Pediatric Sports Trauma and the Kinetics Involved

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Basic Scene Size-up

- Analyze the forces that caused the trauma.
  - Possibility of both external and internal injury.
- Look for mechanisms that might result in head, neck, chest, abdominal, or pelvic injuries.
- Observe for external or internal hemorrhage.
- Number of patients.
- Need for additional resources.
- Initial assessment: CAB/ABCD

Overview of *Kinematics*

- The process of looking at an accident scene and determining what injuries have resulted from the forces and motion involved.

- ***Index of Suspicion***

Kinetic Energy

KE = ½ mass of object x v^2

Velocity = speed of an object (fps, mph, etc)

Acceleration = rate of + ▲ in v

Deceleration = rate of - ▲ in v

Gravity = acceleration of a body by gravity (32.2 fps)

G-Force - multiples of G

Mass or Velocity… Which is More Important?

150 lbs @ 20 mph = 30,000 dynes

300 lbs @ 20 mph = 60,000 dynes

150 lbs @ 40 mph = 120,000 dynes

Transitional vs Rotational

Transitional

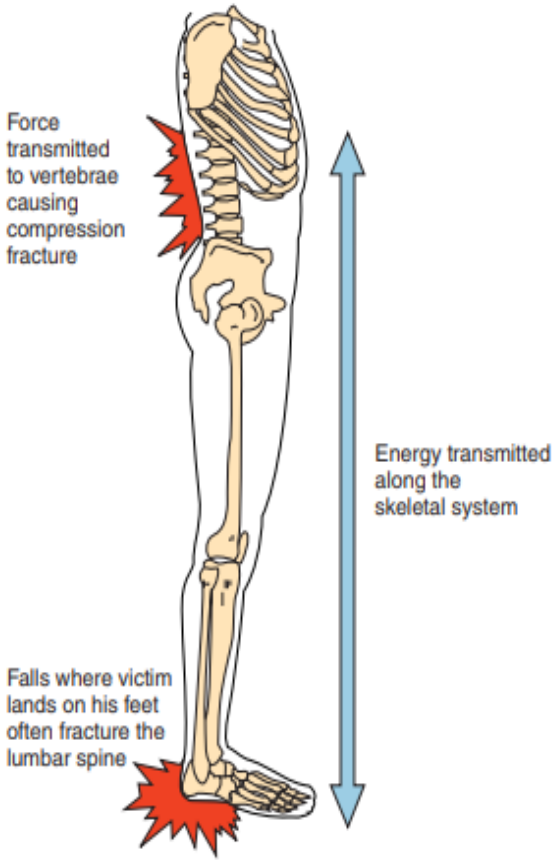
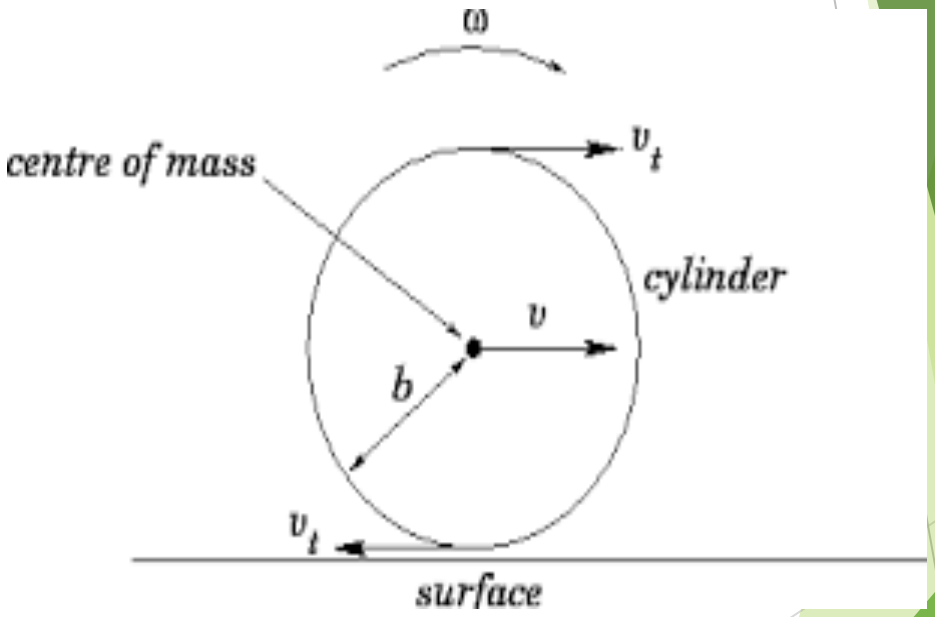
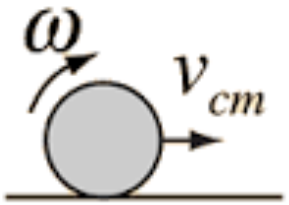


Figure 1-15 Axial loading.

