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TRAUMA LECTURES

SOCIETY OF TRAUMA NURSES
On January 1, 2011, the first of the Baby Boomers turned 65 years old, and every single day for the next 19 years more than 10,000 Baby Boomers will reach the age of 65.
Your elderly trauma patient (defined by the ACS as over 55 years old) may range from
• a 55 year old with chronic renal failure on dialysis who lives in an Adult Foster Care home
• an 83 year old who plays tennis three times a week and lives with her husband in a retirement community
• a 68 year old with dementia who lives in a nursing home
• or as in the picture above a 92 year old widow who lives alone and participates with joy in whatever activity she can.
Objectives

At the conclusion of this presentation the participant will be able to:

- List the most common mechanisms of injury in the elderly
- Discuss 4 physiological changes that make the elderly trauma patient vulnerable to complications
- Describe issues with pain control in the elderly
- Describe the effectiveness of rapid reversal protocols in the head injured patient on antithrombotics

While we will be discussing many issues in the care of this very special population, you will notice a common thread throughout the presentation that relates back to these objectives.
Unintentional injury is the 4th leading cause of death in the younger age group, increasing to the 9th in the over 65 group.
The elderly account for only 10-12% of all trauma victims
But they consume 25% of trauma related health care resources
They have higher mortality rates
They have higher complication rates

<table>
<thead>
<tr>
<th>Causes of Mortality</th>
<th>Age 55-64 yrs</th>
<th>Age 65 and over</th>
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<tr>
<td>1. Malignant neoplasms</td>
<td>1. Diseases of heart</td>
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<td>2. Diseases of heart</td>
<td>2. Malignant neoplasms</td>
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<td>3. Chronic lower respiratory diseases</td>
<td>3. Chronic lower respiratory diseases</td>
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<td>5. Diabetes mellitus</td>
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<td>6. Chronic liver disease/cirrhosis</td>
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<td>10. Septicemia</td>
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The baby boomer generation will swell the ranks of the elderly over the next decades.

The increased life span expectancy is related to:
- Improved health
- Better nutrition
- Better technology
- Social supports
- Better health care
This chart shows the large growth of the population 65 and older from 1900 to 2008 and the even greater projected growth from 2008 to 2050. It also shows the growing numbers of persons 85 and older and their large projected growth to 2050. As the U.S. population ages, the number of geriatric trauma victims will continue to grow. This tsunami (wave) of geriatric patients are heading our way……..What percentage of geriatric patients now make up your trauma service population?
How can we, as trauma professionals, impact these numbers?

Prevention initiatives are part of the answer.

Including age criteria in triage protocols may help early identification.

Implementation of specific geriatric trauma protocols may improve outcomes.

Demographics and Trauma

1995
- 10% of all trauma victims were > 65 years old
- 28% of all injury fatalities were > 65 years old

2050
- 40% of all trauma victims will be > 65 years old
- Fatalities will be ....???
• Everyone defines geriatric differently
• Is this 97 year old an example of the “old, old” or the “elderly, elderly”? 
• She is frail, walks with a walker, occasionally uses oxygen and is on Coumadin.
• If she falls and breaks a rib, a hip or has an intracranial bleed, she has an expected mortality of 100%

**What is Geriatric?**

Age > 65
- the classic retirement age

Age > 70
- geriatric trauma definition
- based upon stratification of
  - injury survival and age

Age > 75
- Geriatrician’s view

Physiologic age
- More importance than chronologic age
While falls are the most common mechanism of injury.
The most lethal is:

(Answer=Pedestrian)
Most common mechanism and can result in severe injuries such as hip fractures and head traumas.

Many older adults, even if they have not suffered a fall, become afraid of falling and restrict their activity, which drastically decreases their quality of life.

As the U.S. population ages, both the number of falls and the costs to treat fall injuries are likely to increase.

Falls among older adults cost the U.S. health care system over $20 billion annually.

The economic burden of older adult falls can help make the case for funding prevention programs and reduce overall health care costs. “

In the next 17 seconds:
- An older adult will be treated in ED for injuries related to a fall

In the next 30 minutes:
- An older adult will die from injuries sustained in a fall
• Brady or tachyarrhythmias may cause dizziness
• Hypotension from antihypertensives (doubling up dose, getting out of bed too fast)
• Hypo or hyperglycemia, hypoxia or hypercarbia may cause altered level of consciousness
• Balance issues may result from deconditioning, vertigo from inner ear issues, arthritis, effects of a stroke, peripheral neuropathies
• As many as 17% of those over 65 years old abuse alcohol
• Combination of medications for pain, anxiety, depression, sleep along with the medications to treat the cardiac, pulmonary, metabolic diagnoses can alter level of consciousness and also negatively impact critical thinking and decision making.
• Then of course we have the environmental issues that can cause a fall.
• How many potentially dangers do you see in this picture?
Causes
• In addition to treatment of the injuries, always work the patient up for the cause of the fall
• 25% due to underlying medical problem
• Which may be more significant than the fall itself
• More trauma services now mandate a geriatric or primary care consult on admission to better co-manage these issues

Injuries
• The most common fall related injuries are:
  • Fractures
  • Head Injury

• Longterm Outcome:
  • Statistics reveal that up to 50% will die within one year of the a serious fall
After falls, MVC’s are the most common cause of unintentional injury in the elderly.

