Stupid Kids Tricks:
Why on earth do they do that?

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Disclosures

• I have no conflict of interest related to this educational activity
Successful Completion

- To successfully complete this course, participants must attend the entire event and complete/submit the evaluation at the end of the session.
- Society of Trauma Nurses is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.
Who are we?

- Level 1 ACS verified Pediatric trauma center
- Shared campus with adult center also ACS level 1
- 48,937 EU visits
- 1,346 Trauma admissions
  - Nearly 60% transfer in
The numbers

• For every child that dies
  • 25 hospitalized
  • 925 treated in ER
    • Many more treated in other settings
    • Or simply don’t seek care

Injury is Preventable and is the #1 killer of children
Pediatric Trauma

- Not an accident
- Disease with predictable signs and symptoms
- Preventable
- Killing children in epidemic proportions
Death rates for children by cause

Adult data

Ages 25–44:
- Unintentional injuries: 26.2%
- Heart disease: 12.3%
- Cancer: 13.7%
- Diabetess: 2.1%
- Stroke: 2.2%
- HIV disease: 2.4%
- Chronic liver disease and cirrhosis: 2.6%
- Homicide: 6.0%
- Suicide: 11.0%
- Other: 20.6%

Ages 45–64:
- Cancer: 32.3%
- Heart disease: 21.2%
- Septicemia: 1.4%
- Kidney disease: 1.5%
- Suicide: 3.1%
- Stroke: 3.4%
- Diabetes: 3.5%
- Chronic liver disease and cirrhosis: 3.7%
- CLRD: 6.8%
- Unintentional injuries: 4.8%
- Other: 19.3%

Ages 65 and over:
- Heart disease: 26.5%
- Unintentional injuries: 2.3%
- Kidney disease: 2.3%
- Influenza and pneumonia: 2.4%
- Diabetes: 2.7%
- Stroke: 6.1%
- CLRD: 6.6%
- Alzheimer’s disease: 4.6%
- Other: 22.9%

Ages 85 and over:
- Heart disease: 30.8%
- Hypertension: 1.5%
- Diabetes: 2.4%
- Unintentional injuries: 2.0%
- Kidney disease: 2.4%
- CLRD: 5.0%
- Stroke: 7.1%
- Other: 26.3%
- Alzheimer’s disease: 7.1%
Basic premise

- Children are not just little adults
- Assessment includes family
Learning Objectives

• Discuss the unique features of brain development during adolescence and young adulthood
• Review neurodevelopmental changes in adolescents which effect trauma patterns
• Explore how mechanism of injury (MOI) effect outcome
• Discuss trauma as a disease process and the role of healthcare providers in advocating safety and prevention
Considerations in Pediatric Care

- Airway Management
- Venous access
- Blood Volumes 80 ml/kg
- Thermoregulation
- Maintenance fluids
Airway Differences

- Smaller upper and lower airways
- Tongue is larger relative to oropharynx
- Cartilage of the larynx is softer
- Larger head/body ratio
- Infants obligate nose breathers
- Larynx is more anterior and higher
- Shorter trachea
- Cricoid cartilage is narrowest portion
Respiratory Differences

- Cartilaginous ribs are compliant
- Intercostal muscles are poorly developed
- Become more fatigued with increased work of breathing
- Less elastic and collagen tissue
- Have thin chest walls
- Normal respiratory rates vary according to age
Circulatory Differences

- Myocardium is less compliant and has less contractile tissue
- Greater ability to compensate for decreasing cardiac output by increasing vascular resistance
- Smaller overall blood volume
- Bradycardia
  - $CO = HR \times SV$
Metabolic and Thermoregulation

- Children have less insulating subcutaneous tissue and fat stores
- Infants less than 3 months of age cannot produce heat by shivering
- Children have higher metabolic rates
Resuscitation Phase

- Priorities of management
  - Primary and secondary survey
  - Patient response to interventions
  - Evaluating severity of injury
  - Inclusion of family in care
Pediatric Traumatic Fatalities

Death by Gender
Middle Adolescents

0-5: 10-May: 14-Nov: 15-17: 18-21:

male: female:

Death by Gender

Washington University Physicians • St. Louis Children's Hospital
Pediatric Trauma Services
Creative Minds...

