Disclosures

• None
Overview

• What is Geriatric Trauma?
  – FALLS!

• Trauma Transfer System in Oregon

• Institutional Experience of POLST System and Trauma
What is geriatric trauma?

• Typically defined as injury age 65+
  – Head injury worse outcomes beginning age 40


What makes geriatric trauma different?

• Worse outcomes than younger trauma patients

• Distinct injury patterns, severity, and sequelae

• Frailty: Decreased physiologic reserve leading to impaired ability to withstand physiologic stress

Cardiovascular  →  Cerebral
Sensory  →  Pulmonary
Skin  →  Musculo-skeletal

## Cerebral

<table>
<thead>
<tr>
<th>Age-Related Changes</th>
<th>Effect on Trauma</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased intracranial space due to cerebral atrophy</td>
<td>Greater likelihood of intracranial bleed</td>
<td>Worse injury with minor trauma</td>
</tr>
<tr>
<td>Preexisting Dementia/Neurovascular disorders</td>
<td></td>
<td>Difficult exam</td>
</tr>
</tbody>
</table>

## Sensory

<table>
<thead>
<tr>
<th>Age-Related Changes</th>
<th>Effect on Trauma</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased vision</td>
<td>Impaired pupil response</td>
<td>Difficult Exam</td>
</tr>
<tr>
<td>Decreased Hearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuropathies/ altered pain perception</td>
<td>Increase in pain threshold</td>
<td>May miss injuries</td>
</tr>
</tbody>
</table>

# Cardiovascular

<table>
<thead>
<tr>
<th>Age-Related Changes</th>
<th>Effect on Trauma</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels lose elasticity</td>
<td>Response to blood loss/hypotension blunted</td>
<td>Hypoperfusion not appreciated, pulse rate unreliable</td>
</tr>
<tr>
<td>Decreased sensitivity to catecholamines</td>
<td>Relative hypotension $(SBP \leq 110 \text{ mmHg})$</td>
<td>Major bleeding with minimal injury</td>
</tr>
<tr>
<td>Arrhythmias/Valve changes</td>
<td>Anticoagulants</td>
<td></td>
</tr>
</tbody>
</table>
### Pulmonary

<table>
<thead>
<tr>
<th>Age-Related Changes</th>
<th>Effect on Trauma</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stiffened chest wall</td>
<td>Chest muscles may fatigue</td>
<td>Hypoxia causing AMS</td>
</tr>
<tr>
<td>Reduced oxygen exchange</td>
<td></td>
<td>Higher risk respiratory failure</td>
</tr>
<tr>
<td>Emphysema</td>
<td>Susceptibility to pneumothorax with blunt trauma</td>
<td>Higher rate aspiration</td>
</tr>
<tr>
<td>Decreased airway protection</td>
<td></td>
<td>Pneumonia</td>
</tr>
</tbody>
</table>

# Integumentary (Skin)

<table>
<thead>
<tr>
<th>Age-Related Changes</th>
<th>Effect on Trauma</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrophy oil glands</td>
<td>Skin tears/breakdown</td>
<td>Bleeding</td>
</tr>
<tr>
<td>Loss of structural support from elastin fibers</td>
<td>Difficulty regulating body temp</td>
<td>Hypothermia</td>
</tr>
<tr>
<td>Fewer cells</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# Musculoskeletal

<table>
<thead>
<tr>
<th>Age-Related Changes</th>
<th>Effect on Trauma</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteoporosis, brittle bone</td>
<td>More prone to fractures</td>
<td>Low impact or ground level falls</td>
</tr>
<tr>
<td>Kyphosis/Lordosis</td>
<td>Spinal cord vulnerable to injury</td>
<td>associated with fractures</td>
</tr>
<tr>
<td>Arthritis</td>
<td></td>
<td>More difficult intubation</td>
</tr>
<tr>
<td>Degenerative Spine disease</td>
<td>Rib fractures prone to contusion</td>
<td>Rib fractures predispose to</td>
</tr>
<tr>
<td>Rigid Chest Wall</td>
<td></td>
<td>pneumonia</td>
</tr>
</tbody>
</table>

Central Cord Syndrome

- Hyperextension of neck
- May not have bony injury
- Motor and sensory loss in Arms > Legs

Source: Arash Salardini, José Biller: The Hospital Neurology Book
www.neurology.mhmedical.com
Copyright © McGraw-Hill Education, All rights reserved.
Hip pain after a fall...
Occult Hip Fracture
Occult Hip Fracture

- Moderate evidence supports MRI for diagnosis of presumed hip fracture not apparent on initial radiographs.

