Trauma and Coagulopathy: Guidelines for Reversal

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Objectives

- Identify why anti-thrombotic agents have become such an issue with trauma care.
- Identify the most common concerns for patients who are on anti-thrombotics.
- Discuss the appropriate nursing assessment and interventions for trauma patients who require anti-thrombotics.
Reversal of Anti-Coagulation for Elderly Patients Taking Anti-Coagulation Medication Who Sustain a Head Injury
Taskforce Chair:
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The Issue

• Trauma is one of the leading causes of death and disability in the United States.
• Many of those injured, are over the age of 65 years.
Anticoagulation

- Is a high-risk therapy, sometimes needed for patients with a wide variety of medical and surgical issues.
- Can utilized on either in or out-patient arena.
- It is a profitable business.
The Issue

• TBI is on the decline in younger individuals (> 15 years and < 65 years) due to preventative measures
  – seatbelt use
  – protective head gear worn in sporting or athletic activities
  – greater public education

• Falls in the elderly are a leading cause of TBI and no decrease has been seen in that age group.
Definitions

• Elderly - 65 and older.
  – definition utilized by the Commonwealth of Pennsylvania and the Pennsylvania Trauma Systems Foundation.
Epidemiology

• Those 65 and over are a rapidly growing population in the United States.
• The number of people 65 and over is projected to increase from 35 -39 million in 2010 to 53-69 million by the year 2020. This increase is attributed to the extended life expectancy of surviving baby boomers.
• About 20 percent of the US’s total population will be over 65 in 2030, compared to approximately 13 percent now.
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The "Other Assault" category includes all assaults that are not classified as sexual assault. It represents the majority of assaults.

Source: NIISS All Injury Program operated by the Consumer Product Safety Commission (CPSC).
Produced by: Office of Statistics and Programming, National Center for Injury Prevention and Control, CDC.
### 10 Leading Causes of Injury Deaths by Age Group Highlighting Unintentional Injury Deaths, United States – 2008

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<th>Age Groups</th>
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Anatomic and Physiologic Differences

• Higher mortality rate due to:
  – Age-related deterioration
  – Decreased stress tolerance and physiologic reserve
  – Greater complication risk
  – Pre-existing chronic disease
  – Pre-existing nutritional deficits
Mechanisms of Injury

- Falls
- Motor Vehicle Crashes
- Pedestrian-Automobile Crashes
- Violence
Falls

• Most common unintentional injury for those over 75
• Mort rate increases dramatically with age
• 50% of elderly who fall do so repeatedly
• Most fall on a level surface and suffer an isolated orthopedic injury.
• Many falls occur in nursing homes
Common Causes of Geriatric Falls

• Syncope due to:
  – dysrhythmias, venous pooling, orthostatic hypotension, hypoxia, anemia, or hypoglycemia.

• Other factors include:
  – alcohol and medications (antihypertensives, antidepressant, diuretic and hypoglycemia agents).

• Changes in postural stability, balance, motor strength, and coordination, reaction time, poor visual acuity and visual attention, overload of information, slower gait
Geriatric TBI

• With aging, the brain progressively atrophies and decreases in size by 10% between ages 30 - 70
• Subtle changes in cognition and memory make evaluation of mental status difficult
• Lower incidence of epidural hematomas
• Higher incidence of subdural hematomas
• The increased “dead space” within the skull may delay symptoms of ICH
• We should have a low threshold for head CT
Geriatric Falls and Bleeding

• Anticoagulants
  – Heparin
  – Unfractionated heparin
  – Low-molecular weight heparin
  – Warfarin
  – Hirudin

• Antiplatelet Agents
  – Aspirin
  – ADP inhibitors
  – GPIIb/IIIa Antagonists
  – Phosphodiesterase (PDE) inhibitors

• Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)
  – Ibuprofen
  – COX-2 inhibitors

• Thrombolytics
  – Streptokinase
  – Urokinase
  – Tissue plasminogen activator (tPA)
Reasons Why People Are On Anticoagulants

- Atrial fibrillation
- Deep vein thrombosis
- Mechanical heart valves
- Stroke prevention
- Heart attacks
- Heart failure
- Pulmonary emboli
- Angina
- Stents
- Orthopedic procedures
- Wound care
- Just because….
So Who Is Old?
Bruce Springsteen