- Salt and ice challenge
- Cinnamon challenge
- Choking game/Space Monkey
- Car surfing/ghost riding
- Bottle rocket wars
- Punching game
Salt and ice challenge

... a dangerous [YouTube](https://en.wikipedia.org/wiki/Salt_and_ice_challenge) phenomenon wherein participants pour salt on their bodies and add ice. This causes a "burning" sensation, and participants vie to withstand the pain for the longest time. The mixture of salt and ice lowers the temperature of the mixture to significantly lower than the freezing point of water, and can quickly cause second- and third-degree injuries similar to frostbite. Due to the numbing sensation of the cold and the lack of sensation caused by nerve damage during the stunt, participants are often unaware of the extent of any injuries sustained during the challenge, and risk suffering second- to third-degree burns
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Car Surfing, Ghost Riding

• 1985 *Teen Wolfe*, Michael J. Fox
• 2007 *Death Proof*
• Stunts performed on moving car while others driving
• Hood, trunk or roof
• GR without benefit of other driver
  • Bay Area culture
Creative Minds...

- Salt and ice challenge
- Cinnamon challenge
- Choking game/Space Monkey
- Car surfing/ghost riding
- Bottle rocket wars
- Punching game
Why are they stupid???

- Brain development
- Environment
- Age
- Gender
The Adolescent Brain
Brain development

• Those as a consequence of puberty
  • Emotion, arousal, motivation
  • Appetite, sleep
• Limbic system/emotional brain
  • Amygdala
  • Hippocampus
  • Hypothalamus
Limbic system

- Fight or Flight
- Pleasure and rewards related to survival
  - Eating, sleeping, sex
- Impulsive rather than logical
  - “gut feeling”
- Rooted in the “emotional brain”
Brain development cont.

• Independent of puberty
• Development of advanced cognitive functioning
• Pre-frontal cortex CEO of brain
  • Cognitive analysis, abstract thought
  • “correct” behaviors
• Last region to reach maturation
Pre-frontal cortex

- Executive functions
  - Problem solving
  - Consequences of behaviors
  - Balancing short and long-term goals
  - Impulse control
- Increase white matter/myelin with time
  - Better flow of info with maturity
Tasks of the Adolescent

- Achieve Independence from parents.
- Adopt peer codes and lifestyles.
- Assign increased importance to body image and acceptance of body image.
- Establish sexual, vocational, ego, and moral identities.
Early Adolescence 11-14 years

“Life’s golden age is when kids are too old to need babysitters and too young to borrow the car”
Early Adolescence 11-14 years
Early Adolescence 11-14 years

- Physical Growth – characterized by marked, rapid physical changes
- Cognitive – Concrete thinking – HERE AND NOW! Unable to sense possible future consequences.
Early Adolescence 11-14 cont.

• **Identity:** Preoccupied with body image. Tend to desire a best friend, easily embarrassed.

• **Independence:** Less interested in family activities. Detached but needy. Privacy.

• **Sexuality:** Interest, questions, anxiety. Self-exploration.

• **Vocation:** Unrealistic or Idealistic goals.

• **Motto:** Am I Normal??
Middle Adolescence 15-17 years
“The young always have the same problem - how to rebel and conform at the same time. They have now solved this by defying their parents and copying one another.”
~Quentin Crisp
Middle Adolescence 15-17 cont.

• Physical: Girls are done with puberty and are menarchal. Boys reach peak height velocity.

• Cognitive: Very self-absorbed, introspective. Early inductive-deductive reasoning. Arguing, just because!
Middle Adolescence 15-17 cont.

• Identity: Peer group extremely powerful. Try different identities, values/causes. Risk taking and experimentation.
• Independence: Conflict. Strong desire to spend time with peers.
• Sexuality: Sexual experimentation.
• Vocation: Less idealistic, more realistic.
• MOTTO: Duh!?!?
Late Adolescence 18-21 years

- Physical: Girls are done with puberty and are menarchal. Boys continue to grow in height.
- Cognitive: Ability to think abstractly. Capable of perceiving and acting on long-range options.
Late Adolescence 18-21 cont.