Take Home:

Age-related changes can lead to missed injuries in elderly trauma patients
Interprofessional Team Approaches to Reducing Falls In Rural Communities

Elizabeth Eckstrom, MD, MPH, Professor & Section Chief, Geriatrics, Division of General Internal Medicine & Geriatrics, Oregon Health & Science University  
Glenise McKenzie, PhD, RN, Associate Professor of Nursing, Oregon Health & Science University

This workshop will share best practices for primary care team-based interventions to reduce falls by older adults in rural settings. The presenters will briefly review the CDC’s STEADI (Stopping Elder’s Accidents, Deaths, and Injuries) falls prevention initiative, share tips we found to be successful when rolling out falls prevention in primary care, and leave plenty of time for group discussion and brainstorming ways to improve fall prevention in your local communities.
Fall Death Rates in the U.S. INCREASED 30% FROM 2007 TO 2016 FOR OLDER ADULTS

If rates continue to rise, we can anticipate
7 FALL DEATHS EVERY HOUR BY 2030

Learn more at www.cdc.gov/HomeandCommunitySafety

Predicting Falls

- Past falls
- Living alone
- Use of walking aid
- Depression
- Cognitive deficit
- ≥ 6 medications

Fall Screening

1. Have you fallen in the past year?

2. Do you feel unsteady when standing or walking?

3. Do you worry about falling?

4. Review and manage medications
Check for Safety
A Home Fall Prevention Checklist for Older Adults

Contact your local community or senior center for information on exercise, fall prevention programs, or options for improving home safety.

For additional information on fall prevention, visit go.usa.gov/xN9XA

Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

STEADI
Stopping Elderly Accidents, Deaths & Injuries
Use this checklist to find and fix hazards in your home.

### STAIRS & STEPS (INDOORS & OUTDOORS)

- Are there papers, shoes, books, or other objects on the stairs?
  - No Always keep objects off the stairs.
  - Yes Fix loose or uneven steps.

- Are some steps broken or uneven?
  - Yes Fix loose or uneven steps.

- Is there a light and light switch at the top and bottom of the stairs?
  - No Have an electrician put in an overhead light and light switch at the top and bottom of the stairs. You can get light switches that glow.
  - Yes Have a friend or family member change the light bulb.

- Has a stairway light bulb burned out?
  - No Have a friend or family member change the light bulb.
  - Yes Fix loose or uneven steps.

- Is the carpet on the steps loose or torn?
  - No Make sure the carpet is firmly attached to every step, or remove the carpet and attach non-slip rubber treads to the stairs.
  - Yes Fix loose handrails, or put in new ones. Make sure handrails are on both sides of the stairs, and are as long as the stairs.

### FLOORS

- When you walk through a room, do you have to walk around furniture?
  - No Ask someone to move the furniture so your path is clear.
  - Yes Remove the rugs, or use double-sided tape or a non-slip backing so the rugs won’t slip.

- Do you have throw rugs on the floor?
  - No Remove the rugs, or use double-sided tape or a non-slip backing so the rugs won’t slip.
  - Yes Put in a nightlight so you can see where you’re walking. Some nightlights go on by themselves after dark.

- Are there papers, shoes, books, or other objects on the floor?
  - No Pick up things that are on the floor. Always keep objects off the floor.
  - Yes Coil or tape cords and wires next to the wall so you can’t trip over them. If needed, have an electrician put in another outlet.

