“Elderly” Falls: The New Trauma Epidemic

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Elderly definition

- Elderly: senior, mature, old, older, silvering, advanced in years, after middle age…
- Who is elderly and what does it mean?
  - Chronologic
  - Physiologic

How old are people in the USA?

(US Census Bureau Data)

In 2012, ~14% of all Americans ≥ 65 years = 40.3 million

- 65-74 years: 21.7 million
- 75-84 years: 13.1 million
- 85-94 years: 5.1 million
- 95+ years: 0.4 million

Almost 6 million people over the age of 84!

How often are "older" folks falling?

www.cdc.gov/HomeandRecreational Safety/Falls/adultfalls.html

1 in 3 people ≥ 65 years fall each year

- 2.3 million treated in ED's in 2010
  (at least half at SJM AA!)
- 662,000 admissions after falls
- $30 billion in fall-related costs

Fall related injuries in the elderly

www.cdc.gov/HomeandRecreational Safety/Falls/adultfalls.html

20-30% sustain moderate to severe injuries

- Lacerations
- Hip fractures
- Traumatic Brain Injury (TBI)
  - Falls were leading cause of TBI in elderly
  - 46% of fatal falls due to TBI

Consequences of falls in the elderly

www.cdc.gov/HomeandRecreational Safety/Falls/adultfalls.html

- 21,700 older adults died from falls in 2010
- 75+ year-olds are 4-5X more likely than 65-74 year-olds to require long-term care facility admission for one year or longer
- Women 2X more likely to fall, but men are more likely to die

Consequences of falling

Retired SJMAA trauma surgeons, Drs. Brandt and Wahl, remain active at Over-the-Hill Senior Center

- Injuries, possibly death
- Cost to patient and society
  - Debility/loss of independence
- Fear of falling-leads to less activity, less mobility and increases risk of future falls

Vellas BJ et al. Fear of falling and restriction of mobility in elderly fallers. *Age and Ageing* 1997;26:189-193

Is this just an American problem?

- Falls are the leading cause of accidental death worldwide
- 80% of fatal falls are in low- or middle-income countries
- In all countries, the death rates are highest in those over 60 years of age

Comorbid conditions among elderly fall patients

- Sensory loss, peripheral neuropathy
- Hearing loss
- Decreased vision, depth perception
- Dementia
- Gait disturbances-osteoarthritis, PD…
- Use of anticoagulants for atrial fibrillation and stroke…

Risk of atrial fibrillation

- 2.3 million Americans
  - Most over 65 years
  - Men > women
  - White > black
  - Other risks:
    - COPD
    - Alcohol
    - Hyperthyroidism
    - Sleep apnea
    - MI, heart disease…

Who is CHAD, anyway?

Gage BF, van Walraven C, Pearce L, *et al.* 2004, *Circulation* **110** (16): 2287–92.
Gage BF, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ 2001, *JAMA* **285** (22): 2864–70.

Risk factor scoring

	Condition	Points
C	Congestive heart failure	1
H	Hypertension: blood pressure consistently above 140/90 mmHg (or treated hypertension on medication)	1
A	Age ≥75 years	1
D	Diabetes mellitus	1
S_2	Prior Stroke or TIA or Thromboembolism	2

Annual stroke risk

$CHADS_2$ Score	Stroke Risk %	95% CI
0	1.9	1.2–3.0
1	2.8	2.0–3.8
2	4.0	3.1–5.1
3	5.9	4.6–7.3
4	8.5	6.3–11.1
5	12.5	8.2–17.5
6	18.2	10.5–27.4

CHA_2DS_2-VASc

refinement of score to include other common risk factors

Additional factors-each 1 point

V-Vascular disease-PVOD, MI, known aortic plaque

A-Age 65-74

S-Female gender

Anticoagulation Therapy

- Score 0=low risk
  - no tx or ASA 75-325 mg daily
- Score 1=moderate
  - oral anticoagulant or ASA (rivaroxaban, dabigatran or coumadin INR 2-3)
- Score 2+=high risk
  - oral anticoagulant (rivaroxaban, dabigatran or coumadin INR 2-3)

Did anyone else notice?