Older drivers make up 15% of all drivers in US.

79% of US MVC fatalities were restrained.

5% were ETOH impaired.

Interestingly driver fatalities in this age group decreased by 18% between 2000 and 2009.

This may be a combination of:
- safer vehicles
- increased restraint use
- safer driving
- improvements in trauma care for the elderly

**Additional concerns with this picture?**
- Good example of “distracted” driving. A 67 year old man, talking on his cell phone, his dog in his lap!!!
• T-bone mechanisms are more common in the elderly
• Making a left hand turn is difficult at best.
• The driver needs to be aware of three different directions, judge the speed of vehicles coming from those directions, determine if they are going to stop at the stop sign or the light, and judge when it is safe to turn.
• A lot of elderly have trouble with night vision.
• In a 2 car collision, when one car is driven by an elderly person, the elderly person is often at fault.
Self protection activities are a normal consequence of aging.

This is due to awareness of changes in their vision, hearing, critical thinking, and attention span.

- Decrease daily driving
- Avoid driving at night
- Avoid driving at peak hours
- Avoid driving on freeways
- Drive at lower speeds
- Drive larger vehicles
- Carry fewer passengers
Burns
- 25% of all burn deaths occur in ages >65
- Elderly have the highest fatality rate among burns

Pedestrian
- 38% of deaths at a crosswalk
- Females > males
- 50% at night

Burns:
- 3rd leading cause of accidental death in elderly
- More at risk because the elderly tend to live in older housing
- Less likely to have smoke detectors
- Less able to evacuate
- Major inhalation injuries & burns

Pedestrian Injuries:
- Causes
  - Slow pace
  - Gait/balance
  - Visual & Auditory Changes
  - Strength and Coordination
• Violence also impacts the elderly
  • Because the elderly tend to concentrate in urban areas
  • Are more vulnerable to violent crime

• Elder abuse and neglect underreported and often missed by health care workers who fail to inquire:
  • Listen to elders and their caregivers
  • Report abuse or suspected abuse to Adult Protective Services

• Suicide was the eleventh leading cause of death for all ages
  • But is the highest among elderly males.
  • Males take their own lives at nearly four times the rate of females and represent 78.8% of all U.S. suicides

• Suicide is a serious public health problem
  • Causes are complex and determined by multiple factors, the goal of suicide prevention is simple: Reduce factors that increase risk (i.e. risk factors) and increase factors that promote resilience (i.e. protective factors)
Suicide

- Males > 75
  Highest Rate of Suicide in the U.S.

- Among Elderly:
  - 4 attempts
  - For every 1 suicide
While injury severity, time to definitive care, and the quality of care in trauma patients have been quantified, it has been much more difficult to quantify pre-existing health status or 'host factors' in trauma patients and relate them to trauma outcome.

Numerous studies have attempted this task, but none have succeeded in producing a simple system to quantify co-morbidities.

The risk of a preventable complication in an inpatient setting increases dramatically with the number of chronic conditions.

Better primary care, especially coordination of care, could help reduce complications and LOS.
While each trauma patient over the age of 65 is considered “elderly”, each has their own unique medical history, physical capabilities, and attitude.

Two disparate responses to injury:

- “why did this happen to me?”
- “how soon after surgery can I start physical therapy?”

Men and women over 50 with more positive self-perceptions of aging live on average **7.6 years longer** than those with negative perceptions.

It may be impossible for a trauma professional to change the attitude of your patients, but there are certain changes that occur as we age that we do need to keep in mind and plan appropriate assessment and interventions.
Assessing for sensory changes may be difficult especially with:

- preexisting dementia
- altered level of consciousness
- Intubation
- pharmaceuticals.

The family/significant others/friends can help.
With aging the brain and spinal cord lose nerve cells and weight.
Nerve cells may begin to transmit messages more slowly than in the past.
Waste products can collect in the brain tissue as nerve cells break down, causing abnormal structures called plaques and tangles to form.
Slowing of thought, memory, and thinking a normal part of aging.
Dementia and severe memory loss are NOT normal processes of aging but can be caused by degenerative brain disorders such as Alzheimer's disease.

