



---

---

---

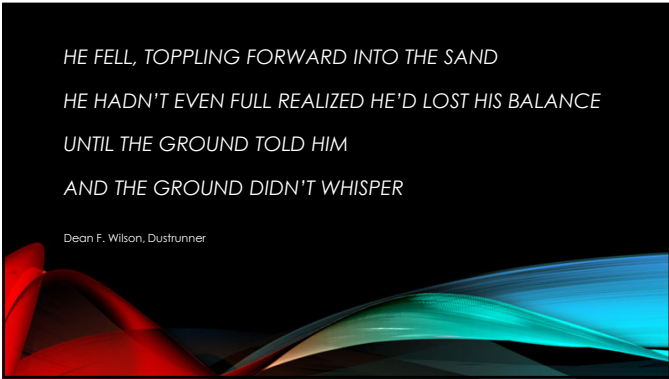
---

---

---

---

---



---

---

---

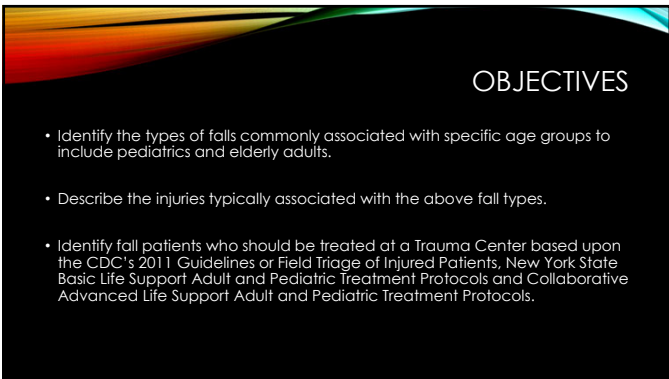
---

---

---

---

---



---

---

---

---

---

---

---

---



# INFANT

<1 YEAR

---

---

---

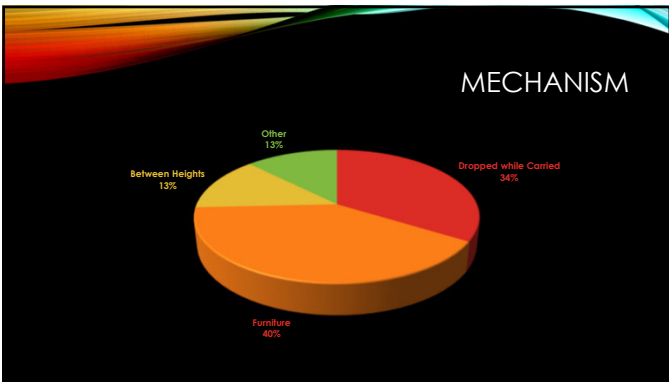
---

---

---

---

---



---

---

---

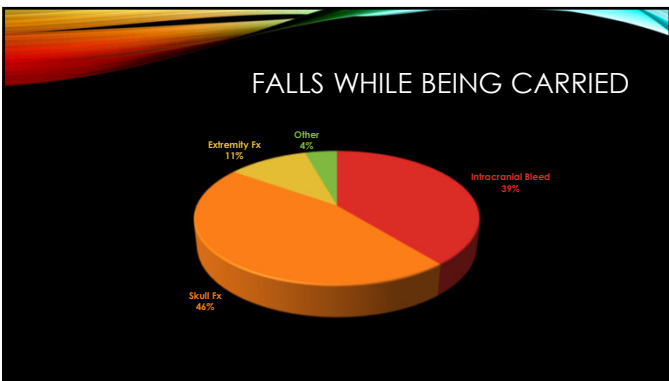
---

---

---

---

---



---

---

---

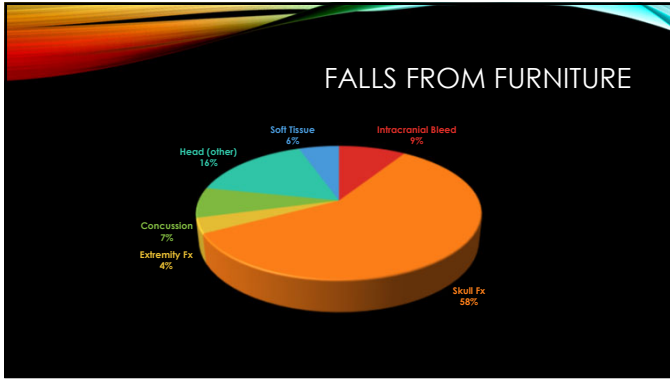
---

---

---

---

---



---

---

---

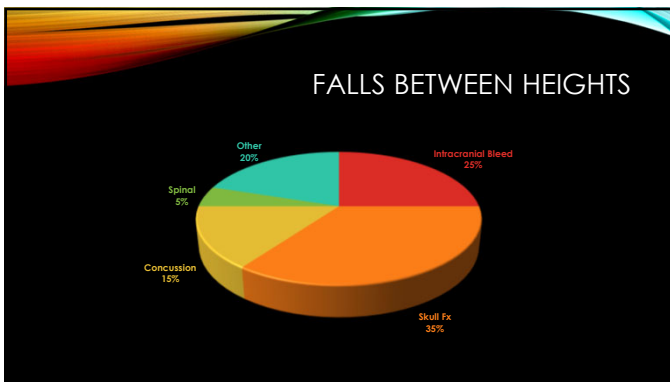
---

---

---

---

---



---

---

---

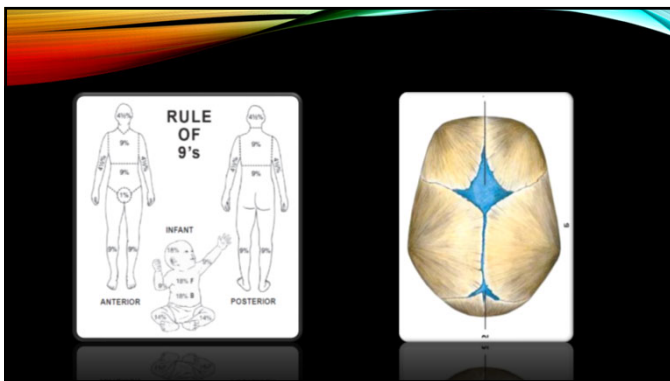
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

