The "2 P's" of Geriatric Trauma
Physiology & Philosophy

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Initial Assessment

- 1 car rollover accident. 67 y/o male restrained driver. Removed from vehicle by bystanders.
- Awake, agitated, GCS E4/V2/M4
- Pale, cold skin
- "Noisy" respirations
- No major visible trauma
- Rapid palpable peripheral pulses
Initial Intervention

- Unsuccessful nasal intubation attempt
- High flow oxygen via mask
- Spinal immobilization
- Immediate preparation for transport

Focused Assessment

- Hematoma to occiput
- Blood coming from mouth
- Pupils equal, sluggish
- Chest wall intact, BS "noisy" bilaterally
- Abdomen "slightly rigid"; pelvis intact
- Extremities normal
- 110, 146/P, 32 shallow; RA SPO2 86%.

Prehospital Intervention

- Spinal immobilization (KED to long board)
- High flow oxygen
- Enroute
  - 2 IV NS via 16 gauge angios, run TKO
  - EKG: sinus tachycardia

Onscene 22 minutes; emergent transport to trauma center took 17 minutes.
Ongoing Assessment

★ Blood pressure went from 146/P to 162/P. No change in BP or RR.
★ No change in mental status

E.D. Assessment

Urban Level I Trauma Center
★ Conscious, confused, pale
★ Head/neck: Ecchymosis R occiput; pupils midline, slow to react
★ Chest: bilateral chest expansion; “noisy” breath sounds; painful to palpation
★ Abdomen/pelvis: normal
★ Extremities: normal
★ 98, 136/90, RR not documented, 35 C (tympanic)

E.D. Diagnostic Testing

Lab
★ ABGs: WNL
★ SPO2: 95% on 15 liters
★ Trauma panel sent

Radiology
★ Chest: Multiple R rib fractures with probable R pulmonary contusion
★ C-spine: clear
★ Pelvis: clear
E.D. Intervention

- Rapid sequence intubation (Versed, Fentanyl, norvecuronium) performed without complication
- IVs continued TKO
- Foley catheter (heme -)
- Transported to CT scan/ICU 65 minutes after arriving in E.D.

CT Scan

- Cranial, thoracic and abdominal CT scan negative per initial interpretation

Transferred to ICU 1 hour after arriving in CT scan suite; condition unchanged.

Hospital Course

Day 2
- "No apparent neurologic deficit"
- U/O low; placed on low dose dopamine
- FiO2 100%, PEEP 10, O2 sat 94%

Day 4
- Dopamine continued
- FiO2 30%, PEEP increased to 17.5, O2 sat 96%

Day 5
- low grade fever

Day 7
- antibiotics initiated
  - FiO2 50%, PEEP 17.5, O2 sat 94%

Day 10
- FiO2 60%, PEEP 17.5, O2 sat 94%
Hospital Course

Day 15
- Dopamine, dobutamine, nitro required to maintain BP and U/O
- FiO2 70%, PEEP 10, O2 Sat 95%

Day 20
- BUN, creatinine, U/O abnormal
- FiO2 90%, PEEP 17.5, O2 sat 91%

Day 24
- Comatose
- Electrolytes, BUN, creatinine abnormal
- FiO2 100%, PEEP 17.5, O2 sat 86%

Day 25
- FiO2 100%, PEEP 17.5, O2 sat 80%
- Bradycardia & hypotension
- Cardiac arrest

Cause of Death
- ARDS
- Multisystem organ failure
- Hypotension

What Happened?

This patient's death was the result of two factors:
- Physiology
- Philosophy
Age and Trauma

- Complication rate increases threefold with the presence of comorbid medical conditions (Richmond et al 2002)
- Standard ISS does not accurately reflect the risk for mortality or discharge placement (Richmond et al 2002)

Age and Trauma

- Trauma mortality for > 65 is x2 that for patients < 65 when corrected for injury severity (Perdue et al 1998)
- Blunt trauma patients with rib fractures (Bergeron et al 2003)
  - > 65 mean hospital stay 26.8 days
  - > 65 28.6% required mechanical ventilation
  - > 65 had 5x the risk of death
5 Year Review & Comparison (60)
(Schiller et al 1995)

- 83% of MVAs failed to use seatbelts
- 13% intoxicated
- Higher average ISS when compared with < 60 (27 vs. 23)

Geriatric Falls & Injury Severity
(Sterling et al 2001)

Geriatric Traumatic Head Injury
(Mosenthal et al 2002)
Predicting Outcome
(Tornetta et al 1999)

**Predictors of mortality**
- Transfusion (10.9 vs. 2.9 U)
- Fluid infusion (12.4 v. 4.9 L)
- GCS (11.5 vs. 13.9)
- ISS (33.1 vs. 16.4)

**Predictors of complications**
- ISS: ARDS, pneumonia, sepsis, GI complications
- Surgery & transfusion: sepsis
- Fluid infusion: myocardial infarction

Timing of death.....

Why??