**Neurologic Considerations**

- **Declining:**
  - Perceptual motor skills
  - Concept formation
  - Complex memory tasks
  - Quick decision tasks
  - Slower reflex times

- **Alters response to:**
  - Drugs
  - Pain
  - Environment
Delirium: We have all observed older patients who develop delirium after surgery. Delirium is reported to occur in 10-15% of elderly patients who receive general anesthesia.

- Variables associated with delirium include:
  - older age, hypoalbuminemia
  - impaired functional status
  - Pre-existing comorbidities.
  - Pre-existing dementia: most predictive

POCD:
- Risk factors for having POCD at 3 months included increasing age, lower educational level, prior stroke and POCD at discharge.

- Effects include: planning, working memory, attention, problem solving, verbal reasoning, inhibition, mental flexibility, and multi-tasking.

Dementia is extremely rare following surgery and presents with cognitive deficits in multiple domains and severe impairment in occupational and social function.
• The average geriatric patient takes 4 or more medications
• Adverse reactions from medications are up to 7 times more common in persons aged 70 to 79 years than in those aged 20 to 29 years.
• The greater the number of medications taken, the greater the risk of a clinically serious drug drug Interaction.”
• Opioids should be started at 25-50% of the adult dose and titrated until pain is reduced to a mild level.

**Pharmaceutical Considerations**

- **Start Low and Go Slow**
- **Avoid:**
  - Meperidine (Demerol)
  - Tramadol (Ultram)
- **Treat Anxiety and Pain**
- **Common side effects:**
  - Constipation
  - balance issues
  - postural hypotension
• Your elderly patient, even with healthy lungs, arrives at the hospital with a lower PaO2.

• **The common rule of thumb** is to subtract 1 mm Hg from the minimal 80 mm Hg level for every year over 60 years of age: (Note: up to age 90) So a 70 year old patient would have a “normal” PaO2 of 70 mm Hg.

• Keeping this in mind, remember that until the PaO2 gets to about 60 mmHG the oxygen saturation stays above 90%. (Google the oxygen dissociation curve for more info.)

• So our elderly patients not only come to us with stiffer pulmonary structures, sticky secretions and comorbidities, they also come to us with diminished reserve (less oxygen available for extraction during times of increased need).

**Some strategies to follow are:**

• Hydration

• Incentive spirometry

• Pain control

• EARLY mobilization

• Monitor SPO2 and remember that an oxygen saturation of 90 is NOT GOOD.
•Our patients may come to us with renal impairment or already on dialysis.
•If already on dialysis, then arrangements for continuation of therapy need to be made.
•Renal Insufficiency defined as:
  Glomerular filtration rate (GFR)<60 mL/min/1.73 m²

•Prevention of renal insufficiency and renal failure by awareness of:
  •categories of nephrotoxic drugs
  •maintenance of optimal blood flow to the kidneys
  •avoiding hypotension
  •monitoring creatinine, CPK & myoglobin

•While not an inclusive list, the following drugs are commonly used in the elderly:
  •ACE inhibitors, Angiotension Receptor Blockers (ARBs), NSAIDS
  •Aminoglycosides and amphotericin B
Those at increased risk include:

- Patients with chronic kidney disease
- Enhanced with diabetes, dehydration, heart failure, age >70, and concurrent use of nephrotoxic drugs.

Treatment:

- Low-osmolar (Non-ionic) contrast
- In the lowest dose possible
- Avoidance of multiple procedures in 24 to 48 hours

**Non-ionic agents include Isovue and Visipaque.**

- Before and after the procedure:
  - 0.9% saline or sodium bicarbonate (154 mEq/L) may be infused
  - NSAIDs and diuretics should be withheld at least 24 hours before and after the procedure.
  - Renal function should be monitored for 24 to 48 hours after the procedure.
  - Acetylcysteine (Mucomist) may be considered before and for two days after the procedure.
  
  - Scavenging a variety of oxygen-derived free radicals and improving endothelium-dependent vasodilation are properties of N-acetylcysteine that may confer protection against contrast-medium–induced renal dysfunction.
  - Free-radical formation is promoted by an acidic environment typical of tubular urine but is inhibited by the higher pH of normal extracellular fluid.
  - Because free radicals are postulated to mediate contrast-induced nephropathy, alkalinizing renal tubular fluid with bicarbonate may reduce injury.
  - The effectiveness of sodium bicarbonate IV and acetylcysteine in prevention of contrast induced nephrotoxicity however remains unproven.
  - The incidence of Contrast Induced Nephropathy is relative low.
  - Therefore contrast should not be withheld routinely as a nephro protective strategy.
Increased risk for constipation:
- change in level of activity
- decrease in oral fluid intake
- decrease in fiber intake
- opiates for pain
- inability to use a bedpan

In a population that often depends on a daily laxative (or two), a stool softener prn is not the answer.

