

Concussion Management and Treatment

2023 Akron Children's Hospital

APRN/PA Pediatric Updates in Clinical Practice

2023

Mackenzie Feathers, APRN-CNP

Neurodevelopmental Science Center



Objectives

1. Understanding diagnosis of concussion
2. Management of concussion (medication and therapies)
3. Risk for returning to activity before recovered

Disclosures: None

Is concussion really that **common** in children?

- 16% of all children require medical treatment for a concussion before the age of 10
- Once sustain 3 concussions, likelihood of 4th is 3x greater
- 1.6-3.8 million sports related concussions/year
- Kids are more vulnerable
 - Developing brain
 - Developing muscles
 - Pediatric brain more susceptible to acceleration/deceleration force

What is a Concussion??

- “Traumatic brain injury that is a complex pathophysiological process affecting the brain.”
- 6 major components evaluated in [TBI clinic](#)
 - Post traumatic headache
 - Cognitive
 - Vestibular
 - Ocular
 - Neck
 - Mood

Post Concussion Syndrome

- Complex disorder in which various concussion symptoms (headaches, dizziness, mental foggiess) last for at least **3 months** after the injury that caused the concussion

Why wait???

(Risks for return to play too soon)

- Worsening of concussion symptoms
- Second Impact Syndrome
 - Rare phenomenon when cerebral edema occurs in a patient who receives a concussion. Those at increased risk of second impact syndrome are patients who receive a subsequent head impact during a period of time (research indicates <1 month is greatest vulnerability) when they have not fully recovered from their initial concussion symptoms .
- CTE (chronic traumatic encephalopathy)
 - Neurodegenerative condition of the brain from repetitive head trauma

CTE continued:

- CTE symptoms
 - Irritability
 - Impulsivity
 - Attention difficulties
 - Executive dysfunction
 - Memory impairments
 - Gait disturbances



CTE continued

- Returning to play too soon increases risk for CTE
- No evidence-based guidelines that address how many total concussions can cause CTE
- Youngest case of CTE found in a 17-year-old
- Case study
 - 202 deceased former football players (NFL, college, high school) who donated their brains to science
 - 177 (87%) found to have mild-severe forms of CTE
 - 84 of these participants severe forms of CTE (more prominent with prolonged football- NFL)

Concussion: Treating post traumatic headache

Abortive:

- Naproxen bridge
- Tylenol bridge (good option for younger kids)
- Prednisone bridge
 - Good options if NSAIDS not working/ other musculoskeletal pain like in MVA
- Toradol bridge (> 17-18 yo)
- Relafen bridge (great for kiddos for neck pain)
- IV infusion (great option when refractory to bridge medications/ over use of NSAIDS)

*** Remember, after completion of a NSAID medication bridge, we do not recommend use of NSAIDS more than 2-3 times/week as it can make headaches worse***

Concussion: Treating Post Traumatic Headache

First line preventative

- Magnesium and Riboflavin (Vitamin B2) **take with food**
 - Magnesium- stomach upset
 - B2- makes urine orange color- normal
- Cyproheptadine (Periactin)
 - Increase appetite, make tired
 - Like Benadryl.. Paradoxical effect of making irritable/energy, which is not common

Topamax- not typically first line for post traumatic headache due to common side effect of cognitive slowing

Concussion: Cognitive Treatment

- ***Cognitive recovery may occasionally lag behind clinical symptom resolution, which suggests cognitive function should be important component of concussion evaluation***
- Cognitive testing through Speech Language Pathologist (SLP)
 - Identify cognitive deficits related to concussion
 - **Language**
 - **Attention**
 - **Delayed memory**
 - **Immediate memory**
 - **Visuospatial/Constructional**
 - Treatment: compensatory strategies related to identified deficit
 - 4-6 week- demonstrate progress/use of strategies will retest
 - On occasion, will extend sessions if needed or suggested neuropsychological testing

Case Example

Testing completed 12/12/22 (initial visit)

- **Repeatable Battery for the Assessment of Neuropsychological Status**

Index Scores: (mean=100, standard deviation=15)

- Immediate Memory: 111
- Visuospatial/Constructional: 125
- Language: 78
- Attention: 84
- Delayed Memory: 84

Testing completed AFTER SLP intervention

- **Repeatable Battery for the Assessment of Neuropsychological Status**

Index Scores: (mean=100, standard deviation=15)

- Immediate Memory: 102
- Visuospatial/Constructional: 104
- Language: 109
- Attention: 113
- Delayed Memory: 106

Concussion: Cognitive Treatment

- Neuropsychological testing- in depth cognitive testing of skills and abilities related to brain function
 - Rule out neurocognitive disorder from concussion
 - Typically used for patients with multiple concussions or severe traumatic brain injuries
 - Educate patients:
 - Full day of testing “ speech therapy testing on steroids.”
 - Bring snacks/water, will have built in breaks
 - Can identify underlying learning difficulties unrelated to concussion
 - Testing anxiety, ADHD, etc
 - Can provide IEP or specific academic recommendations to implement