If you are an older woman, the new scoring system states that you are now high risk for stroke based on a score of 2 (one point each for gender and age-that is a lot of people…)

Limitations of stroke risk prediction models

- Helpful in clinical practice but are limited in "complex cardiogeriatric syndromes"
  - Expand models to consider frailty, cognitive and functional decline and non-adherence to therapy is warranted

Ferguson C, Inglis SC, Newton PJ, Middleton S, Macdonald PS, Davidson PM. Atrial fibrillation and thromboprophylaxis in heart failure: the need for patient-centered approaches to address adherence. Vascular Health & Risk Management. 2013 (9) : 3-11.

http://www.dovepress.com/atrial-fibrillation-and-thromboprophylaxis-in-heart-failure-the-need-f-peer-reviewed-article-VHRM

PERC – Potential Emergent Reversal Case
SJM Protocol

For Coumadin – Thawed plasma will reverse; For thienopyridine platelet aggregation inhibitors, e.g. Plavix (clopidogrel) or Effient (Prasugrel)-- platelets will reverse.

If blood products are not needed (e.g.: CT negative) after 90-minutes the Blood Bank may release to another patient.

For Stat CT – Same as Potential CVA-TPA Case – Back Desk Clerk Pages Radiologist & CT Tech to Arrange Immediate CT & Read (Team 2 Attending to Fill Out CT Requisition If Needed)

Include C-Collar & C-Spine if Necessary (See Spine Protocol)

Physicians accepting ICH patient who is hemostatically compromised should call Blood Bank and pre-order FFP or platelets. Inform Blood Bank that there is an outside hospital “PERC” patient and specify what blood or platelets will be needed.

SJM Rapid Reversal Procedure for Coumadin

4-Units Plasma (thawed or FFP) ordered stat.

Phone call to Transfusion Services (Blood Bank) at ext. 23185.

If T& S done, then use fastest available 4-Units Plasma (thawed or FFP). Transfusion Services calls back desk clerk on Team 2 when ready to tube blood to tube station.

If T&S not complete, then give 4-Units Universal Donor (AB+) Plasma- Transfusion Services calls back desk clerk on Team 2 when ready to tube blood to tube station.

4-Units Plasma (thawed or FFP) to be given in all cases unless INR <1.1.

If INR not back, give 4-Units Plasma (thawed or FFP). Therapeutic range 2.0-3.0 (Note: Normal PT @ SJMH is 8-12.5)

All 4-Units of Plasma to be given within 15-minutes

Give 10 mg Vitamin K IVP @ maximum 1mg/minute7. Use Bard Pump for administration.

Repeat INR to be drawn 10-minutes after last

More than 7 million people worldwide have been prescribed Xarelto®

Anticoagulant Medications

Agent/Mechanism	Duration	Emergent Reversal
Apixaban (Eliquis)-NOAC Rivaroxaban (Xarelto®)-NOAC Direct FXa inhibitors	2+ days, dependent on CrCl	NO ANTIDOTE If <3 hours, activated charcoal Consider PCC4 (KCentra @ 50u/kg)
Argatroban-IV Direct thrombin inhibitor	2-3 hours, longer with hepatic dysfunction	NO ANTIDOTE Consider FVII 40 mcg/kg, monitor a PTT for clearance
Bivalirudin (Angiomax®)-NOAC Direct thrombin inhibitor	1.5 hours (upto 3.5 hours if ↓ CrCl	NO ANTIDOTE Consider FVII 40 mcg/kg, monitor a PTT for clearance
Enoxaparin (Lovenox®)-IM, IV	10-17 hours, longer if ↓ CrCl	Protamine if less than 12 hours from last dose (0.5-1mg per each mg of enoxaparin)
Fondaparinux (Arixtra®)-IV Indirect Fxa inhibitor	2-5 days, longer if ↓ CrCl	NO ANTIDOTE Consider FVII 40 mcg/kg, monitor a PTT
Bivalirudin (Angiomax®)-NOAC Direct thrombin inhibitor	1.5 hours (upto 3.5 hours if ↓ CrCl	NO ANTIDOTE Consider FVII 40 mcg/kg, monitor a PTT
Dabigatran (Pradaxa®)-NOAC Direct thrombin inhibitor	2 days, up to 5 days if ↓ CrCl	NO ANTIDOTE If <2 hours, activated charcoal Consider dialysis (removes 60%) Consider PCC4 (KCentra @ 50u/kg)
Warfarin (Coumadin®) Oral vitamin K antagonist	2-5 days	Check INR Vitamin K 10 mg FFP, Consider PCC4 (KCentra @ 50u/kg)

NOAC=novel oral anticoagulant

Antiplatelet Agents

Agent	Duration	Emergent Reversal
Clopidogrel (Plavix®)	5 days	NO ANTIDOTE Administer 2 x 5 pack of pooled random donor platelets Consider DDAVP (Desmopressin 0.3 mcg/kg IV)
Prasugrel (Effient®)	"	"
Ticagrelor (Brilinta®)	"	"
ASA	"	"