Routine use of a laxative accompanied by a rectal exam and suppository every 48 hours will help avoid the diarrhea of impaction and the onerous duty for you and the patient of disimpacting the patient.

There is a modest relationship between use of PPIs in the elderly and C Difficile,
• Your elderly patient may arrive in your trauma bay with a number of musculoskeletal comorbidities.
• Note the “dowager’s hump” on this great grandmother.
• Osteoporosis is a common cause of compression fractures. Multiple compression fractures can cause kyphosis, the hump-like curvature of the spine.
• A hip fracture is a fracture in the upper quarter of the femur.
• This is a major trauma for an “old-old” patient.
• The outcome in this age group ranges from decrease to loss of independence, to death within the 12 months after the injury.
• The elderly patient may also have had knee or hip replacement.
Compression fractures are common in the elderly and may be acute or chronic.

• Acute may be due to an axial load injury such as a fall from a height landing on feet.
• Compression fractures due to osteoporosis may cause no symptoms at first and may only be discovered when x-rays of the spine are done for other reasons.
• Over time, the following symptoms may occur:
  • Back pain that starts slowly, which gets worse with walking but is not felt when resting
  • Loss of height, as much as 6 inches over time
  • Stooded over posture or kyphosis, also called a "dowager's hump"
The intertrochanteric fracture:

• common injury seen with low energy falls in the elderly.

• While isolated hip fractures may or may not be admitted by the trauma service, there are some improvement initiatives that will improve the overall surgical care of these patients.

• Collaboration with the orthopedic surgeons, anesthesia and the trauma program can decrease time in the emergency department, decrease the clearance for surgery process, decrease time to internal fixation, decrease length of stay in acute care, improve pain management and discharge planning.
• Because of the osteoporosis, spondylosis and compression fractures common in the elderly, particularly elderly women, it may be difficult to clinically and radiographically clear C-spine.

• It is also often difficult to properly fit a cervical collar.
Age Related Changes in the Endocrine System include:

- Insulin resistance which may prevent efficient conversion of glucose into energy
- A decrease in aldosterone and cortisol may affect immune and cardiovascular function
- Hypothyroidism is common

Endocrine Considerations

- Increase in glucose tolerance
- Hypothyroidism
- Menopause
- Continue supplements
- Monitor glucose
**Cardiovascular Considerations**

**Primary Concern:**
- Limited cardiac reserve
- Unable to increase O2 delivery to meet demands

**In the Presence of:**
- Previous MI
- Heart Failure
- Beta blockers
- Bradyarrhythmias
- Loss of atrial kick

**Increasing oxygen delivery requires:**
- Increased heart rate
- Increased contractility
- Optimal preload.
- Optimal afterload (no hypertension or vasoconstriction)

- The patient with a previous MI, with heart failure, taking beta blockers, may not be able to increase heart rate or contractility.

- If the patient is in atrial fibrillation or has a ventricular pacemaker, there is the loss of atrial synchrony (atrial kick).

- The elderly patient is also often dehydrated or has dependent edema sequestering fluid, both of which can decrease preload.
It is very important to continue pharmaceutical therapies.

Abrupt discontinuation of antiarrhythmics can result in atrial fibrillation with uncontrolled ventricular response.

Abrupt discontinuation of antihypertensives, ACE inhibitors, Angiotensin Blockers, may lead to a hypertensive episode that is difficult to manage. This could be particularly harmful in a patient with an intracranial bleed.

If your patient has a pacemaker or an internal cardioverter/defibrillator, the device should be evaluated for proper function after the traumatic event.

If your patient is taking an anticoagulant for atrial fibrillation, prior valvular surgery, pulmonary embolus, DVT, then an evaluation of the risks and benefits of continuing or when to restart the medication must be made.
Some believe that age 70 alone should be a criteria for trauma team activation.

Others state that patients over the age of 60 years of old with multiple injuries or significant mechanism of injury should be a criteria for the highest level of trauma activation.

The CDC Field Triage addresses age only after physiologic criteria, major mechanism criteria and fairly minor mechanism criteria and then at the fourth level of the decision tree, suggests “contact Medical Control and consider transport to trauma center.”