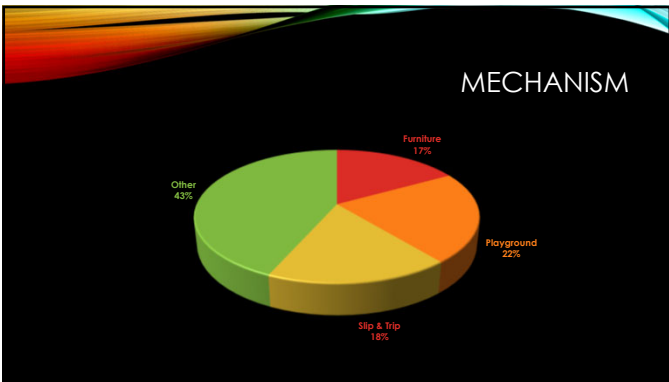
---

---

---

---

---



---

---

---

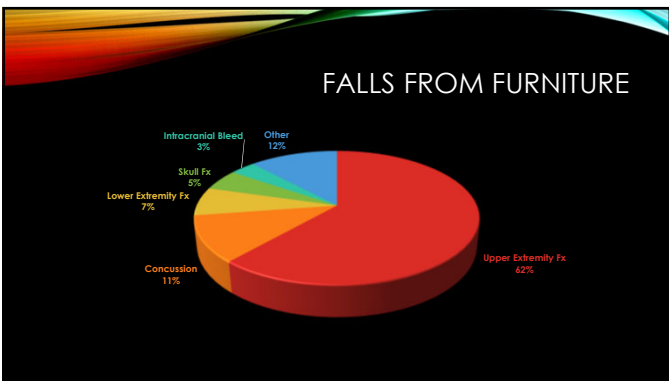
---

---

---

---

---



---

---

---

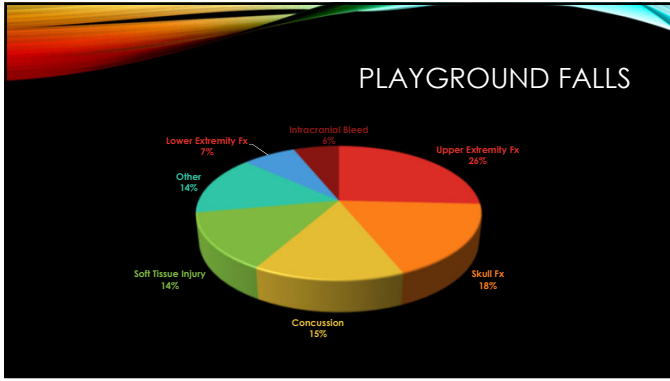
---

---

---

---

---



---

---

---

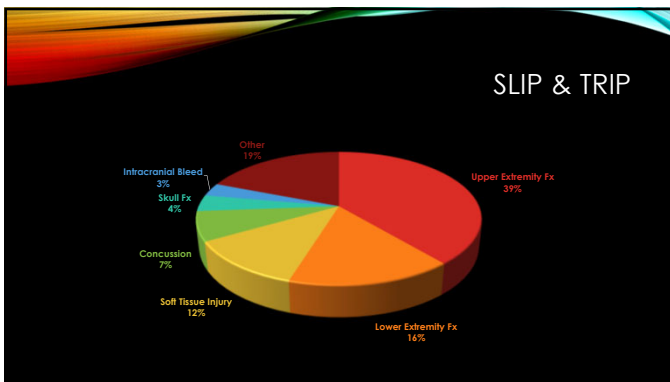
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

