Geriatric Trauma
Core Concepts for Trauma Centers

AAST Geriatric Trauma Committee
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Objectives

1. Scope of the Problem
2. Outcomes of Elderly Trauma Patients
3. Frailty
4. Strategies to Improve Outcomes of Elderly Trauma Patients/Practice Guidelines
Definition of Geriatric

- Age 65 and over*
- Even ground level falls
- Hip fractures—some centers include

*Definition used in most studies
Demographics and Outcomes
Increase in Number of Persons Aged 65+ in the US

Population Size

- **Number (millions)**
  - 1900: 3 (4%)
  - 1910: 4 (4%)
  - 1920: 5 (5%)
  - 1930: 7 (7%)
  - 1940: 9 (9%)
  - 1950: 12 (8%)
  - 1960: 17 (10%)
  - 1970: 20 (11%)
  - 1980: 26 (13%)
  - 1990: 31 (13%)
  - 2000: 35 (12%)
  - 2010: 40 (13%)
  - 2020: 55 (17%)
  - 2030: 72 (20%)

- **Percent of population**

Year

- 1900: 3 (4%)
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- 2030: 72 (20%)

The Aging Tsunami
Cause of Injury Age 65 and over 1/11-8/11 in Pennsylvania

- Fall: 24608
- MVA: 2284
- Pedestrian MVA: 117
Geriatric Trauma Outcomes

<table>
<thead>
<tr>
<th>Year</th>
<th>ICULOS</th>
<th>LOS (mean)</th>
<th>Mortality %</th>
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<tbody>
<tr>
<td>2003</td>
<td>11</td>
<td>10.9</td>
<td>10.9</td>
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<tr>
<td>2004</td>
<td>11</td>
<td>10.4</td>
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<td>2005</td>
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<td>9.5</td>
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<tr>
<td>2011</td>
<td>9.5</td>
<td>9.5</td>
<td>9.4</td>
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Avg. ISS
Case fatality (number of deaths divided by the number of patients X 100) grouped by age. Total N= 41,821. JACS 2005.
Rate of passenger vehicle crash involvements per mile traveled by driver age, 2008

- All crashes per million miles traveled
- Fatal crashes per 100 million miles traveled
Mechanisms of Injury
Mechanism of Injury

• Falls
  • Most common method of injury in the elderly
  • Most responsible for cause of death
  • By 2020, 54.9 billion dollars spent on the treatment of geriatric falls

http://www.cdc.gov/homeandrecreationalsafty falls/fallcost.html
Disease processes that increase your risk of falling...

- Osteoporosis
- Arthritis
- Dementia or Confusion
- Parkinson’s Disease
- Vision Problems
- Hearing Problems
- Diabetes

- Depression
- Heart Disease
- Blood Pressure Problems
- Bowel & Bladder Incontinence
- Foot Disorders
Mechanism of Injury-MVC

• MVC are #1 cause of trauma related death ages 65-74
• In accidents involving elderly patients
  • 80% were found to be at fault
  • 18% syncopal episode was the inciting event
Mechanism of Injury-Pedestrian

• 1 in 5 pedestrians killed and 1 in 10 pedestrians injured is an elder
• Causes
  • Confusion
  • Vision or hearing deficiency
  • Poor gait
  • Timing of traffic lights/crossing
  • Lack of audible traffic signal

http://www.iihs.org/research/qanda/pedestrians.aspx
Mechanism of Injury-Elder Abuse

• Key way of recognizing and preventing elder abuse: awareness

• Knowing the signs and symptoms of abuse, individuals can ensure that the older people do not fall victim to mistreatment
  • Family, friends and caregivers
Elder Abuse More Common than You Think

• Pennsylvania, 2004-2005 fiscal year: 13,006 suspected situations of elder abuse
• Of these, 21% were so severe that they required state protective services.
Increasing Trauma Deaths in the United States

Peter Rhee, MD, MPH, Bellal Joseph, MD, Viraj Pandit, MD, Hassan Aziz, MD, Gary Verbrugge, MD, Narong Kulvatunyoo, MD, and Randall S. Friese, MD
Physiologic Changes of Aging
Cardiovascular Changes with Aging

• Loss of connective tissue elasticity, change in compliance
  • Increased SBP (and widened PP)
  • Increased afterload
  • Decreased diastolic filling, depends on atrial kick
    • Tachycardia and atrial fibrillation poorly tolerated
  • Stiff veins less able to “buffer” changes in volume
    • Volume shifts have exaggerated changes in cardiac filling pressure
  • Peripheral vasoconstriction remains intact
Cardiovascular Changes with Aging

- Loss of SA node cells, slowed conduction
  - Conduction and rhythm abnormalities
- Myocyte death without replacement
  - Decreased relaxation in diastole
- Decreased responsiveness to β receptor stimulation
  - Maximum heart rate decreased: 220-age
Pulmonary Changes with Aging

- Increased chest wall stiffness
- Decreased lung compliance and elasticity
- Decreased strength and endurance of respiratory muscles
Pulmonary Changes with Aging