- Born: Sept 23, 1949
  Long Branch, NJ
- 62 years old
- Accomplished musician, songwriter
- Med hx: Has not disclosed any health concerns
David Letterman

• Born: April 12, 1947
  Indianapolis, IN
• 63 years old
• Late night talk show host, comedian, writer, businessman
• Med hx: Jan. 1, 2000
  had quintuple bypass surgery (52 years old)
Arnold Schwarzenegger

• Born: July 30, 1947
  Austria
• 63 years old
• Body builder, actor, business, Governor of CA
• Med hx: Born with bicuspid aortic valve (had 2 leaflets - not 3)
Arnold Schwarzenegger

- 1997 had replacement valve (made from his own transplanted tissue)
- Dec 9, 2001 – MCC with 6 fx ribs; spent 4 days in the hospital
- Jan 8, 2006 – MCC with 15 stitches in his lip
- Dec 23, 2006 – tripped over pole and broke R femur while skiing in Sun Valley, ID
- Dec 26, 2006 – 90 minute surgery to repair femur fx
Paul McCartney

• Born June 18, 1942, England, 69 years old
• Singer, songwriter, activist
• Med hx: None
George H.W. Bush

• Born: June 12, 1924
  New Haven, CT
  (88 years old)

• War hero, pilot, oil man, statesman, Ambassador, CIA Director, Vice-President and President of the United States

• Med hx: Takes Coumadin for atrial fibrillation due to hypothyroidism
Nancy Davis Reagan

• Born: July 6, 1921 NYC; 90 years old
• Actress, author, First Lady of California and the US
• Med hx: Oct 2008 – fell and broke sacrum and pelvis
Heparin

- Commonly used polysaccharide anticoagulant that inactivates thrombin and thus inhibits the coagulation cascade from forming a fibrin thrombus.
- The effect is a prolonged PTT.
- As heparin inhibits thrombus, PT should be prolonged too.
Heparin

- Heparin overdose is a PTT in excess of 2-2.5 times control
- Antidote is protamine sulfate (50 mg) which can reverse the effects. Reasonable dose is 1 mg/kg.
Warfarin

- Most commonly used oral anticoagulant in North America
- Inhibits thrombin formation
- Best selling drug
- Underestimated drug
Unfractionated Heparin

- A glycosaminoglycan that exerts its anticoagulant effect thru binding and poteniation of ATIII
- Given sub q, IV infusion
- Therapy gauged by PTT or INR which is prolonged
- Half-life is 1 hour
- Reversed by protamine sulfate
Low Molecular Weight Heparin (LMWH)

- Has 1/3 the molecular weight of heparin
- Has more antifactor Xa activity than inhibition of thrombin
- Does not prolong PTT (since it does not affect thrombin)
- Half-life is much longer than heparin and mainly cleared by the kidneys.
- Protamine is only able to neutralize 60% of LMWH activity
Plavix

- Is used to prevent strokes and heart attacks in patients at risk for these problems.
- In a class of medications called antiplatelet drugs.
- Works by keeping platelets from sticking together and preventing clots.
Aspirin

- Is in a group of medications called salicylates.
- Reduces the clumping action of platelets.
- It works by stopping the production of certain natural substances that cause fever, pain, swelling, and blood clots.
All the Others

- Natural herbs
- Drug interactions
- ??????
Guiding Principle

• Patients who sustain a TBI and are taking an anti-coagulant will require a rapid reversal of that agent.

• Anticoagulants are taken by many patients (especially geriatric patients) to avoid a life-threatening event.

• Unfortunately, once a traumatic injury occurs, these agents may increase their mortality due to the disruption of the clotting factors.
Pre-Hospital Arena

• EMS need to evaluate all trauma pts for:
  – any co-morbidities or significant medical hx which would be a predictor of anticoagulant use (i.e. A-fib, valvular replacement, DVT, stroke, etc.)
Pre-Hospital Arena

- EMS need to consider transport to a trauma center if any type of anticoagulant is being taken or the use of one is suspected
Pre-Hospital Arena

- **Undertriage**
  - Often transported to a non-trauma center
  - Under recognition of beta blockers
  - Pre-hospital training on elderly changes
  - No resources to transfer
  - Patient often under triage themselves
  - “They look good”

PTSF Data 2011
Undertriage of elderly trauma patients to state-designated trauma centers

• Even when trauma is recognized and acknowledged by EMS, providers are consistently less likely to consider transporting elderly patients to a trauma center.