- Identity: Comfortable with adult body image. Peer group less important.
- Independence: Reduced restlessness. Parents as partners.
- Sexuality: One on one, sharing, respect.

**MOTTO: Did I really Do That?**
Case Studies

I DON'T EVEN KNOW HOW

I GOT BACK TO MY CRIB LAST NIGHT
“sounded fun at the time”

• 14 year old male, in backyard with family member displaying a homemade cannon that “shoots water jugs.” Cannon apparently “backfired” and something hit patient in the head, either the actual cannon or cinderblocks that attached to cannon.
Homemade Cannon Kills Woman, Injures Man In Potrero, Calif.

Posted on March 6, 2012 by oddly

San Diego County authorities have arrested a man whose homemade cannon fired through the side of his mobile home in a remote community, killing his girlfriend.

Sheriff's Sgt. David Martinez said Tuesday that 39-year-old Richard Fox was arrested for investigation of exploding a device resulting in death. He's been booked into jail after treatment for shrapnel wounds to his right leg.
Scene timeline

- Dispatched 19:46, Arrived 20:01, left 20:13
- Vitals: 114,18,158.palp,98%, GCS15
- Pt awake, talking to bystanders, tennis ball-sized hematoma left forehead, left foot deformity which was grey/pale and cold from ankle distal, no pedal pulse
- Transported directly 73miles
- IV placed, fentanyl given
With Missouri’s new Time Critical Diagnosis System, emergency care starts the minute you call 911. The system brings together 911, emergency medical responders and hospitals in a new way to provide quicker response and higher-quality care for trauma, stroke and heart attack.

Minutes matter. Call 911.

Missouri’s New
Time Critical Diagnosis System
for emergency medical care

Missouri Department of Health and Senior Services  •  health.mo.gov/tcdsystem
AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER Services provided on a nondiscriminatory basis.
Time Critical diagnosis

- Getting patient to definitive care ASAP
- EMS bypass multiple hospitals en route
  - Including other level 1 adult centers
- Multiple fractures, TBI, vascular involvement
- En route communication critical
• First call to SLCH at 2045

• “14yo M, base flew off cannon and hit pt in head, approx 20lbs, +hematoma to forehead, +LOC for 20 seconds and confused on EMS arrival to scene, +deformity to L ankle with color change. Pt awake and alert now, eta 40 minutes”
Initial EU evaluation

• Patient arrives to SLCH at 2121
• Nosebleed, 4cm hematoma left forehead, LLE: tenderness, obvious deformity at ankle, DP and PT pulses are weak on left
• VS: HR 123, R 18, BP 157/82, SPO2 99%, GCS 15
• LLE x-rays
• Head CT
• Evaluation complete by 2146
Comminuted left distal tibia and fibula metadiaphyseal fractures with overriding, lateral displacement.
Head CT 12/24 2205-left frontal nondisplaced fx, left frontal scalp hematoma
Hospital course

- Trauma Consult, Orthopedic Consult in ER
- Sedated in ER for reduction and splinting of fracture
- Admit to floor (orthopedic service) at 0253
- Addendum to CT—trace pneumocephalus at site of frontal bone fracture
- 0900-**Tertiary Survey**, neurosurgery looked at CT, still non-surgical management, f/u in 1-2 weeks. NS recommended plastic surgery consult due to fracture extending to orbit.
- 1100-seen by plastic surgery for consult re skull fracture. Recommend maxillofacial CT.
Tertiary Survey-
A full exam done within 24 hours of admission. This exam is done by the surgery resident or surgery/trauma PNP with the purpose of reviewing patient assessment and looking for any missed or extending injuries. All labs, consults, radiographs are reviewed. Screening for drug/alcohol intervention is done for patients age 12 and older.