Concussion: Cognitive Treatment

- School Accommodations
 - We do not provide indefinite school excuses for concussion
 - accommodations to help patients get through the school day or slow return to school
 - Recommended full return to school before adding on extracurricular activities/work

Concussion: Cognitive Treatment- sample school accommodations letter

- **1. Academic accommodations:**
 - Half days of school 1/24/23-1/27/23 alternating morning and afternoon
 - Starting week of 1/30/23: Monday, Wednesday, Friday half days and Tues/Thursday full days
 - Resume full days 2/6/23
 - Allow extra time to complete coursework and tests, may need a quiet room for testing, lunch and study hall.
 - Allow 5-10 minute breaks during activities that require more than 30 minutes of screen time or reading.
 - Please provide pre-printed class notes due to visual memory processing difficulties.
 - When possible, please allow assignments/test/quizzes to be done on paper
 - Please excuse as much work missed while out of school from this injury as is possible.
 - Consider take home tests, open book or open note tests until caught up with class work.
 - May need extra help or tutoring to get caught up and keep up with the class.
- **2. General physical activity limitations:**
 - No contact sports until cleared.
 - May not return to PE class or recess at this time.

Other things to consider: Band class, choir, shop class, etc:

Concussion: Mood

- Changes in mood common with concussion
 - Feel more anxious/irritable
 - Typically peaks around 4-6 weeks and will get better
- **Unaddressed changes in mood prolong recovery**
- Treatment:
 - Counseling
 - Sports psychology – *especially for kiddos upset that they aren't playing sports
 - Psychiatry- medication management

Concussion Treatment: Vestibular Physical Therapy

- Physical therapy- part of multidisciplinary team that treats concussion
 - Vestibular- balance
 - Neck
 - Helps stabilize the body (proprioception)
 - Tension/strain –can worsen post traumatic headache
 - Important to treat the neck tension
 - Ex: MVA- whiplash
 - Vestibular Ocular Reflex (VOR)- maintains image stationary on retina during head movement
 - Ex: running and catching fly ball

Concussion Treatment: Ocular

- Strabismus- one eye looks directly at object viewing while other eye is misaligned
- Saccades- looking back at forth quickly – looking for dizziness, blurriness, undershooting
 - Ex: reading- patients often have difficult time reading/taking notes
- Treatment:
 - Vestibular physical therapy
 - Severe cases: Vision therapy/optometry evaluation

When to go to ER

- Decreased LOC/Confusion
- Severe headache with emesis
- Post traumatic seizure
- Blurred vision
- Clear drainage from ears/nose

Referral has been made .. What to educate patients while waiting

- Water!!!- Research shows proper hydration after concussion helps promote blood flow to the brain, decrease noise/light sensitivity and help with recovery
- Not skipping meals- want to promote blood flow/nutrients to the brain
- No contact sports/activity
- After first few days, limit napping <1 hours/day
- 80 % of concussion symptoms resolve in the first 2 weeks, other 20% variable recovery
- Limit recreational screen time
 - In TBI clinic recommended < 1-2 hours/day
- If having a headache- okay to treat
 - Start nutraceuticals: Mg/B2
 - NSAID/Prednisone bridge
- Can also provide care information sheet on concussion

Returning to play (RTP) following concussion

- Do not recommended return to contact sports/activity until complete resolution of concussion symptoms
- Following 5 step [return to play](#)
 - **Return to play should occur in gradual steps**
 - Progress through steps at minimum 24 hour intervals
 - **Move to the next level of activity only if you do not experience any symptoms** at the previous level. If your symptoms return, stop participation and contact your health care professional.

Starting Date:	Return to Play Stages
Date ***	1. Low levels of aerobic physical activity provided NO SYMPTOMS return during or after activity. (Examples: walking, light jogging, and easy stationary biking for 20-30 minutes)
Date ***	Moderate physical activity, provided NO SYMPTOMS return during or after activity. (Examples: moderate jogging, brief sprint running, moderate intensity stationary biking, light calisthenics, and sport-specific drills without contact or collisions for 30-45 minutes)
Date ***	Heavy, non-contact physical activity , provided NO SYMPTOMS return during or after activity. (Examples: extensive sprint running, high intensity stationary biking, resistance exercise with machines and free weights, more intense non-contact sport-specific drills, agility training, plyometrics, and repetitive jumping drills for 45-60 minutes)
Date ***	Full contact in controlled practice or scrimmage
Date ***	Full contact in game play