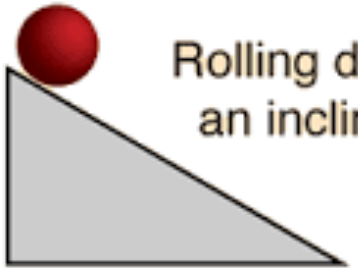
Rotational



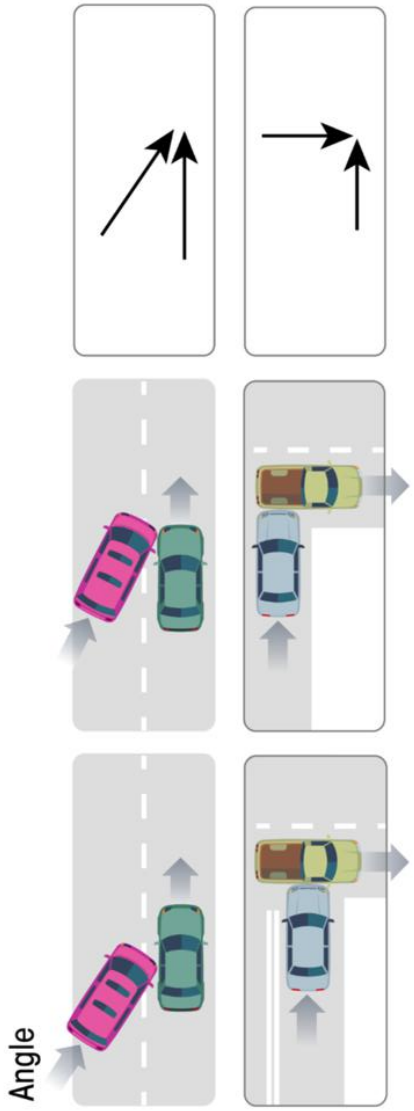
G-Force and multiple angles



Kinetic energy of rolling



Rolling down an incline



Law of Conservation of Energy

- Energy cannot be created or destroyed, only changed in form.

Motor Sp

MMA

Safety Equipment Removal?

Pre-Hospital

- Face mask
- Anything that impedes bleeding control for an active bleed

Emergency Department

- Everything else

Concussions

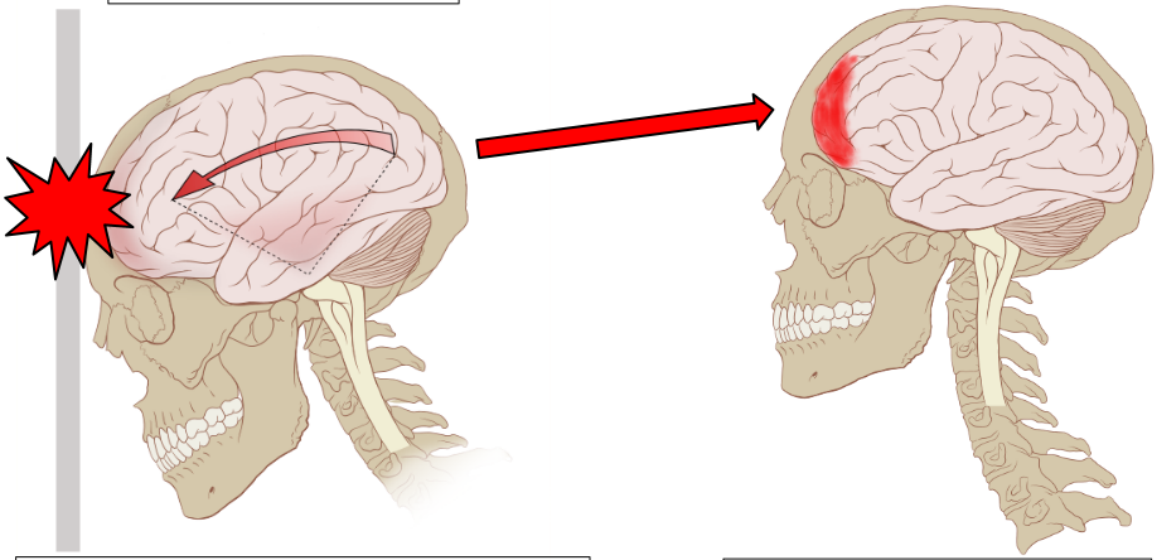
What is a concussion?

