Geriatric (Orthopaedic) Trauma

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Pearls of Geriatric Care

Do not regret growing older. It is a privilege denied to most

Overview

- East Guidelines
- Data
- Relevance to the Cox system
- Trauma activations for geriatric trauma patients

Evaluation and management of geriatric trauma: an Eastern Association for the surgery of trauma practice management guideline
Journal of trauma acute care surgery
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- Assess effective evidence based care pertaining to elderly trauma patients
  - aggressive triage
  - coagulation correction
  - limitation of care

- Should age be an independent determinant of triage decisions such as whether trauma patients receive care as a trauma team “alert” at a designated trauma center or in decision making related to limiting care?
• How should medication-induced coagulopathy be addressed during the early postinjury period?

• Is indiscriminate invasive cardiovascular monitoring with pulmonary artery catheters and supranormal resuscitation still justified after injury in older patients?

• Summation of East Guidelines for Geriatric Trauma

• Lack of evidence based research

• Need for large prospective studies to better understand the survivability of these injuries and the unique response of geriatric patients to trauma

• 15% of US population currently over 65 years of age

• by 2040, over 20-25% of the US population will be over 65 years of age

• Patients over 65 account for over 30% of fatal injuries in the US currently

• 3-5 x higher rate of fatality from trauma

• For each 1 year increase of age beyond 65 years, odds of geriatric patient dying after trauma increases 6.8%

• Each additional rib fracture in the elderly increases mortality by 19% and risk of pneumonia increases by 29%

• Overall mortality from pelvic ring injury approximately 20% (up to 80% in open injury pattern)

• Population based accident/trauma mortality rate in geriatric population higher than any other age group

• Age > 65 years of age has been shown to be an independent risk factor for mortality following trauma
- Trauma is the 5th leading cause of death in patients > 65 years of age
- Geriatric cases account for 20-25% of trauma admissions and 30% hospital charges (46%)
- Average 2 fold increase in cost

- Cox South Trauma Registry Numbers
  - 46-50% of trauma registry patients per month over 65 years of age

Do geriatric patients require trauma evaluation after falls from a height

- Fall from height is the leading cause of injury related death in elderly population
- Patients older than 65 3x more likely to sustain pelvis/femur fracture than younger patients after fall from a height

- In a study of trauma registry patients compared to isolated hip fracture patients
  - mean LOS 18.4 days for hip fx
  - mean LOS 11.7 days for trauma patient

- ICU stay required for 9.5% of hip fracture patients
- ICU stay required for 23% trauma patients
Conclusion

• Inclusion of elderly patients with falls from a height in the trauma registry better help document and understand the trauma population
• Better appreciate the resource utilization and societal impact of trauma

Where are elderly trauma patients being cared for?

• Interestingly, elderly trauma patients are not being transported to trauma centers
• Multiple state studies have independently reported a lack of transport of elderly trauma patients to a Level I trauma center
• 55 years of age

Two-Part study in Maryland

• Undertriage
  • Failure to transport a trauma patient to a state designated trauma center
  • 50% patients >65
  • 18% patients <65
  • Decrease in probability of transfer 50 yoa

EMS Questionnaire

• Age bias
• Lack of knowledge regarding age as a trauma triage criterion
• Perceived negative reception by hospital trauma staff
• Lack of familiarity and training related to the care of elderly patients

Unique Aspects of Elderly Patients

• Cardiovascular
• Pulmonary
• Hepatorenal
• Thermoregulation
• CNS
• Integument

Cardiovascular Changes

• Cardiac output
• Cardiac monocyte number
• Increase in cardiac fibroblasts
• Resultant interstitial fibrosis contributing to decreased cardiac compliance
• Decreased compliance affects both diastolic relaxation and systolic contraction

Youth is the gift of nature, but age is a work of art. – Rembrandt
Increased arterial stiffness
- Increases afterload
- Increases systolic blood pressure
- Leads to LVH

Decrease number of SA nodal cells
- Leads to increased incidence of arrhythmias
- Increased vagal tone
- Decreased basal heart rate

Pulmonary Changes
- Decrease in elastic lung recoil
- Resultant increase in lung compliance (physiologic equivalent of emphysema)
- Decreased chest wall compliance
  - Thoracic cage changes
  - Loss of respiratory musculature
  - Osteoporotic changes

- Decrease in arterial O2 tension and alveolar gas exchange
- Increase in ventilation-perfusion mismatch
- Decreased tidal volume and elevated respiratory rate

- Increased residual volume/FRC
- Decreased FEV1/FVC
- Decreased CNS response to O2/CO2 levels
- Loss of ability to sense respiratory bronchoconstriction

- Loss of respiratory protective mechanisms
  - Impaired ability to cough
  - Impaired mucous production
  - Decline in upper airway musculature
  - Contribute to inefficient bacterial clearance and development of pneumonia
Hepatorenal

- Decreased blood flow through liver
- Decreased ability to metabolize drugs
- Decrease in hepatic clearance
- Decrease in production of plasma proteins

Thermoregulation

- Blunting of the hypothalamus
- Increased heat loss and more prone to hypothermia
- Decreased muscle mass contributes to heat loss
- Lessened vasoconstrictive response to cold

CNS

- Decrease in neurons
- Slower conduction velocity
- Atrophy/denervation of sensory/motor pathways
- By 80 yoa, loss of 30% brain mass

- Decrease in cerebral blood flow
- Decrease in neurotransmitters
- Decrease in fluid cognition
- No change to crystallized cognition
- Overall decrease in level of cognitive function

- 80% individuals over 60 have preclinical stages of Alzheimer’s, Parkinson’s or cerebrovascular disease
Integumentary