• EAST Guidelines (level II) suggest that all patients > 70 y/o should be taken to a trauma center

  EAST Guidelines
Emergency Dept Care

- If the patient is in a non-trauma center and they take anti-coagulants, consider transfer

- Determine:
  - patient’s Glasgow Coma Scale (GCS)
  - patient’s age
  - pre-existing medical conditions (why they are on anti-coagulants).
  - need to initiate reversal
Emergency Dept Arena

- Ask about any prescription or over the counter medications they are taking.
- If anticoagulants are being taken, determine the reason for their use.
Emergency Dept Arena

- Evaluate for co-morbidities or significant medical hx which would be predictor of anticoagulant use - atrial fib, valve replacement, DVT, stroke, etc.
Activation or Not?

- Do you make your elderly an activation?
  - What’s the criteria?
    - Age
    - Mechanism
    - Physiology
    - Personal Medical Hx
    - Medications
Impact of advanced age on trauma triage decisions and outcomes: a statewide analysis

• 13,820 (27%) elderly patients.
• Significantly less likely trauma team activation despite similar severity
• More often required urgent craniotomy and orthopedic procedures
• Undertriaged elderly patients had 4 times the mortality rate

Emergency Dept Care

• Obtain a GCS and vital signs at time of triage:
  – **GCS** and a complete neuro exam should be reevaluated at a minimum every hour or more frequently as warranted.
  – Clinical signs of increased ICP include declining mental status, headache, vomiting, varying respirations, and bradycardia.
  – Changes in the pupillary response or GCS usually signals worsening brain injury.
  – Medical management of TBI is focused on preventing secondary insult.
Emergency Dept Care

• Send trauma panel bloods off and include PT, PTT, INR
• Obtain a STAT CT scan of the head.
• A NS consult should be obtained if the scan is positive for blood.
• Reversal of anticoagulant initiated in those patients diagnosed with intracranial hemorrhage or a strong suspicion.
• Repeat head CT scan in 4-6 hours unless a decreasing neuro exam requires it be sooner.
Vitamin K Antagonists

- Warfarin/Coumadin
  - Suggestive reversals
    - Vitamin K (10mg IV)
    - FFP: At least 2 to start
    - Some data supports rFVIIa but caution is advised
    - Tranexamin Acid (Anyone using yet?)
Unfractionated Heparin (UHF)

- Half life of IV Heparin is 60 minutes
- Reversal agent = Protamine
  - Time since last dose
    - < 30 min
    - 30 – 60 min
    - 60 – 120 min
    - >120
      - Dose of Protamine
        - 1-1.5mg/100units
        - 0.5 to 0.75mg/100 units
        - 0.375 to 0.5mg/100units
        - 0.25 to 0.375mg/100 units
- Sub-Q Heparin may require a longer infusion of Protamine
Low Molecular Weight Heparins (LMWH)

• No proven antidote, Protamine is suggested but it may only neutralize 60% of the anti-factor Xa activity in LMWH

• Enoxaparin and Dalteparin
  – < 8 hours 1mg Protamine/100 anti-factor Xa units LMWH followed by 0.5mg/100 if bleeding continues
  – > 8 hours Smaller doses are needed
Low Molecular Weight Heparin

- The duration of action of either Enoxaparin and Dalteparin should dissipate within 24 hours of a therapeutic dose or 12 hours of a prophylactic dose.