Why do geriatric trauma patients do so poorly?
Cardiovascular

Atherosclerosis
- Decreased Cardiac Reserve
  - Inability to vasoconstrict
  - Inability to increase stroke volume
  - Ability to increase cardiac rate

Underlying hypovolemia
- Decreased cardiac output
- Reduced systemic perfusion

Underlying Anemia
- Multisystem Organ Failure

Cardiovascular Lessons

- It will take less hypovolemia to result in hypoperfusion
- Hypoperfusion will lead more rapidly to lactic acidosis and its complications
- “Classic” signs of shock will not be present
- Oxygen carrying capacity, as estimated by oximetry, will likely be less than anticipated

Respiratory

Alveolar Thickening
- Decreased Vital Capacity
  - Decreased diffusion capacity
  - Inability to increase minute ventilation
  - Inability to sustain increased rate

Weakened musculature
- Hypoventilation
- Hypoxia
- Hypercapnia & respiratory acidosis

Difficulty Weaning
- Multisystem Organ Failure
Respiratory Lessons

- Assisted ventilation will be required earlier, but
- Ventilator dependence may be a major impediment to discharge
- Clear breath sounds don’t necessarily indicate adequate ventilation
- EtCO2 is a valuable tool
- Oxygen carrying capacity, as estimated by oximetry, will be less than anticipated

Neurologic Lessons

- Always assume that the patient has a normal mental status unless you have reliable information to the contrary
- Look for hearing aids and glasses
- Stay in the patient’s visual field
- Careful neurologic exam to identify baseline and trends
- Altered baseline makes conventional GCS, ISS etc. less predictive!
Remember.....

The patient will have 1-3 comorbid conditions. Get a history and pickup meds:
- Respiratory
- Cardiovascular
- Immunologic
- Renal & Diabetes
- Neurologic

Physiology: Take Home Message

Prehospital
- Index of suspicion, especially with falls & rib fractures
- Gather evidence of comorbid conditions
- Oxygen & assisted ventilation early
- Don’t forget alcohol & drugs
- Appropriate fluid therapy

Hospital
- Revise ISS and GCS criteria for trauma team activation
- Intubate & ventilate early; extubate early
- Monitor carefully
  - Blood glucose
  - Oxygenation
  - EtCO2
  - Temperature & WBC
- Assume onset of ARDS & sepsis
Philosophy of Geriatric Trauma

Trauma is a life-changing event!
(Oreskovich et al 1984)

This data is discouraging!

But, what does it mean?
- The elderly recover poorly from trauma, so we shouldn't be overly aggressive in resuscitation
  
  OR

- Trauma outcome in the elderly is poor, so we should increase our efforts to provide aggressive resuscitative care
Philosophy

Are we aggressive in providing trauma care for geriatric patients?

Back to the Case.....

Prehospital
- 22 minute scene time
- No active ventilation; single intubation attempt
ED/CT
- 1 hour + E.D. time
- 1 hour + CT time

ICU
- Aggressive therapy
- Ventilation; PEEP; oxygenation
- Renal perfusion
- Blood pressure control
- Sedation
- BUT IT WAS TOO LATE!

Why too little too late?
We can make a difference!

Geriatric Trauma Discharges

How?

- High index of suspicion
- Careful evaluation of baseline information and trending
- Thoughtful consideration of co-morbid conditions & associated medications
- Aggressive resuscitation
- Improved communication strategies

Action Plan for Geriatric Trauma

We need to change our philosophy!
System Action Plan

- Revise GCS, ISS etc. criteria for trauma center activation in patients > 65.
- Increase the role of non-vital sign criteria
- Include co-morbidities as inclusion criteria for system activation
- Hold system performance for geriatric patients to the same standards as non-geriatric

Prehospital Action Plan

- High index of suspicion for "minor" mechanisms:
  - Same height falls
  - Blunt chest trauma with focal chest pain
- Perform a thorough neurologic exam and assume that abnormal mental status is new
- Rely more on skin and mental status and less on vital signs for decision-making

Prehospital Action Plan

- Ventilate (& intubate) earlier; improve assessment capability using EtCO2
- Seek out and use hearing aids and glasses
- Gather co-morbid condition history
- Monitor carefully for changes in status
- Keep scene times SHORT; don’t assume a “bad outcome”
E.D. Action Plan

- Activate the system earlier
- Ventilate (and intubate) earlier; improve assessment capability using EtCO2
- Consider CVPs or Swan-Ganz early to allow accurate evaluation of cardiovascular status
- Fret about fractured ribs
- Don’t be fooled by “normal” vitals

E.D. Action Plan

- Be scrupulous about aseptic technique
- Monitor renal function early
- Monitor blood glucose levels frequently
- Inventory medications earlier
- Keep the patient informed
- Get the patient moved OUT quickly; it will decrease their physiologic stress

ICU Action Plan

- Look for complications!
  - ARDS
  - DIC
  - Sepsis
- Fret about O2 sat & PaO2
- Aggressive pulmonary therapy
- Rapid transition to IMV to preserve chest wall strength; extubate early
- Support patient & family
Questions?

Thank you!

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