- Reduction in muscle mass
- Atrophy leads to loss of 5-7 cm height
- Decline in general strength/increase in body fat composition
- DJD/OA
- Collagen/elastin deterioration

Resuscitation Efforts

- Hypotension/hypoperfusion underestimated in elderly trauma patients
- Recent study identified elderly trauma patients with "normal" vital signs at presentation at higher risk for mortality
  - recommend aggressive resuscitation for patients with HR>90 or SBP<110 mmHg

- Recent study assigning age >70 as criterion for trauma activation with aggressive monitoring and resuscitation
  - Decreased mortality rate from 54% to 34%

- Recognition of elderly patients with resuscitation needs improves survival
  - Aggressive focused resuscitation
  - ICU management
  - Invasive monitoring
  - Improved survival rate 7%-53%

Serum Base Deficit

- Review of 2,600 patients to Level I trauma center
- Base deficit >-6 marker of severe injury and mortality
- PPV/NPV
- >55 yoa = 25% mortality

- More recent review
  - confirmed base deficit and serum lactate levels associated with increased mortality in elderly trauma patients compared to younger patient population
  - 2X higher rate of mortality
Scoring system to assess elderly trauma patients

- GTSS
  - Geriatric Trauma Survival Score
  - Most specific scoring system for survival prediction in the elderly following trauma
  - Cardiac complications, sepsis, elevated ISS, age all predicted fatality/survivability

Mechanism of Injury

- Blunt trauma
- Pedestrian vs auto
- GSW (accidental or self-inflicted)
- Fall from a height

Predictors of Morbidity and Mortality

- Predictors of mortality:
  - ISS (10 fold higher mortality rate >18)
  - GCS
  - Transfusion requirement
  - Fluid requirement

Factors predictive of complications

- ISS
  - ARDS (81% mortality)
  - Pneumonia
  - Sepsis
  - GI complications

Predictors of morbidity and mortality in elderly trauma patients.

Factors predictive of complications:

- Fluid requirements
  - Predicted myocardial infarction (62% mortality)

- Need for surgery and transfusion predicted sepsis (40% mortality)
Surgery

- No surgery (18% mortality)
- General surgery (36% mortality)
- Orthopaedic surgery (10% mortality)
- Both general and orthopaedic surgery (25% mortality)

Geriatric Trauma and Associated Orthopaedic Injuries

- Geriatric Trauma: Demographics, Injuries, and Mortality
  - Journal of Orthopaedic Trauma 2012; 26: e 161-165

- Study designed to identify injuries and define the incidence of orthopaedic injuries associated with elderly trauma patients
- Overall mortality rate 14% (elderly) vs 6% (young)
- Orthopaedic interventions accounted for 70% of operative procedures

- Orthopaedic injuries statistically associated with mortality
  - Clavicle fracture (23% mortality)
  - Foot fracture
  - Proximal humerus/humerus shaft fracture
  - Sacroiliac fracture
  - Distal ulna fracture

Outcomes

- Difficult to assess
- Age has been confirmed as an independent predictor for mortality regardless of severity of trauma

- Conflicting data regarding ISS correlating with mortality
- Overall mortality rates 5-50%, with 10% mortality rate in hospital (ave 5-6 days)
• National Trauma Data Bank
  • Mortality rates approach 100%
  • severe chest/abdominal injury
  • head injury
  • SBP <90 mmHg at presentation
  • Base deficit <-6

Other factors affecting mortality rates and poor outcomes
  • Male sex
  • Head injury
  • Chest trauma
  • Complication
  • Transfusion requirements
  • Shock
  • Intubation
  • Low GCS

Withdrawal of care
  • 5-10% of elderly patients
  • 2 fold greater in “super-elderly”
  • Associated with lower injury scores and greater comorbidities than younger patient group
  • Poor documentation as to the reasons

On a Positive
  • 1/3 of elderly trauma patients return home following injury
  • 50% released to rehabilitation centers
  • 1/3 of patients report improvement in health following trauma
  • 50-80% able to return to independent living

Economic Impact
  Study designed to explore the relationship between total costs and reimbursement with regards to young and elderly trauma patients

Total cost (TC)
Total payment (TP)
Net Margin (P-L)
- Young patients
  - Medicaid
  - Managed care
  - Commercial insurance
  - Self pay

- Elderly patients
  - Medicare
  - Managed care
  - Commercial source

- Total care
  - $19,000 +/- 30,000 (young)
  - $21,000 +/- 28,000 (elderly)

- Total payment
  - $16,000 +/- 31,000 young
  - $20,000 +/- 29,000 elderly

- Net Margin
  - -$2,400 +/- 22,000 young (*-$8,000)
  - -$739 +/- 17,000 elderly

- Competing data regarding hospital TC for elderly trauma patients compared to younger patients
- DRG based payments underestimate hospital costs with regards to trauma patients
- Reimbursement for trauma care is suboptimal
Focus Moving Forward

• Large Level 1 studies to provide necessary data to answer important questions regarding appropriate care models
• Creation of models to facilitate quality performance improvement in elderly populations
• Development of triage pathways and algorithms regarding aggressive monitoring and resuscitation protocols

Better define our elderly trauma population
• Improvements in reversal of anticoagulated patients sustaining trauma
• Education regarding reversal of newer pharmacologics used for anticoagulation

Better utilization of resources for geriatric trauma patients
• Efficiency pathways for accommodating the growing volume of geriatric trauma patients
• Fall prevention strategies
• Injury pattern recognition
• More early invasive monitoring protocols for patients with risk factors for mortality

Injury pattern recognition to identify at risk patients
• Action plans geared towards improving compensation of trauma care for all age groups

Thank you