Falls in elderly patients on anticoagulation-no PRCT's…

- Warfarin patients-stroke 2%, major hemorrhage 6%, death 20%, mortality greater in those with falls (45%) or dementia (47%)
  - Jacobs LG. *Am J Geriatr Phamracother* 2009 Jun 7(3):159-166.
- Effects of clopidogrel on elderly traumatic brain injured patients-observational study, patients on clopidogrel more likely to die and be discharged to long-term facility
  - Kong DK J trauma, 2008;65:1303.
- Antiplatelet and anticoagulation therapies do not increase mortality in the absence of traumatic brain injury.
  - Ott, MM et al. *J Trauma* 2010;68:560.
- Degree of anticoagulation, but not warfarin use itself, predicts adverse outcomes after TBI in elderly trauma patients.
  - Peiracci FM, et al. *J Trauma* 2007;63:525-530.

Anticoagulant and Antiplatelet Agents: No Problem for the Elderly with a Low-Level Fall

Michigan ACS May 2014
AAST September 2014

Crystal Kavanagh, MD, Mary-Margaret Brandt, MD, Harry Anderson III, MD, Joseph Bander, MD, Wendy L. Wahl, MD

Hypothesis

We hypothesized that anticoagulant (AC) and antiplatelet (AP) use in older patients (≥60) with low-levels falls worsens outcomes

Methods

- After obtaining IRB approval, we examined all patients ≥ 60 admitted to our level II trauma center 2012-2013 with a low-level fall

  (E codes: 880.1, 884.2,-884.6, 885.9, 888.1, 888.8, 888.9)

- All data was extracted from the trauma registry and patient electronic medical record
- Fisher exact and Student t-tests applied – significance defined as $p \leq 0.05$

Methods-Definitions

AC: warfarin, enoxaparin, dabigatran, rivaroxaban

AP: ASA, clopidogrel

Low-level falls: from standing, out of bed or furniture, down less than 3 stairs

PRISM – Placement Resource Indicator for Systems Management

- Validated institutional tool which determines patient acuity on admission based on patient comorbidities and acute illness
- Score 1-5: where 1 is highest risk for death, determined by historical conditions and current clinical factors

Results – All Elderly Fall Patients

Group	Age (years)	ISS	Brain AIS (N)	Hospital LOS days	Mortality N (%)
AC/AP (N=493)	83±9	9±5	3.4±1 (60)	4.8±4	27 (6)
No AC/AP (N=407)	80±10	9±5	3.5±1 (34)	4.5±4	24 (6)
P Value	< 0.001	NS	NS	NS	NS

Results – Brain injury

Group	N	Age (years)	ISS	Brain AIS	LOS (Days)	Mortality N(%)
AC/AP	60	83±8	14±7	3.4±0.9	3.6±4	7 (12)
No AC/AP	34	80±10	16±8	3.5±1	4.1±4	5 (15)
P value		NS	NS	NS	NS	NS

Results - Mortality

Group	N	Age (years)	AC/AP Use N(%)	ISS	Brain AIS	PRISM Acuity Index
Alive	849	81±10	466 (55)	8±4	3.3±1	2.8±0.8
Dead	51	85±8	27 (53)	12±7	4.5±2	2.1±0.7
P value		<0.01	NS	<0.001	<0.001	<0.001

ANTICOAGULATION AND ANTIPLATELET AGENTS DO NOT WORSEN TRAUMATIC BRAIN INJURY OUTCOMES AFTER LOW LEVEL FALLS IN THE ELDERLY

ESICM September 2014, Kavanagh C, Bander J, Wahl WL

Despite our clinical bias that elderly patients who take AC/AP agents are more likely to sustain more severe traumatic brain injuries after low level falls, AC/AP brain-injured patients had the same mortality as their non-AC/AP peers. Mortality was associated with severity of underlying medical comorbidities at the time of admission.

