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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:

Concussion in Sport Group:

- 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 in School-Aged Population

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

Concussion Management

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

Individuals with Disabilities in Education Act (IDEA)

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.

Section 504

- 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.

Serial Reassessment

- 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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