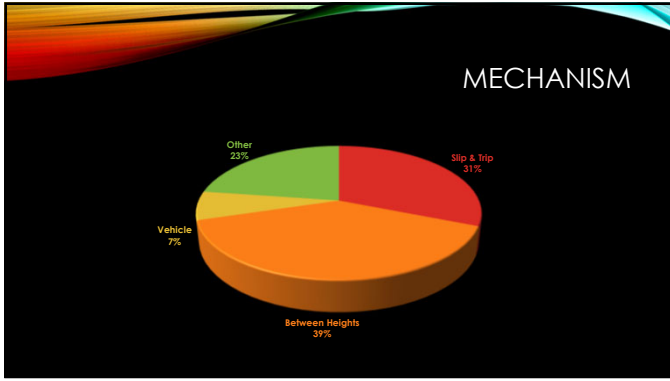
---

---

---

---

---



---

---

---

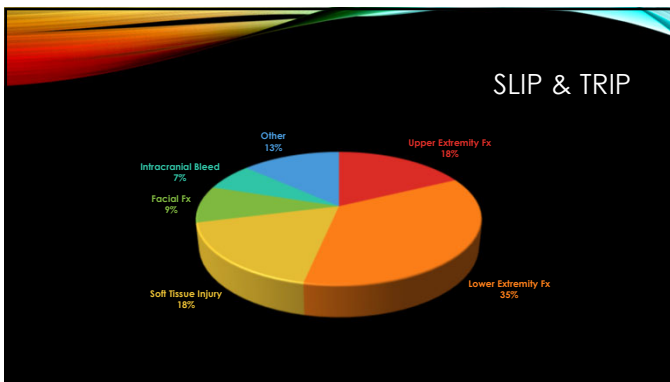
---

---

---

---

---



---

---

---

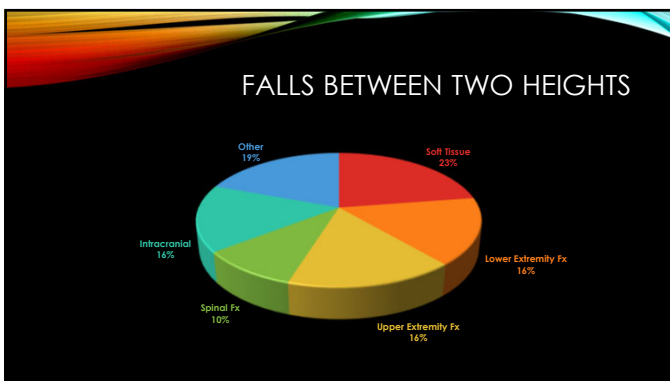
---

---

---

---

---



---

---

---

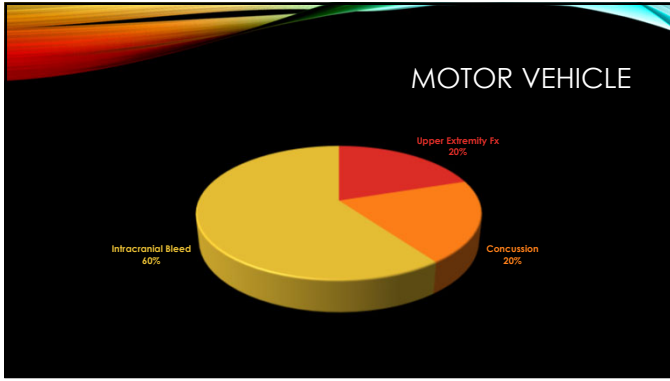
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