Group (N)	Age years	INR	PRISM Score	ISS	Brain AIS	Hospital LOS days	Mortality N (%)	Cost USD
AC (16)	83	3.8*	2.6	16	3.8*	3.4	2 (13)	12,800
AP (44)	83	1.0	2.6	14	3.3	4.0	5 (11)	10,900
No med (33)	80	1.1	2.6	16	3.5	4.1	4 (12)	11,500
P value	NS	*<0.001	NS	NS	*p<0.05	NS	NS	NS

Summary

- Despite our clinical bias, AC/AP use had no effect on mortality in elderly patients after low-level falls

- What did impact mortality?
  - *Advanced age*
  - *Clinical status (comorbid conditions)*
  - *Severity of injury*

Conclusions

- Although patients who died had a higher brain AIS, there were not more brain injuries in the AC/AP group

- Injuries were not more severe in the AP group, but brain AIS was higher for AC, but mortality was the same as those on no AC/AP medication

Clinical Considerations

- Is the lack of increased mortality in brain injured patients on AC/AP a function of standardized reversal protocols?
- Does cessation of AC/AP agents pose a greater risk to elderly fall patients than their continuation?
- Will this outcome change with increased use of NOAC's?

Ground level falls (GLFs) are associated with significant mortality in elderly patients

Spanioloas K et al. J Trauma 2010;69:821.

National Trauma Data Bank

- 32,320 patients > 70 years
- Mortality of elderly 4.4% vs 1.6%

Elderly more likely to sustain long-bone fx, pelvic fx and intracranial injury than younger patients

What kind of work up should we do for ground level falls in the elderly?

- Radiographic assessment of ground-level falls in elderly patients: Is the PAN-SCAN" overdoing it? Dwyer CR et al. *Surgery* 2013;154:816-822.
  - PA State Trauma Registry for 4 years. All hemodynamically stable patients > 65 years who had GLF and admission for at least 24 hours.
  - Compared those who had all 3 scans within 3 hours of admission to those with less imaging
- **PAN-SCAN was not associated with independent decrease in risk of mortality**
- Greater Injury Severity Scale scores documented with PAN-SCAN and less hospital resource use

What about our patients? (900 low level falls 2012-2013)

Admitting Service	Extremity Injury N (AIS score)	Head or Neck Injury N (AIS score)	Chest Injury N (AIS score)	Abdomen Injury N (AIS score)
Trauma	100 (2.2)	178 (3.1)	106 (2.4)	22 (2.4)***
Medicine	41 (2.8)	13 (2)*	20 (2.1)	9 (2.4)**
Ortho	90 (2.7)	0	3 (1.3)	2 (2.5)**
Total	231	191	129	31

*2 TBI DNR/DNI, **All Medicine and Ortho "abdominal" patients were spine fx;
***ONLY 6 true abdominal injuries

Outcomes by admitting service

Service	n	Age years	ISS	Extrem Injury Only N (%)	ICU LOS days	PRISM	Hosp LOS days	AC/AP med N (%)	Death N (%)
Trauma	345	81	9.9*	47* (14)	0.9*	2.6*	4.1	213 (62)*	24 (7)*
Med	463	83	7.7	412 (89)	0.4*	2.6*	5.2*	258 (56)*	27 (6)*
Ortho	92	76*	7.5	87 (95)	0.01	3.4	4.1	22 (24)	0

Patients admitted to the Trauma service were more severely injured, less likely to have isolated extremity injuries, just as sick as those admitted to Medicine with similar mortality and lower hospital LOS

CT evaluation in SJMAA ED

Group	No CT	Head Only	Head + Abd	Head + Chest	Abd only	Abd + Chest	Chest Only	PAN-SCAN
AC/AP N (%)	185 (38)	244 (49)	11 (2)	9 (2)	3 (0.6)	4 (0.8)	6 (1)	31 (6)
No med N (%)	191 (47)	172 (42)	4 (1)	4 (1)	2 (0.6)	7 (2)	8 (2)	19 (5)

*Head includes C spine for most cases

Findings of CT scans performed

Group	Head/Neck CT Ratio (% Positive)	Abdominal CT Ratio (% Positive)	Chest CT Ratio (% Positive)
AC/AP Med	89/295 (30)	5/55 (9)	27/41 (66)
No Med	51/199 (26)	2/32 (6)	22/38 (58)

Radiographic evaluation in ED

- Only 6 true abdominal organ injuries, all other injuries were spine/soft tissue

  -ALL patients had signs or symptoms on chart review (even those with dementia…)

- Despite high rate of positive chest CTs, unclear if clinical management changed (CXR showed most injuries)

Prevention is best

- Review of medications
- Physical therapy
- Exercise programs
- Assistive devices
- Home inspection for fall risks, safety rails…
- Vitamin D supplementation
- Education of patient and family

Summary

- Falls in the elderly are common and now the leading cause of trauma deaths worldwide
- This “epidemic” is likely to increase as the population continues to age
- Rapid reversal algorithms make a difference for warfarin patients, NOAC patients…??
- Fall assessments should be part of the routine health care for the aging since prevention is key