- The duration of action of Enoxaparin may be significantly prolonged in renal insufficiency
Antiplatelet Agents

- Aspirin, Ticlid, Plavix, Effient
  - Platelet transfusion may be useful
  - DDAVP can be considered
IIb/IIIa Inhibitors

- Reopro  
  Give Platelets

- Aggrastat or Integrillin  
  Platelets, can transfuse Cryo and could also use DDAVP if needed.
Anti-Factor Xa Agents

• Fondaparinux (Arixtra)
  – No specific antidote
  – Limited data supports rFVIIa
  – Half life = 18hours
  – Peak is 3 hours after administration

• Apixaban and Rivaroxaban
  – No specific antidote
  – rFVIIa may be useful
Direct Thrombin Inhibitors

- Argatroban and Bivalirudin
  - No specific antidote
  - Rapidly eliminated upon cessation of the therapy
    - Argatroban
      - Half life 30 – 51 minutes
    - Bivalirudin
      - Half life dependent upon renal status
Direct Thrombin Inhibitors

- Dabigatran
  - NO REVERSAL
  - Half life 12 to 17 hours (renally cleared)
  - Hemodialysis
  - Activated Charcoal
  - PCC’s or activated PCCs?
  - FFP?
  - rFVIIa?
ED/Critical Care Arena

- Once reversal of the anticoagulant has started, pt will need to be closely monitored for neurological changes and potential complications from the reversal (i.e. emboli phenomenon).

- Elderly pts anticoagulated with mild TBI, including those with a normal neurological exam and CT scan should be hospitalized for at least 24 hours for observation by either a TS or a NS.
Diagnostic Testing

- Need to be taken to CT quickly
- Need to have scan read quickly
- Need to be able to repeat scan quickly over the next few hours to days
Those Who Take….

• Warfarin may present with small intracranial bleeds that ultimately progress to a larger hemorrhage.

• ASA on a daily basis will usually have small bleeds and other comorbid conditions.

• Plavix are at risk for an event somewhere between the ASA group and the warfarin group with regards to progression of their bleed.
Medical Interventions

- Reversal agents should be given.
- The risks and benefits of anticoagulant use must be reevaluated once a traumatic ICH occurs.
  - Those on anticoagulants for atrial fibrillation, rate of a thrombolic event is 1 in 1300 as compared to 1 in 2 risk of death following an intracranial hemorrhage.
  - Therapeutic and supratherapeutic INRs should be treated with fresh frozen plasma (FFP) and vitamin K or Factor VIIa in any patient with TBI. The INR should be maintained less than 1.4.
Surgical Interventions

• There is little point going to the OR or to IRAD if the bleeding cannot be controlled

• The faster the patient is reversed, the sooner they can go to the OR or IRAD
Common Concerns for Patients on Anti-Thrombotics

- Principle complication is spontaneous bleeding anywhere in the body
- Thrombocytopenia
- Heparin Induced thrombocytopenia (HIT)
- Death
Guiding Principle

- Patients who sustain a TBI and are taking an anticoagulant will require a rapid reversal of that agent.
- Anticoagulants are taken by many patients (especially geriatric patients) to avoid a life-threatening event.
- Once a trauma occurs, these agents may increase their mortality due to the disruption of the clotting factors.
  - STN developed a protocol they believe will assist trauma providers by decreasing the risk of a life-threatening hemorrhage in geriatric trauma patients who are on anticoagulation therapy.
Reversal of Anti-Coagulation for Elderly Patients Taking Anti-Coagulation Medication Who Sustain a Head Injury
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**Society of Trauma Nurses Warfarin Rapid Reversal Pathway**

**Known Warfarin Therapy with acute trauma above the clavicles**

- **NO**
  - History of Warfarin use and head trauma **WITH** CT evidence of intracranial bleeding.
  - Significant signs of head trauma. GSC<14, positive loss of consciousness
  - YES-admit to Hospitalist
  - NO-DC home

- **YES**
  - STAT bedside PT/INR and blood bank tube.
  - Consult Neurosurgery

**INR < 1.4**

- Vitamin K (IM OR IV) STAT
- PCC per wt based dosing scale
  - 35-50 Kg = 1500 IU
  - 51-65 Kg = 2000 IU
  - 66-80 Kg = 2500 IU
  - 81-95 Kg = 3000 IU
  - 96-110 Kg = 3500 IU
  - 111-125 Kg = 4000 IU
  - >126 Kg = 4500 IU

- FFP 2 units stat type specific if possible, otherwise AB

**INR > 1.8**

- PT/PTT, fibrinogen CBC STAT
- **CONSIDER**
  - Continue Vitamin K (IM/IV)
  - PCC Repeat initial dose
  - If fibrinogen < 100mg/dl – 10 units
  - Cryoprecipitate or 2 Unit(s) FFP

