The Elderly Patient and Trauma – It’s More than Broken Hips

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Disclosures

• I have no disclosures
The Elderly Patient: Introduction

- Epidemiology
- Mechanisms
- Triage and evaluation
- Physiology
- Surgical Patients
- Creating a Geriatric Trauma Service
The Elderly Patient

- First: The age question, what is elderly?
- Many articles say 65
- Trauma mortality increases at age 55
- Will generally use 65 as the age for the purpose of this talk
- 23% of adult trauma population is 65 or older
- By 2050, 90 million will be over 65, 1/5 of the adult population
Elderly: Epidemiology

- Adult lifespans are increasing.
- Multiple studies have documented the aging population.
- The CDC estimates that those over 65 years of age will reach 21% of the total population by 2030.
- We will need to continue to adapt and learn to improve care for these patients as we did for penetrating violence in the 90’s or more recently from military conflicts.
Elderly: Epidemiology

- The elderly are more active
- They are driving more miles in cars
- They have greater accessibility given other mobility devices
Mechanisms of Trauma
Triage

- Geriatric morbidity and Mortality in trauma increases at age 55
- Geriatric patients treated at higher level trauma centers do better.
Physiology/ Comorbidities

- 50% have hypertension
- 39% have heart disease
- All of the following occur more than 10%:
  - Diabetes
  - CVA
  - COPD
  - Dementia
  - Arrhythmias
  - Endocrine disorders
- Most also have decreased FRC, thus desaturate more quickly
<table>
<thead>
<tr>
<th>Organ System</th>
<th>Normal</th>
<th>Potential Differences in the Older Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital signs</td>
<td>Increased mortality if HR &gt; 130 beats/min or SBP &lt; 95 mm Hg</td>
<td>Increased mortality if HR &gt; 90 beats/min or SBP &lt; 110 mm Hg</td>
</tr>
<tr>
<td>Neurologic</td>
<td>No baseline deficits</td>
<td>Baseline deficits (dementia, stroke, hearing loss) Report less pain for equivalent injuries, potentially limiting injury discovery</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>No baseline deficits, no hypertension No cardiac medications</td>
<td>Baseline hypertension Medications that affect blood pressure and heart rate (β-blocker, calcium-channel blocker, amiodarone) History of heart failure</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Normal functional residual capacity Potential smoker</td>
<td>Decreased functional residual capacity Chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>Renal</td>
<td>Normal renal function</td>
<td>Decreased glomerular filtration rate</td>
</tr>
<tr>
<td>Coagulation</td>
<td>Normal coagulation status</td>
<td>On blood-thinning medications including ASA, warfarin, and platelet inhibitors</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Normal bone density</td>
<td>Osteoporosis, leading to easier fracture rate</td>
</tr>
<tr>
<td>Medications</td>
<td>Minimal medications</td>
<td>Polypharmacy that can change mental, hemodynamic, renal, and coagulation status</td>
</tr>
</tbody>
</table>

Abbreviations: ASA, acetylsalicylic acid; HR, heart rate; SBP, systolic blood pressure.
Physiology/ Comorbidities

• Appropriate medications cause issues:
  • BB and Ca channel blockers blunt the normal tachycardic response to poor perfusion
  • Anticoagulants from ASA to direct thrombin inhibitors make bleeding risks higher.
  • Steroids for COPD limit wound healing
  • Antipsychotics and dementia lead to post op issues

• Inappropriate medication
  • Often polypharmacy including narcotics, benzos, and anticoagulants that have not been appropriately terminated
Physiology – Practical Issues

- Patients can have major injuries with minor trauma
  - Head bleeds
  - Splenic laceration
  - Fractures, not just hips – especially ribs
- With more frail tissues, patients develop wounds quicker
- Spine deformities are more prevalent
- So limit backboard use
- They will desaturate quicker on intubation
- They will respond poorly to benzodiazepams
- Their pressures are baseline higher so must be kept higher after injury
Rib Fracture Triage

- 2 points:
  - Age ≥ 60yo

- 1 point:
  - ≥ 3 rib fractures
  - Bilateral rib fractures
  - Flail segment
  - IS <500ml
  - Weak or no cough
  - Underlying chronic lung disease

- If ≥3 points-admit pt to the SICU and consult pain for an epidural

- If ≥2 points- consider admission to the OU and early pain consult for an epidural
Emergent Surgical Patients

- Many procedures in the elderly population are urgent or emergent.
- Most trauma operations are not elective, even if not emergent.
- Minimal work up is often all that is needed.
Screen for Non-Elective cases

• Acute cardiac disease
  • Unstable or severe angina
  • Myocardial infarction within 1.5 months
  • New or worsening heart failure symptoms
  • Significant arrhythmias
  • Severe valve stenosis.

