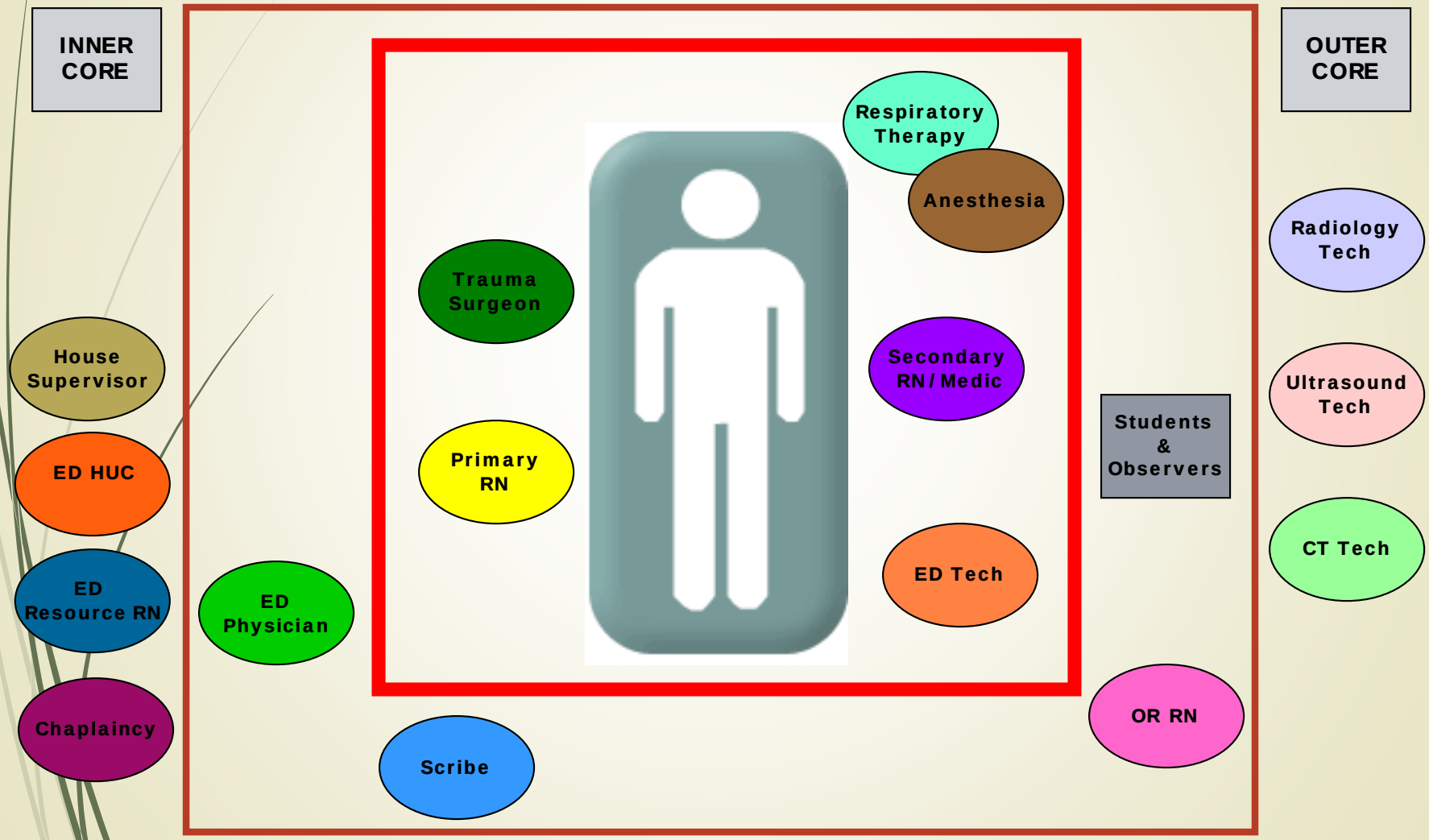
# MVC

- Air Transport (1848-2001)
  - 1848: 198 - 30 - 91/46 - 91% BVM – GCS 3
  - Preparing to Rapid Sequence Intubation (RSI): Atropine, Ketamine & Rocuronium
  - 1857: RSI – desat to 14%, increased with bagging
  - 1925: HR 210 – 95/48 – O2 sats 80s-90s BVM
  - 1939: Lift for Sioux Falls
    - Suction ETT
    - Fluid bolus
    - PRBC initiated
    - Warming measures