- Do you have to walk over or around wires or cords (like lamp, telephone, or extension cords)?
  - No Coil or tape cords and wires next to the wall so you can’t trip over them. If needed, have an electrician put in another outlet.
  - Yes Have grab bars put in next to and inside the tub, and next to the toilet.

### BEDROOMS

- Is the light near the bed hard to reach?
  - No Place a lamp close to the bed where it’s easy to reach.
  - Yes Is the path from your bed to the bathroom dark?

- Is the path from your bed to the bathroom dark?
  - No Put in a nightlight so you can see where you’re walking. Some nightlights go on by themselves after dark.
  - Yes Have grab bars put in next to and inside the tub, and next to the toilet.

### BATHROOMS

- Is the tub or shower floor slippery?
  - No Put a non-slip rubber mat or self-stick strips on the floor of the tub or shower.
  - Yes Do you need some support when you get in and out of the tub, or up from the toilet?

- Do you need some support when you get in and out of the tub, or up from the toilet?
  - No Have grab bars put in next to and inside the tub, and next to the toilet.
  - Yes Fix loose handrails, or put in new ones. Make sure handrails are on both sides of the stairs, and are as long as the stairs.

### KITCHEN

- Are the things you use often on high shelves?
  - No Keep things you use often on the lower shelves (about waist high).
  - Yes Is your step stool sturdy?

- Is your step stool sturdy?
  - No If you must use a step stool, get one with a bar to hold on to. Never use a chair as a step stool.
  - Yes
WHAT HAPPENS AFTER AN INJURY?
Rural Trauma Team Development Course

Pam Bilyeu, MN RN TCRN
OHSU Trauma Coordinator
bilyeup@ohsu.edu

https://www.facs.org/quality-programs/trauma/education/rttdc
• RTTDC group, n = 130; Control group, n = 123
• 41-minute reduction in time to transfer call (p = 0.03).
• 61-minute reduction in referring hospital LOS (p = 0.02)
• No difference in mortality
Contributing/Confounding Comorbidities:

- Acute coronary syndrome
- Hypovolemic
- Urinary Tract Infection
- Pneumonia
- Acute Renal Failure
- Cerebrovascular event
- Syncope
Notable Medications

• Anticoagulants (ASA, Plavix, Coumadin, DOAC, etc.)
• Beta blockers
• ACE inhibitors
• Diabetes--Insulin/glycemic agents
Mortality after ground-level fall in the elderly patient taking oral anticoagulation for atrial fibrillation/flutter: A long-term analysis of risk versus benefit

Tazo Stowe Inui, MD, Ralitza Parina, MPH, David C. Chang, MBA, MPH, PhD, Thomas S. Inui, MD, MSc, and Raul Coimbra, MD, PhD, San Diego, California

- 42,913 on oral anticoagulant (OAC) and 334,960 controls.
**TABLE 4.** Calculated Annual Mortality With Associated Head Injury Compared With the Literature-Based Annual Risk for Stroke

<table>
<thead>
<tr>
<th>CHA$_2$DS$_2$-VASc Score</th>
<th>Annualized Mortality with Head Injury if Patients Survive Their First Fall, %</th>
<th>Literature-Based Annual Stroke Risk, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OAC</td>
<td>No OAC</td>
</tr>
<tr>
<td>0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>2</td>
<td>2.3</td>
<td>1.1</td>
</tr>
<tr>
<td>3</td>
<td>2.2</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>2.1</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>2.1</td>
<td>1.6</td>
</tr>
<tr>
<td>6</td>
<td>2.5</td>
<td>2.1</td>
</tr>
<tr>
<td>7</td>
<td>4.6</td>
<td>2.2</td>
</tr>
<tr>
<td>8</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>9</td>
<td>n/m</td>
<td>n/m</td>
</tr>
</tbody>
</table>
Conclusion:

Patients with CHA2DS2-VASc scores 1 to 3 should give strong consideration to discontinuing their OAC if they are deemed high risk for falls.
TRAUMA TRANSFER SYSTEM IN OREGON
Right Patient  Right Place  Right Time
• Major Trauma or Need Exceed Capacity of Site