**INR < 1.4**

- **CONSIDER**
  - Use of retrievable IVC in patients w/ hx of DVT, PE, coagulopathies, valve replacement

**Repeat Head CT in 4-6 hours or with any signs/symptoms of increasing intracranial pressure. Repeat PT q 6 hours for 24 hours or until INR < 1.4**

**Head CT positive for ICH**

- DC home with appropriate instructions and follow-up

**Head CT Negative for ICH**

- **CONSIDER**
  - Use of retrievable IVC in patients w/ hx of DVT, PE, coagulopathies, valve replacement

**Repeat Head CT in 3 hours or STAT with any signs/symptoms of increasing ICP. Repeat PT q 6 hours for 24 hours or as needed.**

**Head CT negative for ICH**

- **CONSIDER**
  - Use of retrievable IVC in patients w/ hx of DVT, PE, coagulopathies, valve replacement

**Repeat Head CT in 4-6 hours or with any signs/symptoms of increasing intracranial pressure. Repeat PT q 6 (six) hours for 24 hours or until INR < 1.4**
Society of Trauma Nurses
Platelet Inhibitor Reversal Pathway

History of Platelet Inhibitor use.
Head injury with evidence of significant intracranial bleeding*
*Consider in other life-threatening bleeding emergencies.

NO

Patient stable for discharge (GCS 15, no LOC, no significant injury to head, face or neck)

YES

Discharge with instructions and follow-up as indicated

NO

Admit to Trauma Service

YES

Repeat Head CT in 4-6 hours or with any signs/symptoms of increasing intracranial pressure.
PT q 6 (six) hours for 24 hours or as needed. (Plavix will not affect PT)

Head CT evidence of intracranial bleeding

YES

Discharge with instructions and follow-up as indicated

NO

CAUTION
Hyponatremia, seizures, and elevated ICP with DDAVP

2 units platelet transfusion
Consult Neurosurgery
Consider DDAVP 0.3 ug/kg
rFVIIa 30-90 ug/kg
Consider platelet aggregometry

Repeat Head CT in 4-6 hours or with any signs/symptoms of increasing intracranial pressure.
PT q 6 (six) hours for 24 hours or as needed. (Plavix will not affect PT)
Issues and Concerns

• Follow-up
  – is there a clinic near by
  – do they have health insurance
  – do they have a doctor
  – will they participate in follow-up
Issues and Concerns

• Medications
  – Will they fill the prescriptions
  – Will they take the medication
  – Can they pay for the medications
Issues and Concerns

• Laboratory testing
  – Is there a convenient location
  – Are the hours convenient
  – Do they have health insurance to pay for it
  – Will they go have the lab work done
Issues and Concerns

- Potential for injury
  - trauma can happen at any time and any place
- Even when exercising care, taking precautions, etc – things can happen
Issues and Concerns

• Potential for complications –
  – Co-morbidities need to be addressed when someone is anti-coagulated
  – Polypharmacy (these are not benign drugs)
  – Geriatric team and specialists
Stopping the Anticoagulant

- Why were they on it
- What caused the trauma (syncope, clot, etc)
- How long do you think that they will need to be off of it
- How safe and effective is the alternative
Complication Specifics

• The risks and benefits of anticoagulant use must be reevaluated once a traumatic intracranial hemorrhage occurs.
  – Those on anticoagulants for atrial fibrillation, rate of a thrombolic event is 1 in 1300 as compared to 1 in 2 risk of death following an intracranial hemorrhage.

• What do you do when they throw clots
  – IVC, recoagulate, nothing
Restarting the Anticoagulant

- Needs to be in a monitored setting
- Does the team agree with the plan?
- What is the worst that could happen?
- Are we prepared for the worst?
Restarting Issues

- Consider the potential morbidity and mortality of anticoagulation reversal if it is decided to not reanticoagulate or initiate an alternative therapy within 24 hours.
- Anticoagulation should not be reinitiated in a pt with an ICH until it is deemed appropriate by a NS.
- Typically, ASA and Plavix can be restarted sooner than warfarin, but the plan needs to be initiated in consultation with a NS.
Redosing Issues