- Decreased alveolar surface area
- Impaired gas exchange
- Increased non-functional or closed airways (dead space)
  - Increased V-Q mismatch

**TABLE 62-3 -- Normal values for arterial Po_2**

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Mean and Range (mm Hg)</th>
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</thead>
<tbody>
<tr>
<td>20–29</td>
<td>94 (84–104)</td>
</tr>
<tr>
<td>30–39</td>
<td>91 (81–101)</td>
</tr>
<tr>
<td>40–49</td>
<td>88 (78–98)</td>
</tr>
<tr>
<td>50–59</td>
<td>84 (74–94)</td>
</tr>
<tr>
<td>60–69</td>
<td>81 (71–91)</td>
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Renal Changes with Age

- Decreased functioning neurons by 1%/yr >40 years
- Decreased concentrating ability (↓ renin, ↓ aldosterone, ↑ ANP)
- Decreased free water clearance (↑ ADH)
- Decreased thirst drive

\[
\downarrow \text{GFR}
\]

**Creatinine Clearance ml/min**

![Graph showing creatinine clearance over serum creatinine levels for different ages](graph.png)
Renal Changes with Age

• Often asymptomatic

• Loss of solute excretion (K and H) and resorption (Na)
• Exacerbated by diuretic use
• Higher risk of volume & electrolyte abnormalities
• More susceptible to drug toxicity
  • Higher incidence of ATN and acute renal failure

• Preop renal insufficiency is a strong predictor of peri-operative cardiac and pulmonary morbidity, as well as renal failure.
Cognitive and Behavioral Disorders

- “Geriatric Syndromes”
- Cognitive impairment and dementia
- Decision-making capacity
- Depression
- Risk factors for post-operative delirium
- Alcohol and substance abuse
Frailty
Frailty – Loss of Ability to Rebound
### Understanding Frailty

#### Alternative Working Definition

<table>
<thead>
<tr>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodhouse et al</td>
<td>Those &gt; 65 years of age who depended on others for the activities of daily living and were often under institutional care</td>
</tr>
<tr>
<td>Campbell and Buchner</td>
<td>Condition or syndrome which results from a decline in the reserve of multiple systems and is a state of “unstable disability”</td>
</tr>
<tr>
<td>Lipsitz et al</td>
<td>Loose complexity in resting dynamics and show maladaptive responses to perturbations</td>
</tr>
<tr>
<td>Bortz</td>
<td>Concept of symmorphosis &quot;an insidious and relentless thief of energy and vitality&quot;</td>
</tr>
<tr>
<td>Hougaard</td>
<td>A random effects model for time variables, where the random effect (frailty) has a multiplicative effect on hazard</td>
</tr>
</tbody>
</table>

**physiological decline that affects all organ systems**
Sarcopenia

Age 25

Age 63
Sarcopenia
- Skeletal muscle loss
- Poor muscle quality

Physical Function Impairment
- Weak muscle strength
- Slow gait speed
- Poor balance

Frailty
- Deficits accumulation
- Fatigue
- Sedentary behaviour
- Weight loss
- Cognitive impairment
- Social isolation
Age and Rib Fractures

![Graph showing the relationship between age and the number of rib fractures. The graph indicates a higher percent of deaths for patients aged 65 and above with a greater number of rib fractures.](image-url)

Bergeron E et al, J Trauma 2003; 54:478
Specific Injuries
Age and Brain Injury

New York State Trauma Registry 1994-95 (n=11,772 Head-Injured Patients)

Elderly, Nonelderly Nonsurvivors by GCS Score

Susman M, J Trauma 2002; 53:219
Cervical Spine Injuries

• Incidence of c-spine injury is 2x that of younger cohort
• Underlying arthritis may obscure fx lines
• Be aware of central cord syndrome with hyperextension injury
Role of the Trauma System and Center
Under-triage Increases Mortality

- 4534 Pts Age ≥65, 2000-2010
- Undertriage = ISS >15 w/o Trauma Team activation

Findings:
- 15% undertriage rate
- 2X more likely to die

Rogers A et al, Am Surg 2012; 78:711
Geriatric Trauma Strategies for Pre-Hospital

- “Normal” vital signs might not be normal
- Over-triage is better than under-triage
- Designated trauma center

Pracht et al, J Trauma 2011; 71:69
Geriatric Trauma Strategies for ED

- Give IV fluid in **small boluses**
- **Truncate and tailor** evaluation
- **Monitor / assess** early and often (Hgb, ABG, INR)
- Medical & **medication history**
Geriatric Trauma Strategies for Inpatients

Close Monitoring, Frequent Assessments

**Mental Status**
- Identify pre-Existing cognitive impairment
- Look for causes of delirium
- Avoid polypharmacy

**Cardiovascular**
- Assess / monitor for occult hypoperfusion and myocardial ischemia
Geriatric Trauma Strategies: Inpatient (Cont’d)

Functional Status

- Physical Therapy
- Occupational Therapy
- Geriatrics Consultation
- Clinical Pathways

Fallon et al, J Trauma 2006; 61:1040
Friedman et al, J Am Geriatr Soc 2008; 56:1349
Leung et al, J Trauma 2011; ePub
Geriatric Trauma Strategies: Inpatient