• Glasgow Coma Scale <14 or lateralizing signs

• Spinal fracture or spinal cord deficit

• Complex pelvis/acetabulum fractures

• >2 rib fractures or bilateral rib fractures with pulmonary contusion (if no critical care)

• Significant torso injury with advanced comorbid disease
Any doubt: Call

OHSU Regional Hospital
PANDA Dispatch
Transfer Center
Medical Resource Hospital

503-494-7551
800-648-6478
WHERE SHOULD PATIENTS BE TRANSFERRED?
Types of Trauma Facilities

Definitive Care

• Level 1: OHSU and LEH
  – 24hr full trauma capabilities, including neurosurgery, resident training and research

• Level 2: Same as level 1, may not have residents or research

Stabilization

• Level 3: Provide initial evaluation and stabilization, including surgical intervention

• Level 4: Provide resuscitation and stabilization prior to transport
21 Trauma ICU beds
11 adult trauma staff
3000 trauma patients
1044 (35%) transfer patients
Transfer patients are a special patient population: patients are transferred for services distinct to AMCs.

<table>
<thead>
<tr>
<th>UHC Service/Subservice Line</th>
<th>Percentage of All Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma/Trauma</td>
<td>9.4%</td>
</tr>
<tr>
<td>Cardiology/Invasive Cardiology</td>
<td>6.7%</td>
</tr>
<tr>
<td>General Medicine/Gastroenterology</td>
<td>5.6%</td>
</tr>
<tr>
<td>Psychiatry/General Psychiatry</td>
<td>4.4%</td>
</tr>
<tr>
<td>Cardiac Surgery/Cardiac Surgery</td>
<td>3.7%</td>
</tr>
<tr>
<td>General Medicine/Hepatobiliary</td>
<td>3.3%</td>
</tr>
<tr>
<td>General Medicine/Sepsis &amp; Infectious Disease</td>
<td>3.1%</td>
</tr>
<tr>
<td>Cardiology/Noninvasive Cardiology</td>
<td>3.1%</td>
</tr>
<tr>
<td>General Medicine/Respiratory Disorders</td>
<td>3.0%</td>
</tr>
<tr>
<td>Neurosurgery/Neurosurgery</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

Source: UHC Clinical Data Base/Resource Manager™, Peer Group A
<table>
<thead>
<tr>
<th>Variable</th>
<th>Age 15-64</th>
<th>Age 65+</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=1532</td>
<td>N= 952</td>
<td></td>
</tr>
<tr>
<td>Male gender</td>
<td>1095 (71%)</td>
<td>561 (59%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blunt trauma</td>
<td>1418 (93%)</td>
<td>946 (99%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Severe Trauma (ISS&gt;15)</td>
<td>560 (36%)</td>
<td>378 (40%)</td>
<td>0.115</td>
</tr>
<tr>
<td>Mortality</td>
<td>34 (2%)</td>
<td>55 (6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ground miles from OHSU (median, IQR)</td>
<td>50 (15-132)</td>
<td>21 (8.5-87)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
## Trauma Transfer Injuries

<table>
<thead>
<tr>
<th>Injury</th>
<th>Age 15-64 N=1532</th>
<th>Age 65+ N= 952</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>666 (43%)</td>
<td>532 (56%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chest</td>
<td>531 (35%)</td>
<td>360 (38%)</td>
<td>0.111</td>
</tr>
<tr>
<td>Abdomen/Pelvis</td>
<td>372 (24%)</td>
<td>129 (14%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Extremities</td>
<td>590 (38%)</td>
<td>240 (25%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Key Transfer Information

- Care Everywhere (EPIC)
- Medical/Medication history
- Neuro Exam
- Imaging (PACS)
- Labs: CBC, Chem, Coags
- Advance Directives/Surrogate Info
Physician Orders for Life-Sustaining Treatment (POLST)

Resuscitation: Unresponsive and not breathing

- CPR vs DNR

Medical Interventions: Pulse and breathing

- Comfort Measures Only
- Limited
- Full

Artificially Administered Nutrition

- No
- Defined Trial Period
- Yes
POLST and Trauma

Methods:

- All trauma patients age 65+
- POLST identified by prospective trauma registry
- Charts manually reviewed for:
  - Presence of POLST pre-arrival
  - Clinical course
Trauma Patients age >= 65 years
Jan 2012- July 2017
N= 3342

No POLST or Advance Directive
N= 2870

Advance Directive only
N= 168

POLST completed after admission
N= 76

Missing or illegible POLST form
N= 36

Pre-hospital POLST
N= 192 (6%)
6%

Had a POLST on arrival*

*Available in medical record
## Results: POLST vs No POLST

<table>
<thead>
<tr>
<th></th>
<th>Pre-hospital POLST (N=192)</th>
<th>No POLST (N=3150)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Age</td>
<td>86.4 (81-91)</td>
<td>76.7 (70-85)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female Sex—no. (%)</td>
<td>123/192 (64%)</td>
<td>1403 (44%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Medicare—no. (%)</td>
<td>118/192 (61%)</td>
<td>1488 (47%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
## Comorbidities

<table>
<thead>
<tr>
<th>History of CHF--no. (%)</th>
<th>Pre-hospital POLST (N=192)</th>
<th>No POLST (N=3150)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>32 (17%)</td>
<td>299 (9%)</td>
<td>0.001</td>
</tr>
<tr>
<td>History of CVA--no. (%)</td>
<td>30 (16%)</td>
<td>271 (9%)</td>
<td>0.001</td>
</tr>
<tr>
<td>History of Alz/Dem/Parkinsons--no. (%)</td>
<td>85 (44%)</td>
<td>425 (13%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No Known Comorbidities</td>
<td>3 (2%)</td>
<td>312 (10%)</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>
Breakdown of POLST Preferences

<table>
<thead>
<tr>
<th>POLST Resuscitation</th>
<th>n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attempt Resuscitation</td>
<td>38 (20%)</td>
</tr>
<tr>
<td>Do Not Attempt Resuscitation</td>
<td>152 (80%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POLST Treatment</th>
<th>n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Treatment</td>
<td>40 (21%)</td>
</tr>
<tr>
<td>Limited Interventions</td>
<td>102 (54%)</td>
</tr>
<tr>
<td>Comfort Care</td>
<td>48 (25%)</td>
</tr>
</tbody>
</table>
Comfort Measures Only. Provide treatments to relieve pain and suffering through the use of any medication by any route, positioning, wound care and other measures. Use oxygen, suction and manual treatment of airway obstruction as needed for comfort. *Patient prefers no transfer to hospital for life-sustaining treatments.* Transfer if comfort needs cannot be met in current location.

Treatment Plan: Provide treatments for comfort through symptom management.
Comfort Only Measures: 48 (25%)
POLST and Trauma: Comfort Only Measures

Mean age: 88 years (SD 6.6, range 65-98)

Female: 26 (55%)

Mechanism of Injury: Falls (92%)

Time since POLST completion: Mean 24 months (SD 21, range 0-85)
POLST and Trauma Comfort Only Measures

Palliative procedures:
- Repairs of the pelvis, femur, lacerations, chest tubes placement

In-hospital mortality: 6% (3/48)
Conclusions

- Age-related changes make elderly prone to significant injury even with minor trauma
- FALLS are the major source of traumatic morbidity and mortality for elderly persons
- Level 1 and 2 Trauma Centers provide definitive care for complex trauma patients
- Being comfort care does not exclude palliative procedures
Many Thanks

Faculty:
David Zonies, MD, MPH, FACS
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Karen Brasel, MD, MPH, FACS

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Emerson Ong

POLST Registry:
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Dana Zive, MPH

Trauma Registry:
Dawn Brand
Lynn Eastes
Pam Bilyeu

PSU:
Heather Hamilton

Trauma Lab:
Jessica van Waardenburg
Sam Underwood
Amy Ellerbe

Data Analysis:
Beth Dewey, MA
Questions?

Thank You