Normal Presenting Vital Signs are often unreliable:
- Vital signs on presentation are less predictive of mortality in geriatric blunt trauma victims.
- The elderly are often hypertensive and thus a normal BP may represent a relative hypotension that may be under appreciated.
- Geriatric blunt trauma patients warrant increased vigilance despite normal vital signs on presentation.
- New trauma triage set points of HR 90 or SBP 110 mm Hg should be considered in the geriatric blunt trauma patients.
An alternative to the pulmonary artery catheter (PAC) that has been mentioned in the literature is BEAT (Bedside Echocardiographic Assessment in Trauma).

There is significant correlation between the Cardiac Index and CVP as derived from the Echocardiogram and measured from the PAC.
Moderate resuscitation approaches, especially in the elderly, may increase survival in trauma patients.

Excessive fluid resuscitation should be avoided in the ED and when required, operative intervention or ICU admission should be considered.
These 3 situations create major challenges for trauma centers and are increasingly present in the elderly trauma population.
• This picture was taken of a back board that had just been used to transport an elderly patient with a scalp laceration who was on warfarin (Coumadin) and had an INR of 3.

• The medics were also reminded that a pressure dressing does not take the place of direct pressure.

• It is not unusual for an elderly patient to arrive at the Emergency Department Triage desk complaining of a fall, a syncopal episode, dizziness, headache.

• The spouse may tell you that the patient is “acting funny”, “not themselves”.

• In each of these cases specifically trying to determine if the patient fell, not just this day but in the past 7-10 days or so and if the patient takes any anticoagulant or antiplatelet medication is vitally important.
There have been many studies in the correlation of mortality from traumatic intracranial hemorrhage and warfarin.

• Increased mortality is seen at age 60 years in patients who sustained a TBI in a MVC, despite no difference in Injury Severity Score and a decrease in crash severity.

• Patients on anticoagulation or antiplatelet therapy suffering minor head trauma, with GCS 15, have a high incidence of intracranial hemorrhage.

• The frequency of positive head CTs in one study was 41 of 141 (29%).

• LOC was a statistically significant predictor of a positive CT result.

• Positive head CTs almost always led to a change in clinical management.

• There was no statistically significant difference between antiplatelet versus anticoagulant usage and a positive CT result.
Caution

• Neither the initial GCS nor INR in anticoagulated trauma patients reliably identifies patients with ICH.

• Rapid confirmation of ICH with expedited head CT scan combined with prompt reversal of warfarin anticoagulation with fresh frozen plasma decreases ICH progression and reduces mortality

Triage Process

• We must recognize that any patient with a known or suspected TBI who was taking warfarin is at risk.

• If the initial GCS was <14, then a full trauma team activation is called. This gives the patient priority lab processing and immediate access to the CT scan.

• If the GCS is 14 or 15, implement some type of Stat ED consult or develop some kind of a “Code RED”, ensuring that an ED physician sees the patient immediately.

Bottom line: Patients with any head trauma and an elevated INR are a walking time bomb. They need prompt assessment and reversal of their anticoagulation if indicated.
A growing number of adults, usually elderly, are taking Coumadin (warfarin) to manage chronic medical conditions or deep venous thrombosis. While warfarin is a very useful drug for these problems, it is notoriously difficult to maintain tight control of INR. If an individual on warfarin is involved in a fall or vehicular crash, bleeding complications can become life-threatening. Studies have shown that mortality more than doubles in elderly patients who are admitted awake after just falling from standing. The key is to rapidly reverse an elevated INR.
PCC has been used primarily in Europe and is emerging in the US

• PCC appears to be a safe and effective alternative to FFP and provides rapid reversal of INR in patients on vitamin K antagonist therapy.

• These agents may be advantageous compared to FFP in patients with volume restrictions.

More Research is Needed:

• Comparative trials are needed to compare the various PCC products, FFP, and recombinant factor VIIa with regard to clinically significant outcomes such as hemostatic effect.

• In those studies in which PCCs were compared with FFP, PCCs were found more effective in shortening the time to INR correction and were associated with a low risk of thrombotic adverse events.
Factor VIIa provides a cost-efficient option to effectively correct coagulopathy in patients with traumatic brain injury undergoing emergent craniotomy.

In addition, the use of rFVIIa is associated with decreased transfusion of PRBC and plasma and decreased transfusion-related hospital costs in this population.

Reversal of warfarin using FFP and Vitamin K takes time and may delay neurosurgical procedures, thus the reason for using recombinant Factor VIIa.

Relative contraindications to Factor VIIa administration include patients with:

- DVT
- PE
- MI
- CVA

Within last 30 days prior to event or who are pregnant
First, recognize that any patient with a known or suspected TBI who was taking warfarin is at risk.

If the initial GCS was <14, then a full trauma team activation is called. This gives the patient priority lab processing and immediate access to the CT scan. In addition, 2 units of thawed plasma are administered immediately while in the resuscitation room. The FFP is given no matter what the INR.