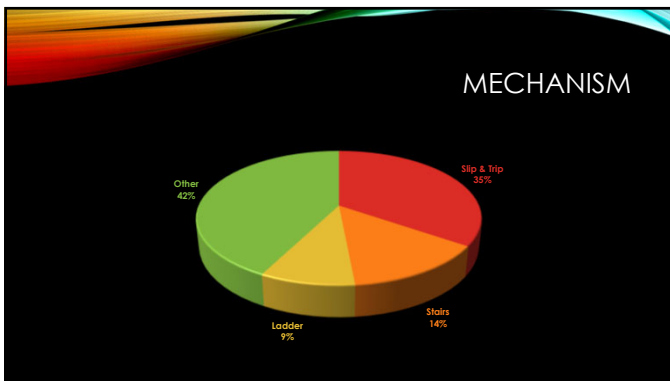
---

---

---

---

---



---

---

---

---

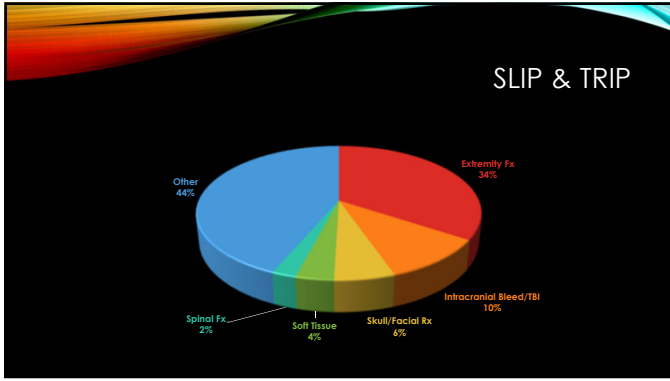
---

---

---

---





---

---

---

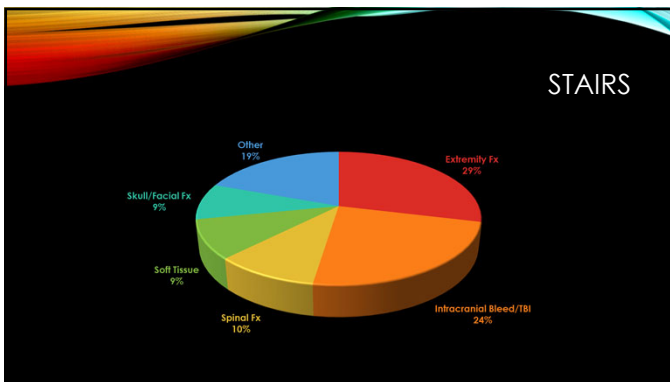
---

---

---

---

---



---

---

---

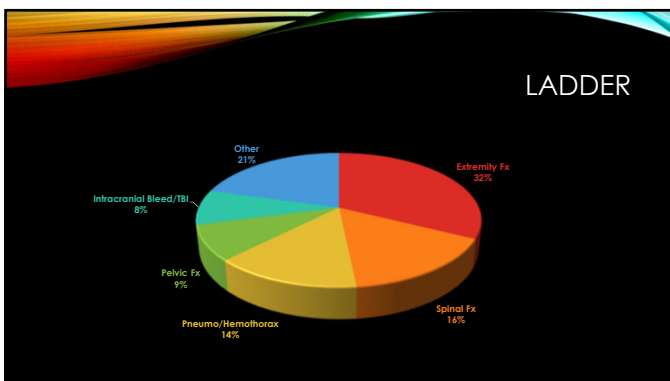
---

---

---

---

---



---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

---

**Consequences of Falls**

- One out of five falls causes a serious injury such as broken bones or a head injury
- Falls are the most common cause of traumatic brain injuries (TBI)

**More prone to falls due to:**

- **Decreased strength**
  - Less muscle means less strength and weaker bones.
- **Poorer sense of balance**
  - Age-related changes and [medication side effects](#)
- **Declining eyesight**
  - Vision helps us keep our balance and avoid obstacles
- **Loss of flexibility**
  - Stiffness increases the likelihood of falling.
- **Decreased endurance**
- **Declining ability and desire to walk**
  - Walking improves strength, balance, flexibility, and endurance