# MVC

- Air Transport (1848-2001)
  - 1952: Maintenance issue in aircraft
  - Divert from Sanford to McKennan
  - 1955: Level 1 Trauma activation

# Avera McKennan Hospital Trauma Service
# Level I Trauma Team Response

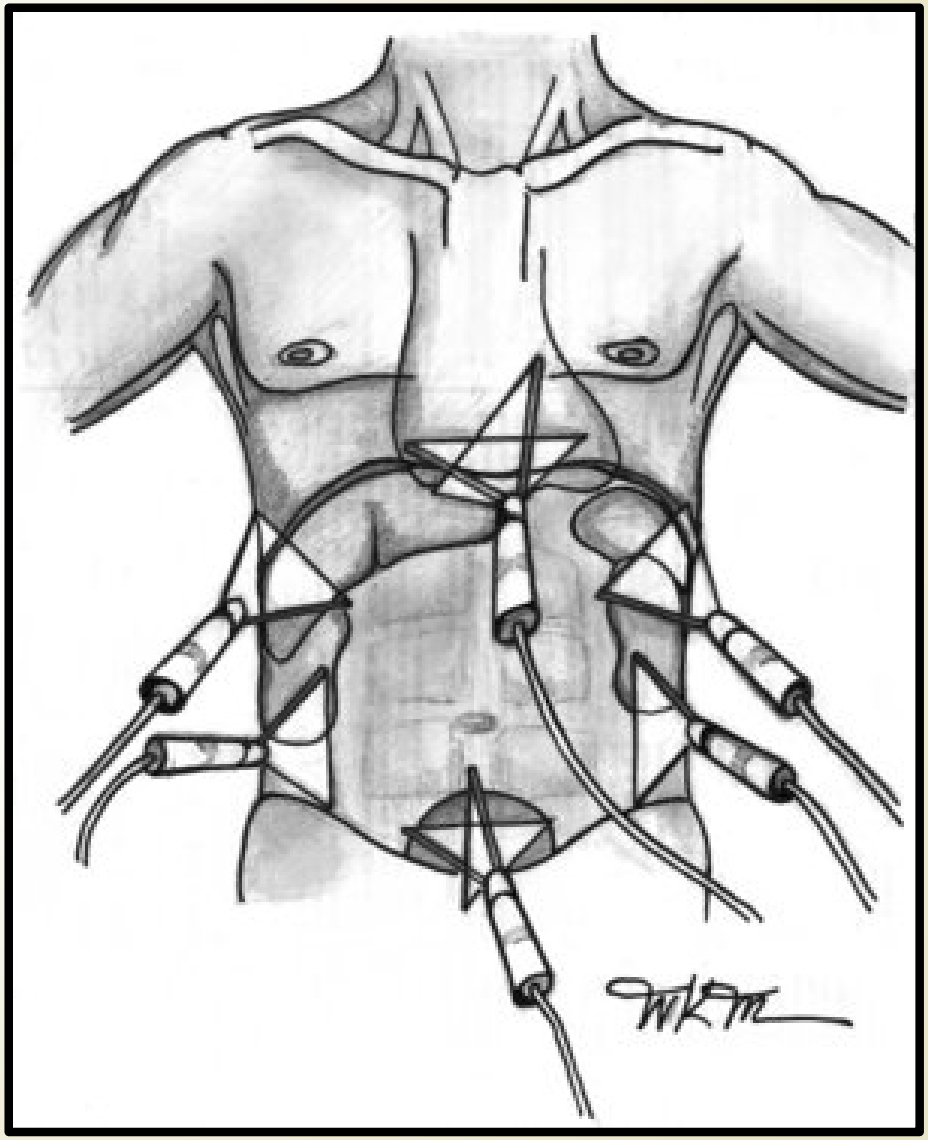


# MVC

- Avera ED (2007-2134)
  - Vitals: 97.3 - 197 - 24 - 84/55 - 86% ambu – GCS 3
  - Bilateral pupils-sluggish
  - 2007: Trauma surgeon arrival
  - 2032: CT scans
    - Sats declining, manual bagging with ETT manipulation
    - Peds Intensivist in CT
    - O neg
  - 2110:FAST
  - 2134: PICU