• The above require a more thorough workup and possible cardiology consult. However, this is for risk assessment and OR planning, not to stop cases.
Screen for Non-Elective cases

- **Targeted labs and tests**
  - Basic labs – CBC; BMP; T&S or T&C per procedure, others per symptoms or medications
  - ECG
  - CXR – suspicion for CHF, dyspnea, PNA, hypoxia
  - TTE – evaluate CHF with worsening symptoms, evaluation of an new/undiagnosed murmurs, reevaluation of known significant valvular disease (moderate or greater) if no recent study available (within 2 years)
- **Continue/restart home medications ASAP**
- **Retrieval of records from most recent cardiac evaluation**
- **Cardiac devices – must determine brand and type and interrogate if > 3 months**
Geriatric Trauma Service

- How can we continuously improve care for such patients?
Introduction

• Our trauma service was not satisfied with the care of the older injured patient

• Factors that we reviewed included:
  
  • TQIP data that revealed we may be an outlier in isolated hip fractures
  • Individual patient reviews that revealed what we considered fragmented care
  • An ACS review that noted some issues with improving geriatric care
Introduction

- At our center, all multiply injured patients with significant injury pre and post intervention were admitted to the Trauma service, regardless of age.

- Single system isolated injuries were admitted to various services depending on PCP and ED consultation
  - Isolated hip fracture admitted to orthopedics or a medicine service
  - Small ICH with normal GCS admitted to neurosurgery, neurology, or medicine.
Introduction

• Using this information we approached hospital and Department of Surgery leadership to develop a plan to improve the care of the geriatric patient.

• A decision was made to identify areas of concern and to design and implement a Geriatric Trauma Service (GTS) to address those issues.
Issues Identified on Review

- No protocol on where to admit minor to moderately injured geriatric patients
- No consistent admitting service, resulting in some patients transferred services multiple times
- Inadequate therapy (OT and PT) resources to ensure rapid assessment and placement of patients after required medical care with even less availability on weekends
  - There was a much higher therapy intensity available on the joint replacement service floor
- No protocol for standard preoperative evaluation. Instead, medicine, hospitalists, and anesthesia providers differed significantly and resulted in case cancellations
Issues Identified on Review

• Inadequate resident coverage to care for these patients on the main Trauma service
• No standard protocols for postoperative care
• No standard for medication review or follow up with the patients’ primary care providers (PCP)
• Floor based social worker teams that created multiple handoffs between social workers as patients moved from ICU to the floor
Introduction

- Our study aim was to assess the effectiveness of the new GTS as measured by mortality and length of stay
Methods - Implementation

• Hired and trained 3 nurse practitioners to run the service during the day
• Dedicated ICU trained trauma attending to round on patients daily
• Hired more PT/OT and changed shifts to ensure a robust therapy intensity
• Changed SW model to team instead of floor based model, ensuring less handoffs of these patients
• Floor based nursing education on geriatric patients
• Changed triage criteria for those over 54 to ensure trauma attending consultation before admission, ensuring correct admitting service
• Developed standard treatment protocols
Methods - Implementation

- Beers medication review of home meds for every patient
  - Review for potentially inappropriate medications
  - Benzodiazepines, narcotics, sedatives, and blood thinning medications removed most
  - Adjustments for renal failure
- Developed protocols with anesthesia for standard and efficient work up for these patients
- Contacted PCPs for every patient that had one, and helped to find one for those that do not
Methods - Implementation

Geriatric Trauma service admission criteria

• 55 or older
• Single system or multisystem low to moderate severity
Methods – Study Design

• Pre-Post, time interrupted series with retrospective review of prospectively collected trauma database

• Pre GTS control group – All trauma patients > 55 admitted to Neurosurgery, Orthopedics, or Medicine in 2012

• Post GTS experimental group – All trauma patients > 55 admitted to the GTS for 15 months after implementation of the GTS, October 2013 through December 2014

There was a 9 month implementation phase between groups while all elements of the GTS were implemented.
## Results – Patient Numbers

<table>
<thead>
<tr>
<th>Team</th>
<th>Pre GTS</th>
<th>Post GTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTS</td>
<td>NA</td>
<td>798</td>
</tr>
<tr>
<td>Trauma</td>
<td>343</td>
<td>449</td>
</tr>
<tr>
<td>Non Trauma</td>
<td>652</td>
<td>392</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>221</td>
<td>203</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>281</td>
<td>121</td>
</tr>
<tr>
<td>Medicine</td>
<td>150</td>
<td>68</td>
</tr>
<tr>
<td>Totals</td>
<td>995</td>
<td>1247</td>
</tr>
</tbody>
</table>
# Results - Demographics

