Frailty in Geriatric Trauma Patients

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Elizabeth Bryant, MPH
Objectives

• Understand the conceptual model of frailty

• Recognize the prognostic significance of frailty in trauma

• Describe interventions that improve outcomes
Grey tsunami

Note: Data for 2010–2050 are projections of the population. Reference population: These data refer to the resident population.

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Trauma in older adults

Unintentional Injury is the 7th leading cause of death in older adults

56% Falls

23% MVC

In hospital mortality for older trauma patients ~ 11%

Mortality of TBI 2 X younger patients

18% Mortality after rib fractures

35% Other Acute

% Trauma patients admitted to US hospitals

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Frailty vs Aging

Frail:

- 10% of patients over aged 65
- 50% of patients over 85
- 44-78% of older trauma patients
## Normal physiology of aging

<table>
<thead>
<tr>
<th>System</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Increased resistance, Decreased compliance</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Decreased compliance, Decreased FRC</td>
</tr>
<tr>
<td>Endocrine</td>
<td>Decreased thyroid activity, Impaired glycemic response to injury</td>
</tr>
<tr>
<td>Renal</td>
<td>Decreased thirst, Inability to concentrate urine, Volume overload</td>
</tr>
</tbody>
</table>
The cycle of frailty

Neuroendocrine dysregulation

- Anorexia of aging
  - \( \downarrow \) Total energy expenditure
  - \( \downarrow \) Activity
  - Frailty

Chronic undernutrition

- \( \downarrow \) Resting metabolic rate
- \( \downarrow \) Walk speed
- \( \downarrow \) Disability
- Dependency

Aging, Senescence, Musculoskeletal changes

Disease

Falls

Delirium

Functional Impairment

Dependence

Social Isolation

Increased care needs
"The Precipice"

Physiologic Reserves Available

Homeostasis

Physiologic Reserves Already In Use

Increasing Age
Markers of frailty

<table>
<thead>
<tr>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrinkage</td>
</tr>
<tr>
<td>Weakness</td>
</tr>
<tr>
<td>Exhaustion</td>
</tr>
<tr>
<td>Low physical activity</td>
</tr>
<tr>
<td>Slowness</td>
</tr>
<tr>
<td>Multimorbidity</td>
</tr>
</tbody>
</table>
What happens when you have trauma and you’re frail?
Impact of trauma

- Fluid loss
- Hemodynamic changes
- Respiratory change
- Impaired glucose regulation
- Functional changes
- Mental status changes
Optimizing outcomes from surgery & trauma

• Best if you can:
  – Pee
  – Poop
  – Breathe
  – Eat
  – Walk
  – Participate

• Older patients:
  – Decreased renal function
  – Constipation
  – Decreased functional capacity
  – Dysphagia
  – Functional limitations
  – Cognitive impairment or delirium
Superiority of Frailty Over Age in Predicting Outcomes Among Geriatric Trauma Patients
A Prospective Analysis

Bellal Joseph, MD; Viraj Pandit, MD; Bardiya Zangbar, MD; Narong Kulvatunyou, MD; Ammar Hashmi, MD; Donald J. Green, MD; Terence O’Keeffe, MB, ChB; Andrew Tang, MD; Gary Vercruysse, MD; Mindy J. Fain, MD; Randall S. Friese, MD; Peter Rhee, MD

Complications

Table 5. Multivariate Logistic Regression Analysis for Factors Associated With In-Hospital Complications, Categorized by Age Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age 65-74 y (n = 121)</th>
<th></th>
<th>Age 75-84 y (n = 82)</th>
<th></th>
<th>Age ≥85 y (n = 47)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P Value</td>
<td>OR (95% CI)</td>
<td>P Value</td>
<td>OR (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td>Frailty Index ≥0.25</td>
<td>1.3 (0.8-2.6)</td>
<td>.01</td>
<td>1.5 (0.4-3.2)</td>
<td>.46</td>
<td>1.1 (0.7-2.3)</td>
<td>.19</td>
</tr>
<tr>
<td>ED vital signs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>1.2 (0.9-3.6)</td>
<td>.40</td>
<td>1.1 (0.4-1.9)</td>
<td>.28</td>
<td>1.4 (0.6-2.5)</td>
<td>.52</td>
</tr>
<tr>
<td>Heart rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injury Severity Score</td>
<td>9-15</td>
<td>1.2 (0.7-2.8)</td>
<td>.58</td>
<td>1.2 (0.9-2.4)</td>
<td>.30</td>
<td>1.1 (0.7-1.7)</td>
</tr>
<tr>
<td></td>
<td>≥16</td>
<td>1.6 (0.9-3.4)</td>
<td>.25</td>
<td>1.3 (0.7-2.9)</td>
<td>.18</td>
<td>1.2 (0.7-1.7)</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; OR, odds ratio.
Superiority of Frailty Over Age in Predicting Outcomes Among Geriatric Trauma Patients
A Prospective Analysis

Table 7. Multivariate Logistic Regression Analysis for Factors Associated With Adverse Discharge Disposition, Categorized by Age