**Pulmonary**
- Assess Function – Serial Spirometry
- Assess Swallowing, Aspiration Risk
- Avoid Oversedation, Supine Position
- Pain Management
Pain Control

• Over medication can lead to delirium
• SO CAN under-treated pain
  • Up to 45% of elderly patients say pain is undertreated in the hospital

• Comparison of 43 patients and incidence of delirium looking at delivery of “as needed” (PRN) analgesic medications
  • 26% vs 48% of “allowed” analgesia given in delirious vs non patients.
Sleep Disruption

• Sleep disorder affects 50% of elderly patients at baseline

• Hospitalization increases the morbidity of sleep deprivation
  • Poor wound healing
  • Decreased resistance to infection
  • Immune suppression
  • Disrupted nitrogen balance

• Multiple disruptors
  • Lights, noise, patient care
Delirium Prevention Measures

• Optimize light/dark & sleep/wake cycle
• Decrease disruptions at night
• Re-orient regularly, minimize restraints
• Minimize sedatives, especially benzodiazepines and benadryl
• Treat pain appropriately
• Mobilize!
Surgical Problems that Develop in the ICU

In addition to surgical issues that necessitate ICU care, elderly patients are more susceptible to surgical problems developing while in the ICU:

- Ogilvie’s syndrome
- Acalculous cholecystitis
- Toxic Megacolon / Clostridium difficile colitis
- Peri-rectal abscess
- Decubitus ulceration
- Wound infection
- Post pneumonia empyema
Beers Criteria

• Criteria for safe med use in adults (>65)
• First issued 1991, repeatedly revised and updated.
• Named for Dr. M.H. Beers, principal author of original 1991 criteria.
Models of Geriatric Trauma Care

1. Acute Care of the Elderly (ACE) unit
   • More home-like environment
   • Patient-centered care preventing disability and iatrogenic illness, and comprehensive discharge planning and management

2. Geriatrician-led interdisciplinary team approach
   • Goals to improve functional status, reduce acute care hospital days and readmission, and lower mortality rate

3. Comprehensive geriatric assessment

4. NICHE (Nurses Improving Care for Hospitalized Elders)

5. Geriatric Resource Nurses: relatively low-cost option for putting geriatric knowledge across units and clinics.

6. Geriatric consultation
Your Guidebook

- Background
- Trauma Team Activation
- Initial Evaluation
- Specializing Inpatient Care
- Decision-Making Capacity
- Beers Criteria
- Substance Use/Abuse
- Depression
- Frailty
- More
Advance Directive

How much is the patient willing to go through, for what chance, of what outcome?
Palliative Care Goals

• Palliative care is a transition from care with curative intent, to care with a goal of comfort and preservation of dignity

• Honest communication about prognosis and goals of care is essential

• Often this conversation is delayed beyond of the patient’s inability to participate
What Palliative Care is Not...

• End-of-Life Care
• Withdrawal of Care
• ‘Do not Treat’
• Giving up
Interdisciplinary model for palliative care in the trauma and surgical intensive care unit: Robert Wood Johnson Foundation Demonstration Project for Improving Palliative Care in the Intensive Care Unit

Anne C. Mosenthal, MD, FACS; Patricia A. Murphy, RN, PhD, FAAN

Changing the Culture Around End-of-Life Care in the Trauma Intensive Care Unit

Anne C. Mosenthal, MD, FACS, Patricia A. Murphy, PhD, Lyn K. Barker, MA, Robert Lavery, MA, Angela Retano, MA, and David H. Livingston, MD
Model of Palliative Care in the ICU

1. Bereavement and psychosocial support within 24 hrs of admission

2. Interdisciplinary palliative care assessment within 24 hrs of admission

3. Family meeting with MD and nurse within 72 hrs of admission
Model of Palliative Care in the ICU

4. Comprehensive palliative care plan by 72 hrs

5. Palliative care standing order set for patients identified as imminently dying

6. Integration of palliative care performance measures into M&M and peer review
Summary

- Elderly trauma population is growing
- Elderly suffer worse outcomes compared with younger adults
- More Research is needed to identify reasons for worse outcomes, and interventions that improve outcomes
Summary

• Elderly patients require ICU care more often than younger injury/illness matched patients

• Outcomes in elderly patients requiring ICU care are often worse than younger patients

• Some poor outcomes are from reversible insults within the ICU

• Clarity of goals for care and expectations for prognosis are important, and end of life discussions should be held earlier
<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
</tr>
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<tbody>
<tr>
<td>Sasha Adams</td>
<td><a href="mailto:Sasha.D.Adams@uth.tmc.edu">Sasha.D.Adams@uth.tmc.edu</a></td>
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<td>Carl Soderstrom</td>
<td><a href="mailto:csoderstrom@mddot.state.md.us">csoderstrom@mddot.state.md.us</a></td>
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<td>Andrew Bernard</td>
<td><a href="mailto:andrew.bernard@uky.edu">andrew.bernard@uky.edu</a></td>
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