Dealing with Persistent Concussion Symptoms

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River Valley Neuropsychology
Objectives

• Understand what a neuropsychologist is
• Review the common cognitive, physical and emotional sequelae of a brain injury
• Identify the risk factors that might prolong a recovery
• Identify the goals of assessment during different recovery stages
• Discuss when and how to refer for treatment
What is Clinical Neuropsychology?

- Science of *Behavior-Emotion & Cognition* in the developing or aging brain

- Gives you the functional picture behind the MRI or CT scan: relates brain integrity to everyday functioning @home, school, work, play.....

- Research, diagnosis & treatment of diseases and traumas affecting the integrity of brain functioning. Leading the way for the CDC in Concussion Management.

- Expertise for differential diagnosis of cognitive and psychological dysfunction in neurological trauma or disease.
What can we contribute to overall care

- Guide treatment
  - Aid in diagnostic considerations
  - Better understand the patient’s level of cognitive and emotional functioning
- Patient’s ability to understand medical condition, implications of treatment choices
  - Medical decision-making
- Monitor cognitive symptomology (e.g. tumors, dementia, CNS disease, surgical intervention) to adjust services
- Concern of possible neurological impairment or cognitive issues
Elements of a Neuropsych Assessment

• Clinical interview (often pt + collateral)
• Review of medical records, imaging, labs, etc
• Assessment of several domains
  ▪ Effort
  ▪ Pre-morbid & current intelligence
  ▪ Attention/Processing Speed/Executive Functioning
  ▪ Language
  ▪ Visual spatial functioning
  ▪ Verbal & non-verbal memory
  ▪ Motor
  ▪ Mood/Personality functioning
Don’t other specialties examine cognition?

• Neuropsychology unique because:
  ▪ Use of formal measures of effort/engagement
  ▪ Integration of data related to effects of mood on cognition
  ▪ Ability to combine cognitive data with other sources of data to aid in diagnosis
  ▪ Comprehensive reports
  ▪ Feedback sessions - both to providers and patients and their families
Concussion: definition

A concussion is a mild traumatic brain injury caused by a bump, blow, or jolt to the head OR body that causes the brain to rapidly move within the skull.
Traumatic Brain Injury

Glasgow Coma Scale

“Minimal”

Mild

Mod

Severe

Severe \( \text{GCS} \leq 8 \)

Moderate \( \text{GCS} 9 - 12 \)

Mild \( \text{GCS} 13 - 15 \)

Sports concussion

Teasdale et al Lancet 1974; ii: 81-4
How to Recognize a Concussion

• *Any* kind of forceful blow to the head or to the body that resulted in rapid movement of the head.

• *Any* change in the person’s behavior, thinking, or physical functioning.
Sports-related Concussion

- Once thought to be a nuisance injury, it is now recognized that these brain injuries may lead to chronic neurocognitive impairment if not managed properly.
Common Concussion Sequelae

- Cognitive
- Mood
- Vestibular
- Ocular
- Cervical
- Fatigue
- Sleep
- Motor
- Headache/migraine

Adapted from a model developed by UPMC Sports Concussion Program
Presented on June 9, 2013 by Michael W. Collins, PhD
Emotional Response

- Neurobiology of brain injury with immediate emotional symptoms
- Exacerbates pre-existing mental health condition
- Time of identity development
- Egocentric
- Immature emotional response system
  - Lack fully developed neurological system for executive functioning
  - Lack experience with disappointments—no quick fix
Emotional Response

Child’s reaction to support system reaction:
- Permissive vs. Controlling parent
- Economics
- Stress on family system
- Pressure of academic functions
- Pressure of athletic expectations
- Post Concussion Syndrome Disorder
  - Constellation of cognitive, emotional, physical symptoms
  - ? Definitions vary on when this dx is made: 5-7 days? 3 weeks? 3 months?
  - Takes away control, increases anxiety
Evolving Goals of Assessment

- **Acute phase: detection**
- **1st days: description**
- **Week 1 or 2: resolution**
- **Month 1 or 2: interventions**
- **Month 3+: address lingering problems**
Evolving Goals of Assessment

- **Acute phase: detection**
  - 1st days: description
  - Week 1 or 2: resolution
  - Month 1 or 2: interventions
  - Month 3+: address lingering problems

- **Sideline assessment, KD, Impact**
  - Rating scales, Impact
  - Rating Scales
  - MD, Neuropsych, ST, PT, OT, Vision, Counseling
  - MD, Neuropsych, ST, PT, OT, Vision, Counseling
Prospective, Head-to-Head Study of Three Computerized Neurocognitive Assessment Tools (CNTs): Reliability and Validity for the Assessment of Sport-Related Concussion