If the head CT is negative, plasma is stopped.

For patients with a GCS of 14 or 15, a “Code RED” or stat ED consult is called, ensuring that an ED physician sees the patient immediately. A point of care INR is drawn and the patient is sent for stat head CT. If the head CT is negative with INR>2.5, the patient is admitted for observation and a repeat head CT is obtained 12 hours later. Caution: We have seen patients develop delayed hemorrhage when they have high INR.

Apply a restrictive set of criteria to determine if a patient may go home from the ED, which causes us to admit most for observation. And if they do have a positive CT, consult NS and begin Vit K and FFP or PCC infusions. Also may consider VII.
Clopidogrel (Plavix) was the seventh leading drug in terms of US sales with $2.23 billion spent on this in 2006.

- It is also ranked as having the “most motivating pharmaceutical advertisement” directed toward consumers in 2005.

- TBI patients on clopidogrel may have increased long-term disability and fatal consequences when compared with patients who are not on these drugs or on other anticoagulants.

- Patients on clopidogrel should be advised of safety when engaging in potentially dangerous activities to avoid the consequences of TBI.

- Repeated administration of platelets may reverse the disaggregation caused by the clopidogrel

**Clopidogrel (Plavix)**

**Action:**
- Inhibits platelet aggregation
- This action is irreversible
- Long half life

**To counteract:**
- Repeated Platelets required
- But the infused platelets are inhibited by remaining drug
- Requires repeated platelets to get meaningful clot formation
• Pradaxa is a real problem in trauma.

• **There is no antidote to Pradaxa.**

• It can be dialyzed (protein binding is low), with the removal of about 60% of drug over 2 to 3 hours; however, data supporting this approach are limited.”

• Some have suggest that if the last dose of the drug had been taken within 2 hours to consider activated charcoal administration as well as consideration for dialysis.
• Spinal cord injuries in older patients are becoming more prevalent.

• Mechanisms of injury frequently involve low velocity falls, as opposed to the high velocity traumas responsible for most other spinal cord injuries.

• Age-related comorbidities such as cervical spondylosis, osteoporosis, osteoarthritis, and neuromuscular disorders play into the pathophysiology of injury in this population.

• The mortality rate in this patient group is much greater than in younger patients and should be taken into account when aggressive interventions are considered and in counseling families regarding prognosis.
This is a result from a study performed at Cleveland Metro Health, a Level 1 trauma center in Ohio. The unfavorable outcomes included death, transfer to a skilled nursing facility or a long term acute care facility. Favorable was discharge home or to acute inpatient rehab.

Note the similarity in unfavorable outcome whether isolated injury versus multiple injuries

The results strongly indicate that a low impact isolated injury has slightly less unfavorable outcome than a cervical spine injury with associated injuries (including spinal cord injury), however the mortality rate is the same.
**Flexion injuries** may occur when there is a fall and the back of the head strikes a step, a coffee table, a counter top.

**Flexion teardrop fracture** occurs when flexion of the spine, along with vertical axial compression, causes a fracture of the anteroinferior aspect of the vertebral body. This fragment is displaced anteriorly and resembles a teardrop.

**Compression (or wedge) fracture** is a fracture of the vertebral body caused by squeezing of the bones when downward compressive force is transmitted to lower levels in the cervical spine, the body of the cervical vertebra. Depending on the force it can also shatter outward, causing a burst fracture. This fracture involves disruption of the anterior and middle columns, with a variable degree of posterior protrusion of the latter.
Another Flexion injury is **subluxation** as seen in slide, or unilateral or bilateral facet injuries.

**Anterior subluxation** in the cervical spine occurs when posterior ligamentous complexes rupture.

- Anterior subluxation is rarely associated with neurologic sequelae.
- Nevertheless, most authorities approach this injury as if it were potentially unstable because of the significant displacement that can occur with flexion, and very rare cases have associated neurologic deficit.
The image above is called a hangman’s fracture and is a type of fracture caused by hyperextension.
Odontoid Fractures: A fracture caused by sudden forward and backward movement of the head with respect to the trunk

A. **Type I odontoid fracture** is an avulsion of the tip of the dens

B. **Type II odontoid fractures** occur at the base of the dens and are the most common odontoid fractures. This type is associated with a high prevalence of nonunion due to the limited vascular supply and small area of cancellous bone.

C. **Type III odontoid fracture** occurs when the fracture line extends into the body of the axis. Nonunion is not a major problem with these injuries because of a good blood supply and the greater amount of cancellous bone.

*Several studies have documented increased morbidity and mortality among geriatric patients sustaining odontoid fractures. The nonunion rate in this population has been reported to be as high as 85% (range, 20%–85%) and the mortality rate has approached 60% (range, 10%–57.1%).

