Post-Discharge Management of Pediatric Patients Who Sustain a Concussion

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• What does concussion recovery look like in children?

• Post-concussion management
  • Stepwise progression for academics and sports
  • IDEA/Section 504

• Serial reassessment of cognitive-linguistic function
  • Overview of the tools measuring cognitive-linguistic constructs

• Prevention of further injury
  • Models of prevention
  • Difference in sports and positions
Concussion, defined:

- TBI induced by biomechanical forces
- Blow or jarring motion to the head, face, neck or elsewhere in the body, with force transmitted to the head
- Complex multi-system event
- Typically functional, rather than structural injury
- May not be evident on imaging studies
- Neurochemical and neurometabolic changes

~ McCrory, et al., 2017
Concussion, defined:

• Rapid onset of short-term impairment with spontaneous resolution (7-14 days)
• Symptoms may evolve over a period of time
• Range of clinical signs, not necessarily including LOC
• Clinical symptoms and functional signs may involve changes in behavior, neurovegetative functions, executive functions, cognitive-linguistic processing, and academic abilities
What can we do for the children who sustain concussions?
Concussion and the developing brain

• Conventional wisdom: neural resilience

• Evidence for periods of increased vulnerability:
  • Animal models indicate decreased capacity for learning post-brain injury
  • Higher rates of mortality in children with TBI, compared to adolescents

• Maturational differences in musculoskeletal system, thinner skulls, less developed necks

~ Elbin, Covassin, et al., 2015; Giza and Hovda, 2001
Concussion occurs among school-aged children primarily in the context of sports-related activities, but also from any activity which involves a jarring motion of head or body.
Concussion in School-Aged Population

Increased risk for brain injury:

• 5 – 10% of all students involved in sports
  • >800,000 student athletes in Texas

• Inexperience with contact sports

• Diverse presentation in strength, physical stature, aerobic conditioning, coordination

• Ongoing development of frontal lobes of the brain
Impact of concussion on academic function

• Student-athletes with concussions present with symptoms consistent with traumatic brain injury.
  - Decreased attention to task
  - Limited encoding, storage, and retrieval of visual and verbal memory
  - Impaired problem solving
  - Poor impulse control
  - Delayed responses
Impact of concussion on academic function

- Breakdown in logical sequencing
- Sensitivity to light or sound
- Increased fatigue
- Decreased tolerance for frustration
- Word retrieval issues
- Impaired auditory comprehension for verbally-presented information

~McAvoy, 2012, Salvatore & Sirmon Fjordbak, 2011
Long-term effects of concussion

• Ten times as many children with mTBI/concussion required services 12 months post-injury, as compared to mod-severe TBI.

• mTBI/concussion is a more significant public health risk due to the increased frequency of occurrence and higher proportional representation in the population.

(Rivara, et al., 2012)
Best Practices in Concussion Management

• Baseline data collection

• Rest – cognitive and physical

• Incremental stepwise return to increased activity

• Careful monitoring for exacerbation of symptoms and changes in physical and cognitive status
Concussion Management

Stepwise return to play:

• No activity
  • Light aerobic exercise
    • Sport-specific exercise
      • Non-contact drills
        • Full contact drills
          • Return to normal game play

~ McCrory, et al., 2013
Stepwise return to academic function:

• No academic activity
  • Shortened school days and reduced overall load
    • Regular school day, decreased homework
      • Extra time on exams
        • Multiple rest breaks
          • Return to full academic load

~ Salvatore & Sirmon-Fjordbak, 2011, McAvoy, 2012
Management = Monitoring

• If signs/symptoms exacerbate, pause the stepwise progression

• Serial re-assessment for comparison to baseline

• If intervention is indicated, provide it according to state and federal guidelines (i.e., IDEA, Section 504)
How can we serve students with concussions?

• Unlikely to have an IEP already in place

• Generally experiencing short-term physical and cognitive-communicative problems

• Concussion Management Protocol

• Modifications and accommodations to the academic schedule
Appropriate utilization of the federal regulations is a means by which student-athletes who have experienced a concussion can receive the necessary intervention from the most qualified providers, and can more quickly return to familiar patterns of schoolwork and play.
• Educational modifications and accommodations are still an option

• **Section 504 of the Rehab Act of 1973.**

• Requires programs and activities that receive federal assistance from the US DoE to provide regular or special education, including adaptive or compensatory services.

• This piece of legislation prohibits discrimination against individuals for whom disabling conditions limit major life activities.
What this means:

• A student experiencing changes in function after a concussion is entitled to modifications, as necessary (e.g., schedule changes).

• **RtM model** may be employed, providing for classroom accommodations when direct instructional modifications may not be indicated.
• Baseline data collection
• Data utilized to contribute to return-to-play decisions based on recovery trajectory
✓ Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT)
✓ NIH ToolBox® for Assessment of Neurological and Behavioral Function
✓ Other cognitive-linguistic measures
Concussion Prevention
(Tator, 2012; Lo & Sirmon-Taylor, 2014)

• **Epidemiology**
  • Description of demographic characteristics, analysis of risk

• **Education**
  • Increased awareness of concussion risk for stakeholders

• **Environmental modification**
  • Equipment designed to reduce injury; changes in cultural perceptions

• **Enforcement**
  • Legislation regarding pre- and post-injury management; rule changes

• **Evaluation**
  • Effectiveness/efficacy of prevention programs
**Differences in positions**

• 36 high school football players, mean age 14.6 yo

• Speed positions: quarterback, running back, wide receiver, ends, defensive back, safety, and linebacker.

• Non-speed positions: defensive and offensive linemen.

• Athletes who play non-speed positions performed significantly more poorly on measures of verbal memory for word recall and auditory comprehension of sentence-length spoken directions.

Yoo & Salvatore, 2017
Differences in sports

• Preliminary data from our lab comparing teenaged athletes who play football, basketball, and hockey

• Memory
  • Task involving recall of words
  • no difference

• Auditory comprehension
  • Task involving the ability to follow verbally presented directions
  • No difference

(Yoo & Sirmon-Taylor, in preparation)
Concussion Texas Project (ConTex)

- Partnership between UT Southwestern and UIL
- Concussion Surveillance System
- 6-A and above
- Cause of the injury, concussion history, the gender of the player, and other data

https://www.utsouthwestern.edu/research/brain-injury/research/con-tex.html
Questions?

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