# FAST Ultrasound

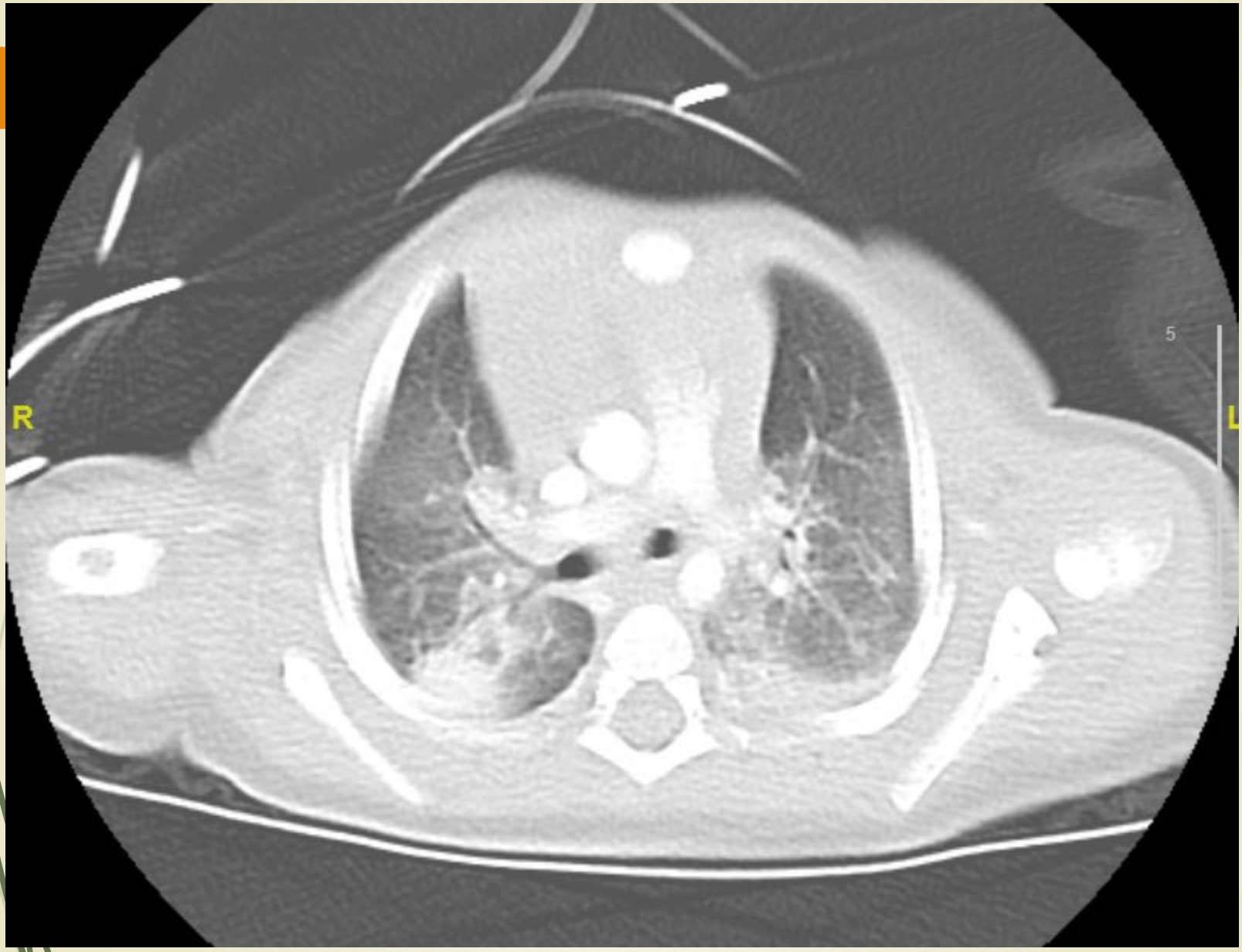
- ***FAST***
- Focused assessment with sonography for trauma - free fluid in abd
- 5 areas of focus:
  - Perihepatic
  - Perisplenic
  - Pelvic (bilateral)
  - Pericardial



# MVC

- Injuries:
  - Grade V spleen laceration
  - Bilateral pulmonary contusions
  - Lrg. Hemoperitoneum
  - Grade II Liver laceration
  - CHI / DAI
  - IVH / IPH small
  - Forehead contusion
  - Craniocervical distraction injury