---

---

---

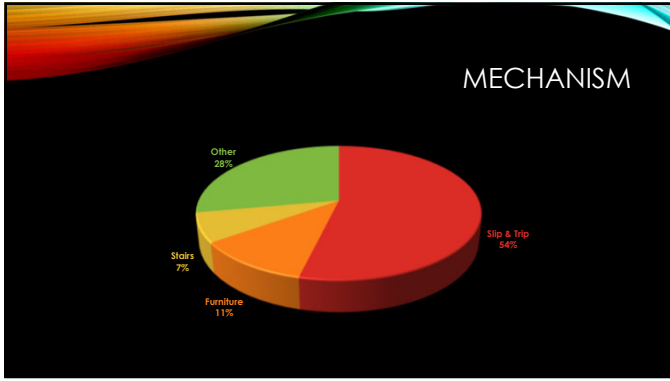
---

---

---

---

---



---

---

---

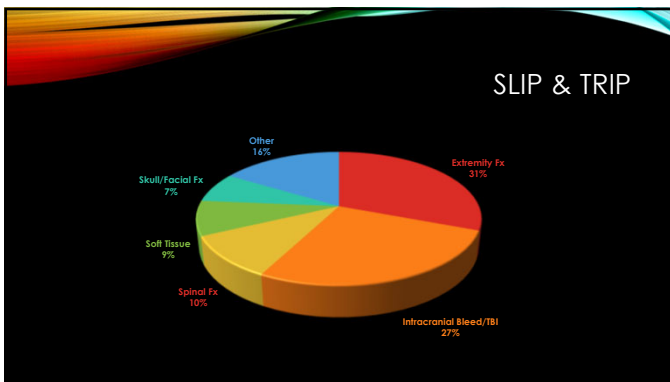
---

---

---

---

---



---

---

---

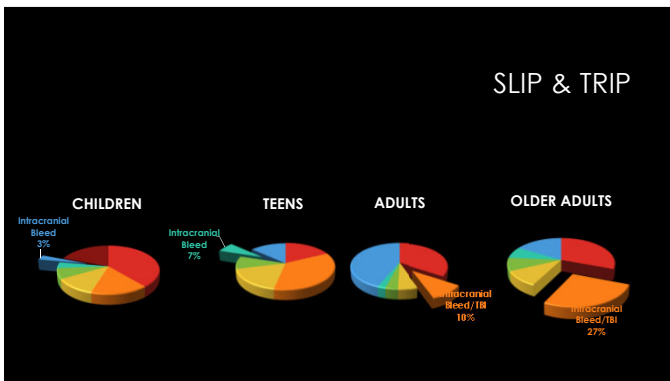
---

---

---

---

---



---

---

---

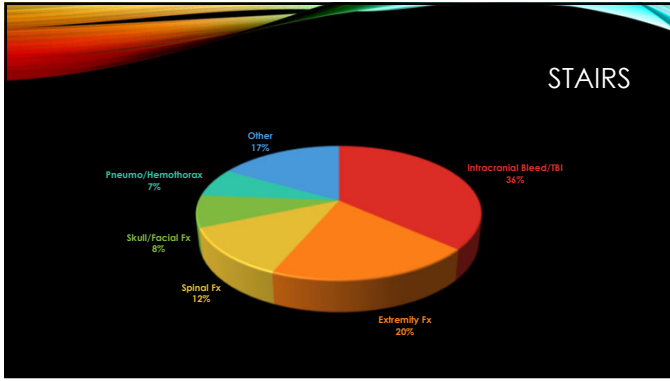
---

---

---

---

---



---

---

---

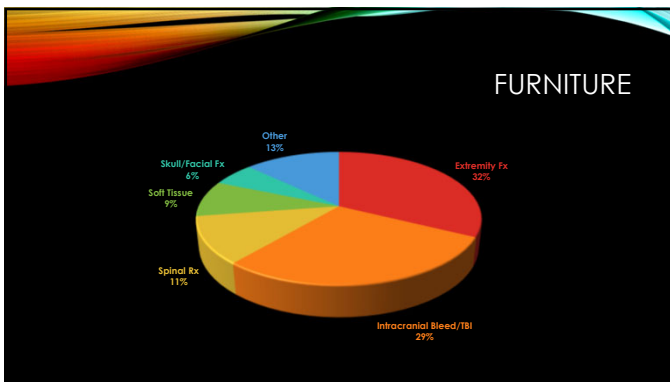
---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

# WHAT IS INCLUDED IN THE TRAUMATIC BRAIN INJURY PROTOCOL?

---

---

---

---

---

---

---

---

**(4.12) Trauma Patient Destination**  
Applies to adult and pediatric patients

**2011 Guidelines for Field Triage of Injured Patients**

- 1. Scene Safety**  
— Ensure scene safety for all personnel and patients.  
— Do not become a casualty.
- 2. Primary Assessment**  
— Assess for life-threatening conditions.  
— Treat immediately.
- 3. Secondary Assessment**  
— Perform a thorough physical exam.  
— Obtain vital signs and oxygen saturation.  
— Document findings.
- 4. Triage Decision**  
— Determine if patient meets criteria for transport to a trauma center.  
— If not, transport to the nearest appropriate facility.

When in doubt, transport to a trauma center.  
Put the patient in good hands. [www.trauma.org](http://www.trauma.org)

---

---

---

---

---

---

---

---

**3**

**Assess mechanism of injury and evidence of high-energy impact**

- **Falls**
  - Adults: >20 feet (one story is equal to 10 feet)
  - Children: >10 feet or two or three times the height of the child
- **High-risk auto crash**
  - Intrusion, including roof: >12 inches occupant side, >18 inches any side
  - Ejection (partial or complete) from automobile
  - Death in same passenger compartment
  - Vehicle telemetry data consistent with a high risk of injury
- **Auto vs. pedestrian/bicyclist thrown, run over, or with significant (>20 mph) impact**
- **Motorcycle crash >20 mph**

---

---

---

---

---

---

---

---



Adults - falls from >20 feet  
Children – falls from 10 feet or  
2-3 times child's height

---

---

---

---


---

---

---

---

Toddler from Bunk Bed      Equals Adult from Roof



---

---

---

---

---

---

---

---

**Transport to a trauma center,**  
which depending upon the  
defined trauma system, need  
not be the highest level  
trauma center.