- Too much
- Too little
- Interaction with other medications, herbal and nutritional supplements drugs which can increase or decrease their strength
Nursing and Medical Assessments and Interventions

• Assessments
  – neuro, CV, body systems, etc
  – safe to be OOB, ambulating
  – safe to be making decisions
  – safe to go home
Nursing and Medical Assessments and Interventions

- Interventions – safety alarms, restraints, padded side rails
- Reduce bruising and edema
- Comfort measures including pain control
- PT/OT
- DVT precautions
- Resp tx for cough and deep breathing
- Special mattresses, skin care
Nursing and Medical Assessments and Interventions

• Diagnostic studies – repeat CT scans
• Laboratory Studies
  – Electrolytes
  – Magnesium
  – Calcium
  – Cardiac isoenzymes
• Other
  – 12-lead EKG
Renal Issues

- Impaired ability to concentrate urine
- Decreased glomerular filtration rate
- Slight increases in blood urea nitrogen and creatinine expected; changes considered when using contrast media and certain drugs
- Monitor renal functions and CT scans and drugs
Nursing and Medical Assessments and Interventions

- End-of-life decisions
- Guidelines for making treatment decisions
  - Patient’s right to self-determination
  - Patient’s best interest
  - Benefits of treatment outweigh adverse outcomes
Nursing and Medical Assessments and Interventions

- Specific directions for withholding or withdrawing treatments
- Advanced directives
  - Do they have one?
  - Is it with them?
  - Does the family know their wishes?
  - Is there a medical decision maker who can deal with a fluid and dynamic process?
Nursing and Medical Assessments and Interventions

• Long and short term goals:
  – Do they need rehab?
  – Can they get rehab?
  – Can they go home?
  – Is their a family member who can deal with a fluid and dynamic process?
Outcome Criteria

• For minor injury and an ISS < 9, the mortality for 65 years and older is increased

• For moderate injury and an ISS 9-24, the mortality for 45 years and older is increased
Outcome Criteria

- Markers for poor prognosis at admission:
  - Age > 75
  - GCS of 7 or less
  - Presence of shock on admission
  - Severe head injury
  - On anticoagulants
  - Development of Sepsis
Prevention

• Wear a Medic Alert bracelet

• Tape your name and emergency contact info inside your phone, helmet, wallet, etc

• Be safe and utilize appropriate precautions
Prevention

• **Rugs**
  – Use nonskid tape or backing on throw rugs
  – Tack down all carpet edges

• **Stairs**
  – Need good lighting
  – Solid easy to grasp handrail that is rounded or knobbed at the end
  – Consider painting or taping the top and bottom steps so they are easily noticed
  – Don’t rush when climbing up or down stairs

• **Bathroom**
  – Be sure mats are non-skid and there are treads in the tub and shower to prevent slips
  – “Grab bars” should be in the tub area and next to the toilet if possible

• **Traffic Lanes**
  – Clear walkways thru every room
  – Don’t use doorway, hall or stairs for storage
Prevention

- Floors
  - Do not walk on freshly washed or waxed floors.
  - Wipe up any spills immediately
  - Avoid wearing only socks, smooth soled shoes or slippers on uncarpeted floors

- Outdoors
  - Keep stairs, porches, and walkways free of wet leaves, snow and ice
  - Be sure stairs and walkways are in good repair. Use a handrail on stairs.
Prevention

- **Carrying Objects**
  - Make sure your view isn’t blocked
  - Get a firm grip. Lift with your legs (knees bent, back straight) and walk slowly
  - Get help for heavy or awkward objects

- **Reaching High Places**
  - Use a solid step stool or ladder, not a chair or box
  - Avoid using the highest step on a ladder
  - Get help if you need it
Prevention

- Use crosswalks or cross at corners
- Wait for the signal and cross with the light and give yourself enough time to cross
- Always look both ways
- Carry a flashlight at night
- Always wear a seatbelt, helmet and other safety equipment

- If no sidewalk, walk facing traffic so you can see it coming toward you

**Buses**
- Take your time getting on and off
- Brace yourself whenever it starts or slows down
- Have your fare ready so you are not standing when the bus begins to move
- Keep one hand free to hold the railings and brace yourself.
Everyone deserves to have a healthy Grandma and Grandpa to love them!
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