<table>
<thead>
<tr>
<th></th>
<th>Pre GTS</th>
<th>Post GTS</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>74.1</td>
<td>77.2</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Gender (M/F, %)</td>
<td>245/433, 36%</td>
<td>240/414, 37%</td>
<td>NS</td>
</tr>
<tr>
<td>ISS</td>
<td>9.54</td>
<td>8.8</td>
<td>NS</td>
</tr>
<tr>
<td>AIS Head</td>
<td>1.23</td>
<td>0.81</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>AIS Face</td>
<td>0.13</td>
<td>0.14</td>
<td>NS</td>
</tr>
<tr>
<td>AIS Chest</td>
<td>0.16</td>
<td>0.36</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>AIS Abdominal</td>
<td>0.05</td>
<td>0.16</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>AIS Extremities</td>
<td>1.45</td>
<td>1.6</td>
<td>0.0428</td>
</tr>
<tr>
<td># of comorbidities</td>
<td>21.1</td>
<td>21.33</td>
<td>NS</td>
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Results Mortality and LOS

- LOS: Pre GTS = 5.5, Post GTS = 4.5, p < 0.001
- % Mortality: Pre GTS = 4.75, Post GTS = 2.01, p = 0.003
### Mortality Logistic Regression

<table>
<thead>
<tr>
<th>Effect</th>
<th>Point Estimate</th>
<th>95% Wald Confidence Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>1.011</td>
<td>0.985 - 1.038</td>
</tr>
<tr>
<td>Comorb</td>
<td>1.019</td>
<td>1.001 - 1.037</td>
</tr>
<tr>
<td>Pre vs Post GTS</td>
<td>0.506</td>
<td>0.263 - 0.972</td>
</tr>
<tr>
<td>AIS_Head</td>
<td>3.231</td>
<td>1.330 - 7.850</td>
</tr>
<tr>
<td>AIS_Face</td>
<td>2.066</td>
<td>0.908 - 4.701</td>
</tr>
<tr>
<td>AIS_Chest</td>
<td>1.140</td>
<td>0.417 - 3.115</td>
</tr>
<tr>
<td>AIS_Abdominal</td>
<td>0.626</td>
<td>0.078 - 5.026</td>
</tr>
<tr>
<td>AIS_Extremities</td>
<td>0.582</td>
<td>0.232 - 1.462</td>
</tr>
<tr>
<td>AIS_External</td>
<td>0.695</td>
<td>0.356 - 1.355</td>
</tr>
</tbody>
</table>

GTS, p=0.04, AIS Head, p=0.01, Comorb, p=0.04
## Length of Stay - Linear Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate</th>
<th>Standard Error</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>-0.00084</td>
<td>0.01267</td>
<td>NS</td>
</tr>
<tr>
<td>AIS_Head</td>
<td>0.42181</td>
<td>0.12905</td>
<td>0.0011</td>
</tr>
<tr>
<td>AIS_Chest</td>
<td>0.73959</td>
<td>0.19453</td>
<td>0.0001</td>
</tr>
<tr>
<td>AIS_Abdominal</td>
<td>0.34305</td>
<td>0.3009</td>
<td>NS</td>
</tr>
<tr>
<td>AIS_Extremitites</td>
<td>0.801</td>
<td>0.15244</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Pre vs Post GTS</td>
<td>-1.0587</td>
<td>0.30098</td>
<td>0.0004</td>
</tr>
</tbody>
</table>
# Results – Non GTS Patients

<table>
<thead>
<tr>
<th>Service</th>
<th>Pre GTS</th>
<th>Post GTS</th>
<th>Pre GTS</th>
<th>Post GTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Non Trauma</td>
<td>ISS 9.5</td>
<td>ISS 10</td>
<td>ISS 5.5</td>
<td>ISS 5.0</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>14.1</td>
<td>14.6</td>
<td>14.6</td>
<td>14.6</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>7.4</td>
<td>6</td>
<td>5.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Medicine</td>
<td>6.8</td>
<td>6</td>
<td>6.7</td>
<td>4.9</td>
</tr>
</tbody>
</table>
Conclusions

• Creation of a Trauma Surgeon led Geriatric Trauma Service significantly decreased mortality and length of stay at our trauma center.

• Head AIS is also a significant predictor of Mortality and increased LOS.

• In light of the increasing burden of older injured patients, trauma programs must develop robust systems to care for these patients safely and expediently.
Summary – The Elderly Patient

• The elderly patient does better at higher level trauma centers

• Recognize differences in physiology and use that information

• A GTS can improve outcomes