---

---

---

---

---

---

---

---

4

Assess special patient or system considerations

- **Older Adults**
  - Risk of injury/death increases after age 55 years
  - Low impact mechanisms (e.g. ground level falls) may result in severe injury
- **Children**
  - Should be triaged preferentially to pediatric capable trauma centers
- **Anticoagulants and bleeding disorders**
  - Patients with head injury are at high risk for rapid deterioration
- **Burns**
  - Without other trauma mechanism: triage to burn facility
  - With trauma mechanism: triage to trauma center
- **Pregnancy >20 weeks**
- **EMS provider judgment**

---

---

---

---

---

---

---

---

---

---

Transport to a trauma center or hospital capable of timely and thorough evaluation and initial management of potentially serious injuries. Consider consultation with medical control.  
**Think Trauma Center & Specialty Centers!**

---

---

---

---

---

---

---

---

---

---

### FALLS AND REFLEXES

Normal Reflexes



Delayed reflexes



---

---

---

---

---

---

---

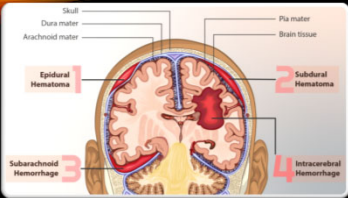
---

---

---







**SUBDURAL AND INTRACEREBRAL HEMORRHAGE**

MORE COMMON IN ELDERLY THAN YOUNGER PATIENTS

Anatomical Differences (brain atrophy)  
Anticoagulants

---

---

---

---

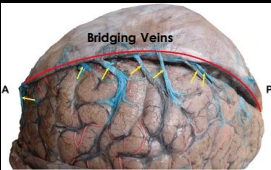
---

---

---

---

**SUBDURAL HEMATOMA**



- Stretch and weaken as elderly brain atrophies
- Shearing of vessels creates subdural hematoma

---

---

---

---

---

---

---

---

**EMS MANAGEMENT**

- Avoid hypoxia and hypotension
  - Single episode of SBP < 90 mmHg = 2x greater chance of death
  - Single episode of SPO2 < 90 = 3x greater chance of death
  - Combined = 6x greater chance of death
- Eucapnia is better than hypocapnia
  - Decreased CO<sub>2</sub> leads to arterial constriction
  - Equals less oxygen to the brain
- Elderly patients on anticoagulation
  - Prone to subdural hematomas
  - Increased bleeding
- Future protocol considerations
  - Hypertonic Saline to reduce brain swelling
  - Ketamine may have neuro-protective benefits and anti-epileptic properties
  - TXA may improve outcomes for moderate-to-severe TBI (no change high or low severity TBI's)

© American Medical Association  
Quick Taker: Risk Factors and Interventions for Patients with TBI  
Pre-hospital Management of a Traumatic Brain Injury: Saline, Ketamine, TXA and Finding the CO2 Sweet Spot  
EMSLife, 2020

---

---

---

---

---

---

---

---

# HOSPITAL MANAGEMENT

---

---

---

---





---

---

---

---

## A NEUROSURGEON IS NEEDED TO DETERMINE MANAGEMENT

Type of Hemorrhage	Systolic BP Goal (mmHg)	Seizure Prophylaxis	Therapy
 Primary ICH	<140-180	No	<ul style="list-style-type: none"> <li>EVD if GCS &lt; 9, significant ICH with obstructive hydrocephalus, or herniation</li> <li>No platelets</li> </ul>
 Subdural	>100-110*	Phenytoin if GCS≤10	Surgery if: <ul style="list-style-type: none"> <li>Width ≥10 mm</li> <li>Midline shift &gt; 5 mm</li> <li>GCS&lt;9 or GCS change ≥2</li> </ul>
 Epidural	>100-110*	Phenytoin if GCS≤10	Surgery if: <ul style="list-style-type: none"> <li>Volume &gt; 30 cm<sup>3</sup></li> <li>GCS &lt; 9 with asymmetric pupils</li> </ul>
 Traumatic SAH	>100-110*	Phenytoin if GCS≤10	Supportive management