- Mild Traumatic Brain Injury (MTBI) or Concussion
  - American Academy of Neurology
    - Any trauma induced alteration in mental status that may or may not include loss of consciousness
  - “A concussion is a brain injury that is caused by a sudden blow to the head or to the body. The blow shakes the brain inside the skull, which temporarily prevents the brain from working normally.”

Pathophysiology

Concussion: A traumatic brain injury that changes the way your brain functions.

This can lead to bruising and swelling of the brain, tearing of blood vessels and injury to nerves, causing the concussion.



The brain is made up of soft tissue and is protected by blood and spinal fluid. When the skull is jolted too fast or is impacted by somthing, the brain shifts and hits against the skull.

Most concussions are mild and can be treated with appropriate care. But left untreated, It can be deadly.

Pathophysiology

- Blow to head or body causes brain to bounce or twist inside the skull, causes damage to cells
- Metabolic Cascade
  - Head injury causes uninhibited release of excitatory neurotransmitters (glutamate)
  - Binds to NMDA receptors, which disrupts and activates Na/K pumps
  - Increased use of ATP, which increases glucose demand
  - Reduction of cerebral blood flow due to endothelial accumulation of calcium causing neurovascular constriction
  - Equals supply/demand mismatch

Jake Snakenberg Youth Concussion Act January 2012

- Education to all coaches
  - Private/public schools
  - Club and recreational leagues
  - Ages 11-19 years
- Removal from play if concussion suspected
- Return to play with medical clearance
  - MC, CO, PA, NP and PhD Psychologist with Neuropsych and/or concussion training

Theory of Danger

- Metabolic dysfunction, until resolved leads to significantly increased neurologic vulnerability if subsequent trauma is sustained.

Secondary Impact Syndrome

The Hidden Epidemic

- Symptoms may be subtle, may not be connected with initial injury
  - ***90% of concussions are not associated with a loss of consciousness***
  - Concussive symptoms may develop over days
- Often do not seek medical attention and or go unreported.
- The number of sports related TBI has been decreasing in recent years.
- Peak 15-24 years, or >75 yrs
  - Females have a higher risk.

Symptoms of a Concussion

- Loss of Consciousness
  - Not necessarily a marker of severity
- Fogginess
- Amnesia
- Migraine

- Questions to ask:
  - What position to you play?
  - What is your coach's name?
  - What is your team mascot?
  - What is your jersey number?
  - What size engine is your dirt bike?
  - What event where you in?
  - What is the name of your horse?
  - Is it day or night?
  - Is it a week day or weekend?
  - Are you the home team or visiting?

Symptoms Continued

Physical

- Headache/Pressure
- Blurred vision
- Numbness/tingling
- Sensitive to light
- Ringing in ears
- Glassy eyed
- Nausea/vomiting
- Poor balance
- Neck pain

Cognitive

- Feeling “slowed down”
- Difficult remembering
- Difficulty concentrating
- Easily distracted
- Slowed speech
- Easily confused

Symptoms Continued

Emotional

- Inappropriate emotions
- Personality change
- Nervousness/anxiety
- Lack of motivation
- Feeling more “emotional”

Maintenance

- Fatigue
- Drowsiness
- Excess sleep
- Sleeping less than usual
- Trouble falling asleep

Risk Factors

- Age
- Gender
- Genetics
- Past concussion
- Underlying diagnosis
  - Learning disability
  - ADD/ADHD

Sideline or EMS Evaluation

- Symptoms assessment
- Critical questions:
  - Is this immediately life threatening?
  - Is there potential for deterioration?
  - Does this patient have a concussion?
  - Does this patient have potential for delayed presentation of concussion?

Referral for urgent medical evaluation

- Loss of consciousness
- Amnesia longer than 15 minutes
- Increase in blood pressure
- Vomiting
- Motor, sensory, balance or cranial nerve deficits
- Post-concussion symptoms that worsen
- Additional symptoms develop
- Athlete is still symptomatic at the end of the game

Handoff to Parent

- Report MOI and symptoms in writing
- Clear recommendations for medical evaluations and observation
- Education about potential delayed presentation

REAP

- R = Reduce all cognitive demands
- E = Educate everyone on symptoms
  - Physical, cognitive, emotional, maintenance
- A = Accommodate academics
  - Teacher need to play and active role
- P = Pace
  - Gradual return-to-play

Pre-Game for stand-by events

- Practice procedures with event crew prior to the event.
- #1 get there early
- Have a smile and be friendly
- Find your POC and review procedures and communication practices
- Egress plan and maintain authority on keeping it clear and open
- Walk the grounds, watch, talk to people, be part of the event
- Show concern and urgency if requested to respond
- Have fun and enjoy the event!