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age 65-74 y (n = 121)</th>
<th></th>
<th>Age 75-84 y (n = 82)</th>
<th></th>
<th>Age ≥85 y (n = 47)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frailty Index ≥0.25</td>
<td>1.3 (0.9-2.6)</td>
<td>.13</td>
<td>1.4 (0.7-3.3)</td>
<td>.47</td>
<td>1.1 (0.7-4.7)</td>
<td>.02</td>
</tr>
<tr>
<td>Male sex</td>
<td>.40</td>
<td>.01</td>
<td>.59</td>
<td>.59</td>
<td>.22</td>
<td>.09</td>
</tr>
<tr>
<td>Insured status</td>
<td>1.1 (0.5-2.8)</td>
<td>.35</td>
<td>1.3 (0.9-3.1)</td>
<td>.41</td>
<td>1.1 (0.8-2.6)</td>
<td>.28</td>
</tr>
<tr>
<td>ED Glasgow Coma Scale score</td>
<td>1.0 (0.7-2.1)</td>
<td>.55</td>
<td>1.2 (0.9-3.1)</td>
<td>.25</td>
<td>1.2 (0.8-1.9)</td>
<td>.09</td>
</tr>
<tr>
<td>Mechanism of injury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-15</td>
<td>1.4 (0.6-2.4)</td>
<td>.47</td>
<td>1.3 (0.7-1.8)</td>
<td>.21</td>
<td>1.2 (0.9-1.9)</td>
<td>.13</td>
</tr>
<tr>
<td>≥16</td>
<td>1.3 (0.8-2.1)</td>
<td>.26</td>
<td>1.4 (0.9-2.5)</td>
<td>.10</td>
<td>1.3 (0.8-1.8)</td>
<td>.09</td>
</tr>
<tr>
<td>Head Abbreviated Injury Scale score</td>
<td>1.1 (0.6-1.7)</td>
<td>.18</td>
<td>1.2 (0.9-2.2)</td>
<td>.15</td>
<td>1.1 (0.8-1.5)</td>
<td>.18</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; OR, odds ratio.
**Preinjury physical frailty and cognitive impairment among geriatric trauma patients determine postinjury functional recovery and survival**

Cathy A. Maxwell, PhD, RN, Lorraine C. Mion, PhD, RN, Kaushik Mukherjee, MD, Mary S. Dietrich, PhD, Ann Minnick, PhD, RN, Addison May, MD, and Richard S. Miller, MD Nashville, Tennessee

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>6 mo</th>
<th>1 y</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted</td>
<td>Adjusted*</td>
</tr>
<tr>
<td>Age</td>
<td>1.07 0.003</td>
<td>1.08 0.003</td>
</tr>
<tr>
<td>Injury severity</td>
<td>1.05 0.047</td>
<td>1.08 0.005</td>
</tr>
<tr>
<td>Comorbidity index</td>
<td>1.03 0.274</td>
<td>1.03 0.392</td>
</tr>
<tr>
<td>Cognition (preinjury AD8 score)</td>
<td>1.09 0.185</td>
<td>0.96 0.501</td>
</tr>
<tr>
<td>Function (preinjury Barthel Index score)</td>
<td>1.51 0.001</td>
<td>1.33 &lt;0.001</td>
</tr>
<tr>
<td>Sex (1 = male, 2 = female)</td>
<td>1.29 0.515</td>
<td>1.12 0.752</td>
</tr>
<tr>
<td>Race, white</td>
<td>0.66 0.543</td>
<td>1.03 0.964</td>
</tr>
<tr>
<td>Live alone</td>
<td>1.33 0.490</td>
<td>1.32 0.457</td>
</tr>
</tbody>
</table>

*Test of overall model: $X^2 = 26.51, p < 0.001.$

**Test of overall model: $X^2 = 46.51, p < 0.001.$
Preinjury physical frailty and cognitive impairment among geriatric trauma patients determine postinjury functional recovery and survival

Cathy A. Maxwell, PhD, RN, Lorraine C. Mion, PhD, RN, Kaushik Mukherjee, MD, Mary S. Dietrich, PhD, Ann Minnick, PhD, RN, Addison May, MD, and Richard S. Miller, MD Nashville, Tennessee
More experienced hospitals have lower mortality rates

TC Level
- Level II had 27% lower mortality

Proportion of Volume
- 28% lower mortality
- 31% lower failure to rescue
- 11% reduction in mortality/100 increase in geriatric trauma admissions
Interventions

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He’s vigorous and sharp as a tack...

- History from wife and children is that he’s able to perform all activities of daily living

But when you probe...

- Has been having mild memory and hearing loss
- Doesn’t drive very far anymore
- Messing up the bills
- He just hasn’t been feeling well lately
Comprehensive Geriatrics Assessment

<table>
<thead>
<tr>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical medical conditions</td>
</tr>
<tr>
<td>Mental health</td>
</tr>
<tr>
<td>Functioning</td>
</tr>
<tr>
<td>Social circumstances</td>
</tr>
<tr>
<td>Environment</td>
</tr>
<tr>
<td>Advance care planning</td>
</tr>
</tbody>
</table>

• Cochrane review:
  - 25% reduction in death or cognitive decline at 6 months
  - 31% higher chance of being alive and in own home at 6 months
  - Number needed to treat = 13 to avoid one death
Long-term Postinjury Functional Recovery Outcomes of Geriatric Consultation

Areti Tillou, MD, MSEd; Lorraine Kellev-Ouon, MD; Sigrid Burruss, MD; Eric Morlev, MPH; Henry Crver, MD, PhD.