• 1100-seen by plastic surgery for consult re skull fracture. Recommend maxillofacial CT.
Maxillofacial CT
12/25 1210 (14 hours after previous CT):

Interval development of a left frontal epidural hematoma.
Anatomy review
Epidural hematoma:

- Typically there is a known head trauma
- Usually secondary to a rupture of the middle meningeal artery, most often as a result of a skull fx that penetrates the groove in the skull occupied by the artery. (20-40% of children-no skull fracture)
- Lower incidence of EDH in early childhood = middle meningeal artery is not embedded in the bone surface of the skull until approx 2 years old.
- Blood accumulates between the dura and the skull.
**Epidural hematoma:**

- Brain compression occurs rapidly (arterial)
- Classic clinical picture—momentary unconsciousness followed by a normal period, then lethargy/coma): RARELY OCCURS in children.
- Impaired consciousness/LOC may not occur
- May have nonspecific symptoms—irritability, headache, vomiting
- Symptom-free period can last 48+ hours
Management of children with mild traumatic brain injury and intracranial hemorrhage

Jacob K. Greenberg, BA, Ivan T. Stoey, MD, Tae Sung Park, MD, Matthew D. Smyth, MD, Jeffrey R. Leonard, MD, Julie C. Leonard, MD, MPH, Jose A. Pineda, MD, and David D. Limbrick, MD, PhD, St. Louis, Missouri

- 118 subjects, seen at SLCH between 2006-2011 for any type of ICH with initial plan of non-operative management.
- All included in study had admission GCS of 14-15 and no other injuries that would require ICU admission.
- Most common mechanism of injury was fall (40%), followed by MVC, bike, skateboard, or scooter accidents, and assault.
- Study looked for CIND (clinically important neurological decline), radiologic progression of hemorrhage, and medical decline.
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- Only 6.8% of subjects experienced CIND and 5.1% needed neurosurgical intervention.
- **Both CIND and the need for intervention were significantly higher among EDH patients than other types of ICH.**
- 3/6 patients requiring neurosurgical intervention didn’t show clinical decline until more than 3 days after presentation.
- Conclusion of study: Most pediatric patients with mild TBI and ICH can be safely monitored in a non-ICU setting.
Considerations for management were suggested, including risk factors for CIND: EDH, coagulopathy, and high-risk comorbidities, including known AVM or shunted hydrocephalus.
Nursing documentation

- 1146, 1428—patient drowsy/somnolent
- 1430-Neurosurgery consult after enlarging EDH seen on CT. Patient having continued headache and lethargy
- 1544-patient to OR for craniotomy for evacuation of epidural hematoma
- Admitted to PICU post-op
- D/C to home postop day 2. Ambulating with crutches, eating well, tolerating pain with oral meds.
What went well

- Family awareness
- Astute nursing documentation
- Availability of resources
- Rapid intervention
Success.
Case of the “motivated brothers”

HPI: brothers age 11 and 13 suffered flash burns while trying to light outdoor wood furnace with accelerant.

PMHx: asthma Meds: albuterol prn

They were stable following the event initially and was able to talk without difficulty and even showered at home. Taken by ambulance to an outside hospital where they were intubated due to singed nasal hairs and concern for significant inhalation injury. Both were given IV antibiotics and Tetanus vaccine at the outside hospital and transferred for further management. Arrived in stable condition, intubated, sedated and paralyzed.

Physical Exam: (13yo) coarse bilateral breath sounds, palpable pulses in all extremities, and partial thickness burns to his face, ears and dorsum of his right hand

VSS: 37.2, 116, 18, 140/67, 100% BVM
Case Study continued
Typical distribution
Hospital Course

- Wound care, bacitracin
- IV fluids, Foley, PICU
- ENT consulted
- Extubated HD2 and transferred to floor
- Advanced diet and activity
- Q 4hr face soaks
- Discharged home HD3
- Returned at 1 week healed
Key points

- Flash burns outdoors
- Inhalation
  - Smoke, enclosed spaces, structural fires
- Accelerant
  - Gasoline
  - Vapors
Summary

• Discuss the unique features of brain development during adolescence and young adulthood “Brain damaged”

• review neurodevelopmental changes in adolescents which effect trauma patterns utilizing case studies

• explore how mechanism of injury (MOI) effect outcome - discuss trauma as a disease process and the role of healthcare providers in advocating safety and prevention
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