Moreover, the choice of management (operative vs. nonoperative, halo-vest immobilization vs. Cervical orthosis) has been postulated to influence mortality.*
The images are of an 89 year old woman who slipped, fell forward hitting chin on coffee table. She walks into triage with her daughter.

As you can see, there is significant kyphosis from compression fractures.

Is she a candidate for a hard collar, a Halo vest, surgical fixation? The next slides will give you the information you need to answer this question.
This is an example of **nail fixation of an odontoid fracture**.

- While there is no Class one evidence that surgical fixation is the treatment of choice for odontoid fractures in the elderly
- There is evidence that mortality rates are less.
**Fit Concerns**

- A stable fracture generally requires only a hard collar, however it will be very difficult to find a collar that fits her appropriately.

**Complications of collars:**

- The most common adverse complication is skin breakdown
- Incidence of skin breakdown as high as 8% of all trauma in some centers
- Days in the cervical collar is a significant predictor of skin breakdown, along with presence of edema.

How about a Halo Vest?
The halo vest, in particular, has been associated with an increased risk of complications and death in elderly patients.

**Reported complication rates** of halo use in the elderly:
- pneumonia (34%)
- cardiac arrest (26%)
- mortality (42%)

These complications may be the result of:
- the difficulty in swallowing
- the immobility that often results
- the issues of balance
- the presence of pre-existing dementia
Rib fractures are a significant cause of pain and disability in patients with isolated thoracic injury and in patients with associated extrathoracic injuries. Developing new therapies to accelerate pain relief and healing would substantially improve the outcome of patients with rib fractures. **Note the rib fractures on this CT image.**
Pneumonia is significantly associated with mortality in the elderly patient with isolated rib fractures.

Aggressive attempts to relieve pain, prevent atelectasis, improve functional residual capacity and vital capacity, and improve the ability to clear secretions.

Image is a type of Incentive Spirometer.
Thorough assessment of pain
- History and Physical
- Self report using appropriate scale for individual

Schedule:
- Opioid & NSAID’s pain meds around the clock
- Select least invasive and safest route
- Multi-modality therapy now the norm
- Options: PCA, epidural, & peripheral nerve block

Multi-modality
Multi-modality therapy for multiple rib fracture-related pain control has become increasingly common in recent years with the introduction of intravenous (IV) NSAIDs and regional analgesia using continuous bupivacaine infusions, both of which have been shown to decrease opiate requirements and their related side effects.
Opioid Side Effects
• Of all the unwanted effects of the opioids, the most difficult to deal with is that of constipation.
• An aggressive approach using bowel stimulating laxatives is critical in order to prevent this problem

• Pain management is essential and in addition to opioids, tylenol and NSAIDS (if no contraindications), regional anesthesia/analgesia can provide excellent and prolonged postoperative analgesia that provides quicker and more comfortable patient mobility, decreases opioid requirements, facilitates participation in physical therapy, and expedites return-to-normal activities.
Patient controlled analgesia (PCA) is a method of pain control that gives the patient the power to control their pain.

- In PCA, a computerized pump called the patient controlled analgesia pump -- that contains a syringe of pain medication as prescribed by a doctor is connected directly to a patient's intravenous (IV) line.

- In some cases, the pump is set to deliver a small, constant flow of pain medication. Additional doses of medication can be self-administered as needed by the having the patient press a button. Other times, a patient can control when he or she receives pain medication and does not receive a constant flow.

The pump can be used whenever the patient is feeling pain. However, patients should not press the button on the machine if they are feeling too sleepy. The more alert the patient is, the more likely he or she is to participate in a therapy program to aid and possibly shorten recovery. Once the acute pain from surgery is controlled, the patient will be switched to pills for pain relief.
These Guidelines were published in the Journal of Trauma by Eastern Association for the Surgery of Trauma (EAST) in 2005.

However in a meta analysis published in 2009, Carrier et al in Quebec concluded that “No significant benefit of epidural analgesia on mortality, ICU and hospital LOS was observed compared to other analgesic modalities in adult patients with traumatic rib fractures.

However, there may be a benefit on the duration of mechanical ventilation with the use of thoracic epidural analgesia with local anesthetics. Further research is required to evaluate the benefits and harms of epidural analgesia in this population before being considered as a standard of care therapy.”