---

---

---

---

---

---

---

---

## CONSIDERATIONS

- Multi-systems trauma is frequently associated with intracranial hemorrhage and traumatic brain injuries
- Delays in definitive care (Trauma Center) lead to worsened outcomes
- Care should not be delayed to obtain tests that cannot be treated
  - CT of the head is not necessary for the obviously injured patient who will be transferred to a trauma center

---

---

---

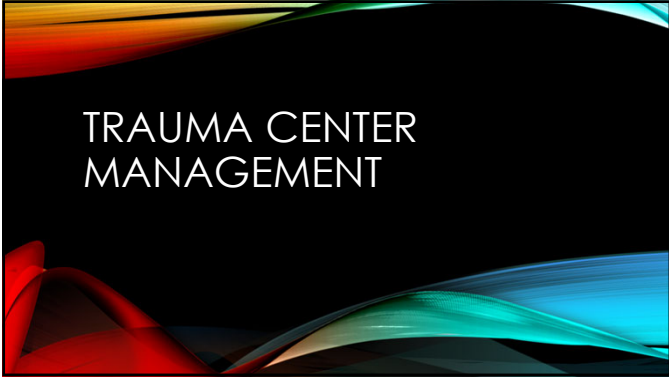
---

---

---

---

---



---

---

---

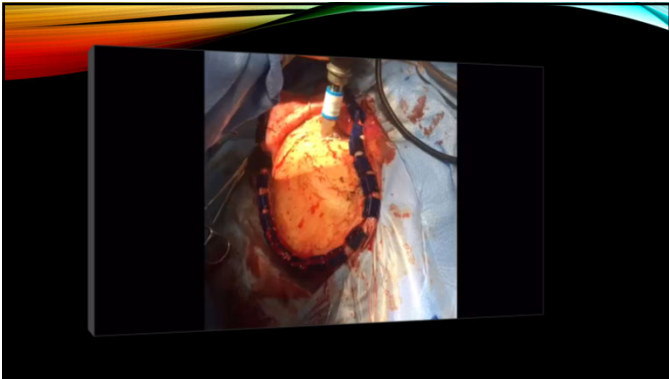
---

---

---

---

---



---

---

---

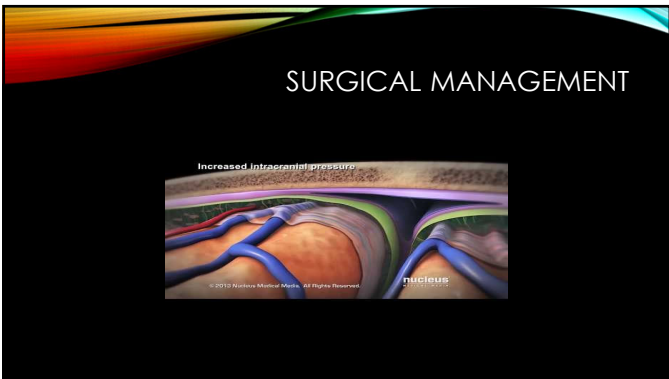
---

---

---

---

---



---

---

---


---

---

---

---

---



## CONCLUSIONS

- Low-level falls can be life-threatening (especially for Infants & Older Adults)
- Falls frequently cause multi-system injuries and those meeting CDC Field Triage Criteria benefit from treatment at a Trauma Center
- Hospitals should not delay transfer to a Trauma Center to obtain tests that they cannot treat.

---

---

---

---

---

---

---

---