Date	Return to Play: Football Example
5/1/23	Low levels of aerobic physical activity provided NO SYMPTOMS return during or after activity. (Examples: walking, stretching, light jogging, and easy stationary biking for 20-30 minutes)
5/2/23	<p>Moderate physical activity, provided NO SYMPTOMS return during or after activity. (Examples: moderate jogging, brief sprint running, moderate intensity stationary biking, light calisthenics, and sport-specific drills without contact or collisions for 30-45 minutes)</p> <p>Sport specific drills: throwing football, walking through plays, catching pass</p>
5/3/23	<p>Heavy, non-contact physical activity, provided NO SYMPTOMS return during or after activity. (Examples: extensive sprint running, high intensity stationary biking, resistance exercise with machines and free weights, more intense non-contact sport-specific drills, agility training, plyometrics, and repetitive jumping drills for 45-60 minutes)</p> <p>Sport specific drills: Running routes, defensive drills, up downs</p>
5/4/23	Full contact practice (wearing pads)
5/5/23	Game

Date	Return to Play: Gymnastics (prolonged approach)
5/1/23	<p>Low levels of aerobic physical activity provided NO SYMPTOMS return during or after activity. (Examples: walking, light jogging, and easy stationary biking for 20-30 minutes)> Sport specific: Warming up and stretching with team (no tumbling)</p>
5/2/23	<p>Moderate physical activity, provided NO SYMPTOMS return during or after activity. (Examples: moderate jogging, brief sprint running, moderate intensity stationary biking, light calisthenics, and sport-specific drills without contact or collisions for 30-45 minutes) Sport Specific: Core work, body weight strength training, floor/beam work that includes jumping (no tumbling)</p>
5/9/23	<p>Heavy, non-contact physical activity, provided NO SYMPTOMS return during or after activity. (Examples: extensive sprint running, high intensity stationary biking, resistance exercise with machines and free weights, more intense non-contact sport-specific drills, agility training, plyometrics, and repetitive jumping drills for 45-60 minutes) Sport Specific: Tumbling on floor, trampoline</p>
5/16/23	<p>Full gymnastics practice Sport Specific: Parallel bars, vault work, full balance beam</p>
5/23/23	<p>Cleared for gymnastics meet</p>

When to consider **retiring** from sports?

- Would recommend conservative approach with children with the goal to promote the future health of the patient
- Must also take individualized approach as every patient/circumstance is different
- Currently no evidence based guidelines that address how many concussions is too many
- Currently no evidence-based guidelines that address how many concussions is too many in 1 season
 - TBI recommends sitting season out if sustain 2 concussion in 1 season

When to consider retirement from sports

- Neurosurgical considerations
 - Craniotomy
 - Non displaced skull fracture
- Prolonged recovery
- Behavioral changes
- Cognitive changes
 - Drop in grades
 - Abnormal neuropsychological testing
- Intractable headaches

When to Retire: Case Example

- 17 yo Male, hx of 6 concussion, no other significant PMH
- Sports: Football, Baseball
- Last 2 concussion occurred within 3 months
- Last concussion had prolonged recovery
 - Significant drop in grades, with cognitive deficits in speech therapy (after completing multiple sessions)
 - Refused Neuropsychological testing

Where to Refer?

- TBI Clinic
 - All ages
 - Cognitive concerns*
 - No limit to number of concussions
 - Neurosurgical findings/neurology dx.
 - Only located in Akron
- Sports Medicine
 - First concussion or uncomplicated second
 - 9 years or older
 - No neurosurgical findings
 - No neurology diagnosis (seizure, migraine)
 - Multiple Location

References



1. Ellis MJ, McDonald PJ, Cordingley D, Mansouri B, Essig M, Ritchie L. Retirement-from-sport considerations following pediatric sports-related concussion: case illustrations and institutional approach. *Neurosurg Focus*. 2016 Apr;40(4):E8. doi: 10.3171/2016.1.FOCUS15600. PMID: 27032925.
2. McCrory P, Feddermann-Demont N, Dvořák J, Cassidy JD, McIntosh A, Vos PE, Echemendia RJ, Meeuwisse W, Tarnutzer AA. What is the definition of sports-related concussion: a systematic review. *Br J Sports Med*. 2017 Jun;51(11):877-887. doi: 10.1136/bjsports-2016-097393. PMID: 29098981.
3. Mez J, Daneshvar DH, Kiernan PT, Abdolmohammadi B, Alvarez VE, Huber BR, Alosco ML, Solomon TM, Nowinski CJ, McHale L, Cormier KA, Kubilus CA, Martin BM, Murphy L, Baugh CM, Montenigro PH, Chaisson CE, Tripodis Y, Kowall NW, Weuve J, McClean MD, Cantu RC, Goldstein LE, Katz DI, Stern RA, Stein TD, McKee AC. Clinicopathological Evaluation of Chronic Traumatic Encephalopathy in Players of American Football. *JAMA*. 2017 Jul 25;318(4):360-370. doi: 10.1001/jama.2017.8334. PMID: 28742910; PMCID: PMC5807097.
4. Sim A, Terryberry-Spohr L, Wilson KR. Prolonged recovery of memory functioning after mild traumatic brain injury in adolescent athletes. *J Neurosurg*. 2008 Mar;108(3):511-6. doi: 10.3171/JNS/2008/108/3/0511. PMID: 18312098.

Thank you!

- Questions?
- Contact Me
 - Mackenzie Feathers
 - mfeathers@akronchildrens.org