**Epidural Analgesia EAST Guidelines**

**Level I Evidence**
1. Epidural analgesia:
   - Optimal modality for blunt chest wall injury
   - Preferred for severe blunt thoracic trauma

**Level II Evidence**
1. Use Epidural analgesia:
   - Age ≥ 65 with > 4 rib fxs
   - Unless contraindicated
2. Consider epidural analgesia:
   - Ages ≤ 65 with > 4 rib fxs
   - or
   - Ages ≥ 65 with lesser injury
Documented benefits appear to be dependent on successfully improving analgesia, and include decreasing baseline/breakthrough/dynamic pain, supplemental analgesic requirements, opioid-related side effects, and sleep disturbances.

In some cases, patient satisfaction and ambulation/functioning may be improved; an accelerated resumption of passive joint range-of-motion realized; and the time until discharge readiness as well as actual discharge from the hospital or rehabilitation center achieved. Lastly, postoperative joint inflammation and inflammatory markers may be decreased.

Nearly all benefits occur during the infusion itself, but several randomized controlled trials suggest that in some situations there are prolonged benefits after catheter removal as well.

Major risks including clinically relevant infection and nerve injury are relatively rare.
Surgical management of patients with severe flail chest is at present controversial. However, surgical stabilization is strongly indicated in specific clinical situations. The effectiveness and the ideal timing of chest wall stabilization in patients on mechanical ventilation is related to the degree of the pulmonary parenchymal damage. The presence of extensive pulmonary contusion is a relative contraindication to surgical stabilization. Patients with mild or no pulmonary contusions, early surgical stabilization (within few days of internal pneumatic stabilization) may result in shorter intensive care unit stay with lower morbidity and prevention of pulmonary restrictive complications resulting in working incapacity.

Another indication for surgical stabilization is the presence of an extensive antero-lateral flail chest in a young patient even in the absence of severe respiratory failure.

Image is of internal fixation of a rib.
Using this case study, think about what special considerations due to this patient’s age and injuries will be necessary as the plan of care is developed.
You get this information via pre hospital radio report.
Will you activate your trauma team?
What level?
ED Physical Exam

- Left frontal contusion, odor of alcohol
- Tenderness to palpation left lateral chest with crepitus, equal breath sounds and bilateral wheezing, heart sounds distant

What can cause an odor of alcohol?
How about wheezing?
Are distant heart sounds significant?
What are potential injuries so far?
Now what are the injuries?
Potentially a head injury, fractured ribs, maybe pulmonary contusion along with fractured hip and possibly fractures of radius, ulna humerus.

Three systems and we still don’t know his health history (co-morbidities)
Is the drop in BP significant? He is still tachycardic. What is the significance of the pulse oximetry result?
Why is speech slurred? Did he have a stroke and then fall? Is he impaired by alcohol? Is an intracranial bleed expanding?

- PERLA, oriented only to person, speech slurred, obeys inconsistently
- GCS 13-14
A drug list is found in his wallet.
What are his comorbidities?
Diabetes? Does this explain the alcohol breath?
High Blood Pressure? Atrial Fibrillation
Why the Warfarin?
Does he have COPD?

<table>
<thead>
<tr>
<th>Additional Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>• He is on Glucophage (Metformin)</td>
</tr>
<tr>
<td>• Metoprolol (Lopperor)</td>
</tr>
<tr>
<td>• Warfarin (Coumadin)</td>
</tr>
<tr>
<td>• Alupent (metaproterinol) inhaler tucked in a half-empty cigarette pack</td>
</tr>
</tbody>
</table>
What do the ABS’s tell us?  
The H&H?  
How about the WBC? The Glucose and the INR?  
And of course the BAC.  

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABG</td>
<td>7.30 50 180 19 94% NRB</td>
</tr>
<tr>
<td>H&amp;H</td>
<td>33.5 11.2</td>
</tr>
<tr>
<td>WBC</td>
<td>12,500</td>
</tr>
<tr>
<td>LYTES</td>
<td>OK</td>
</tr>
<tr>
<td>GLUCOSE</td>
<td>275</td>
</tr>
<tr>
<td>BAC</td>
<td>0.125</td>
</tr>
<tr>
<td>INR</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Is there a component of metabolic acidosis?  
Does he have a urinary tract infection, or is the WBC related to the inflammatory response?  
Is he taking his Coumadin?  
We now know he drinks
What are potential complications for this patient?
• Pneumonia
• Atalectasis
• Alcohol withdrawal
• DVT
• Sepsis from pre-existing UTI
• Skin Breakdown
• Prolonged length of stay

What are some of the coordination of care issues?
• Communication with out of town family
• Discharge planning
  • Acute vs subacute rehab
  • Potential transfer to be near children
Summary

- The elderly are not able to compensate as quickly or as efficiently as a younger adult.
- Co-morbidities in the elderly trauma patient can have deleterious affects on their outcome.
- They will be us……

The image is a group of members of a local Senior Citizen Center.