Change in ADL Ability

Time After Injury, mo

Consult group (n=85)

Control group (n=37)
Background

• Academic, urban, Level I trauma center

• Majority of patients are ≥ 65 years

• Primary mechanism of injury is falls
2014: Triggered Geriatrics Consults

– Admitted patients ≥ 70 years
– Seen within 72 hours of admission
– Comprehensive Geriatrics Assessment
# Improved Processes of Care

## Proportion of population, %

<table>
<thead>
<tr>
<th>Process of Care</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geriatric consult</td>
<td>3.26</td>
<td>100.0</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Documentation of delirium</td>
<td>31.16</td>
<td>38.22</td>
<td>0.14</td>
</tr>
<tr>
<td>DNR/DNI code status</td>
<td>10.23</td>
<td>38.22</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Referral for formal cognitive evaluation</td>
<td>2.33</td>
<td>14.21</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

### Recognitions
- Recognition of delirium: 7%
- DNR/DNI code status: 28%
- Referral for cognitive evaluation: 12%
## Improved Outcomes

### Proportion of population, %

<table>
<thead>
<tr>
<th>Patient Outcome</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>$P$ value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital mortality</td>
<td>9.30</td>
<td>5.24</td>
<td>0.12</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>11.63</td>
<td>6.81</td>
<td>0.10</td>
</tr>
<tr>
<td>ICU readmission</td>
<td>8.26</td>
<td>1.96</td>
<td>0.06</td>
</tr>
<tr>
<td>30-day hospital readmission</td>
<td>16.92</td>
<td>14.92</td>
<td>0.60</td>
</tr>
<tr>
<td>Hospital length of stay, days†</td>
<td>6.41</td>
<td>5.95</td>
<td>0.90</td>
</tr>
</tbody>
</table>

In hospital mortality 4%
30-day mortality 4.8%
ICU readmission 6.6%
Background

• Problem: Discontinuities in care when trauma geriatrician isn’t available

• Objectives:
  1. Reduce variability
  2. Reduce delirium
  3. Improve function
Methods

Step 1: Identify specific components of care to accomplish the pathway’s objective
- In person meetings with stakeholders
- Literature reviews
Pathway Components

DELIRIUM
- Non-pharm prevention
- Sleep-wake cycle
- Confusion Assessment Method (CAM)

FUNCTION
- Early mobility
- Bowel and pain regimens
- Consults
- Vitamin D/Ca$^{2+}$ labs
- Orthostatics
- Swallow screen

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Step 2: The FRAIL Scale

Fatigue
Resistance (inability to walk up flight of stairs)
Ambulation (inability to walk length of football field)
Illness (5 or more)
Loss of weight (5% or more body weight)
Pathway Overview

ED: Trauma patient 65+ screened  $\rightarrow$ FRAIL scale positive  $\rightarrow$ Enters Pathway
Pathway Overview

Admission Order Set
- Vitamin 25-OH D and Ca\textsuperscript{2+} labs
- Orthostatics
- Bowel regimen
- Pain regimen
- Healthcare proxy identified, MOLST/advance directives
- Aspiration precautions

Nursing Care
- Pain Assessments
- Bowel checks
- Early mobilization
- Swallow screen
- CAM/delirium prevention

Consults
- CGA
- Nutrition
- Physical therapy
- Social work (if lives by self)
- Family meeting

Education
- Fall prevention packet
Implementation

• Staff education
  – Residents
  – Nurses, physician care assistants (PCAs)
  – Fellows, attendings
  – Physician assistants (PAs)
  – Other clinical staff

• Kick off date for step-down: April 11, 2016
• Kick off date for ICU: June 16, 2016
Maintenance

• Multidisciplinary rounds twice a week
• Monthly check-in meetings
• Data presentation at monthly PIPs
• Online educational module for all clinical staff who work on the trauma service
<table>
<thead>
<tr>
<th>Process Outcomes</th>
<th>July 2016</th>
<th>February 2017</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median number of CAM/day</td>
<td>2.5</td>
<td>3.5</td>
<td>3</td>
</tr>
<tr>
<td>Family meetings if patient had LOS ≥5 days</td>
<td>25%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>Nutrition within 72 hours of admission</td>
<td>75%</td>
<td>87%</td>
<td>100%</td>
</tr>
<tr>
<td>Fall prevention information</td>
<td>6.25%</td>
<td>33%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Challenges/Pitfalls

• Electronic medical records
  – Documentation
  – Nursing checklist

• PCA involvement
Next Steps

• Expand to other floors/services that regularly see this patient population
• Long-term outcomes
• Expand fall prevention component