**ISS:59**
**Ps:0.0654**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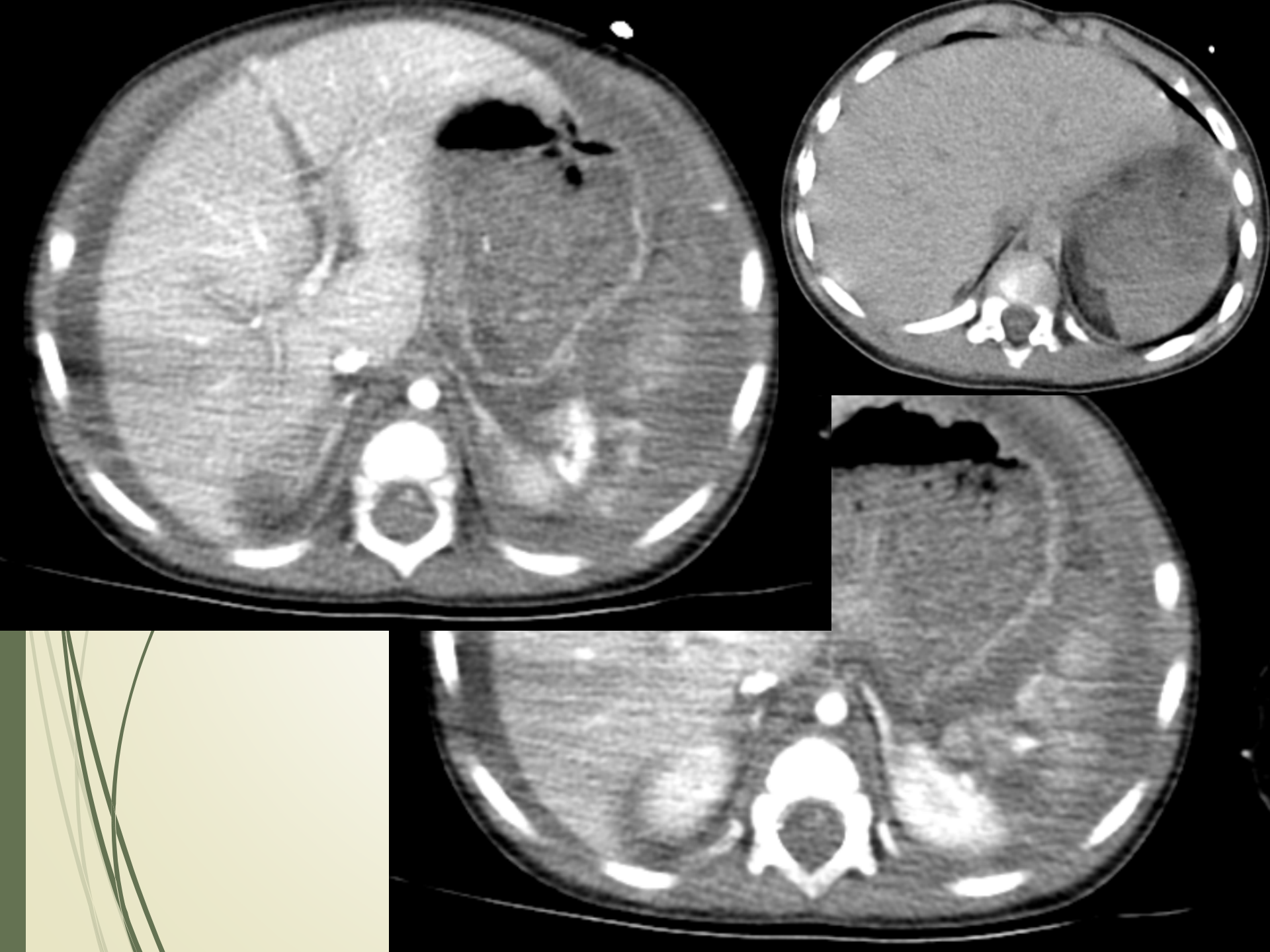


Sex: M
HL
FR

# MVC

- PTD #0
  - 2136: PICU
    - No corneal reflex, cough or gag
  - 2200: Central line placed
  - 2229: attempted to place bolt
  - 2245: decompensating-brought to OR
    - 200cc NS bolus
  - OR (2306-2355)
    - Exploratory lap, splenectomy, repair of liver laceration, abdominal packing with vac placement
    - FFP and blood

# MVC

- PTD #1
  - Absent corneal reflex
  - PERRL bilateral
  - R) side moves to painful stimuli, no movement to the L)
  - MRI head & spine, EEG (slowing), Echo (-)
  - Planning for transport to Sanford (brother is there)
- PTD #2
  - Transfer to Sanford PICU

# MVC – Follow-up

- Inpatient stay
  - Extubated
  - Therapies: PT/OT/ST
  - Aspen collar
- MRI stable 4 months out, collar removed
- Climbing chairs, running, speaking 2-3 words

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