Lindsay D. Nelson,1 Ashley A. LaRoche,1 Adam Y. Pfaller,1 E. Brooke Lerner,1 Thomas A. Hammeke,1,2 Christopher Randolph,3 William B. Barr,4 Kevin Guskiewicz,5 AND Michael A. McCrea1,2

1Medical College of Wisconsin, Milwaukee, Wisconsin
2Clement J. Zablocki VA Medical Center, Milwaukee, Wisconsin
3Loyola University Medical School, Maywood, Illinois
4New York University School of Medicine, New York, New York
5University of North Carolina at Chapel Hill, Chapel Hill, NC
Comparison of 3 Computerized Tests

- Evaluated ANAM, Axon Sports/Cogstate Sport, and ImPACT
- High school and college athletes, concussed vs. control
- Compared at <24 hours, 8, 15 and 45 days

- Results: CNTs may add incremental validity (beyond symptom scores) to the identification of clinical impairment within 24 hours of injury, but do not add significant value over symptom assessment later.
“Typical Recovery”

• 80% recover in a few days to weeks
• 90% recover within 30 days
• 90-95% recover within 3 months
• 5-8% have more prolonged symptoms
• Children and teens take longer than college-age students and adults to recover
“Difficult” or Prolonged Recovery

• Persistent post-concussive symptoms (>10 days) in about 10-15%

• Important to consider other issues

• Should be managed in multidisciplinary manner by healthcare providers experienced in concussion
Understand the injury to the brain

Understand the brain that is injured
**Pre-existing Risk Factors that Contribute to a Longer Recovery**

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<td>• parenting style (permissive vs. helicopter)</td>
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Among participants aged 5 to 18 with acute concussion, physical activity within 7 days of injury was associated with less risk of PCS at 28 days.
Buffalo Concussion Treadmill Test

- Graduated exercise test
- Measure of physical exhaustion (Borg RPE) and/or exercise intolerance
- Use of the BCTT:
  - Establish exercise intolerance – acute, post-concussion syndrome (PCS)
  - Differential diagnosis of post-concussion symptoms (PCS, cervicogenic, etc.)
  - Identify physiologic changes associated with concussion, exacerbation of symptoms (exercise intolerance)
  - Assist in treatment protocols, Return to play
How to Change the Outcome?
How to Change the Outcome?

• Think: **Individualized**
  Concussions are like snowflakes, no two are the same
How to Change the Outcome?

Model Programs:

• RESPONSIVE TEAM
• SETS EXPECTATIONS
• ANTICIPATE
• MAKE FLEXIBLE DECISIONS
Take Immediate Action

• Communicate what concussion response team is to parent and student athlete
• Create transparent communication network to reassure and normalize
• Do not “awfulize”...avoid worst story sharing
Treatment

- Sensible rest
- Exercise!
- First referral:
  - PCP
  - Vestibular/PT evaluation
  - Neuropsychological evaluation
- Next steps:
  - Neuro-optometrist/vision therapy
  - Counseling
  - Nutrition
  - Sleep hygiene/sleep study
  - Speech therapy
  - Medical/neurologic follow-up (headache specialist)
Case Study #1
“Ashley”
Ashley: 14 year-old female volleyball student

- Middle of three children; good health; A/B student
- 1\textsuperscript{st} concussion in October
  - Recovered within a week
- 2\textsuperscript{nd} concussion in September of following year
  - No memory for getting hit, brief LOC, immediately nauseous and tired
  - Persisting headaches, ringing in her ears, sensitivity to light
  - Remained out of school for a few days
- Attended a volleyball practice and was struck on the head
  - Symptoms exacerbated
Ashley: Initial Evaluation

_Evaluated 6 weeks post concussion, Symptoms:

- Sensitive to light and sound
- Occasional dizziness
- Daily headaches that abated only somewhat on weekends
- Fatigue
- Poor concentration
- Difficulty recalling what she has read
- Grades beginning to slip

- Was full time at school, no adjustments
- Had pulled out of all extra-curricular activities
Ashley: Initial PT findings

• Oculomotor signs:
  – smooth pursuit with symptoms, hypometric corrections during saccades
  – Convergence 45cm (normal approx. 6cm)
  – Dynamic visual acuity 7 line difference
  – King Devick Score more than twice normal time

• Balance Assessment
  – Deteriorated balance with movement and with eyes closed-Dynamic Gait Index 17/24-
  – Activities Balance confidence scale- 64.4/100
  – Poor ability to engage in simple cognitive tasks during physical exertion.
Ashley: Concussion Symptoms

- Cognitive
- Mood
- Vestibular
- Ocular
- Cervical
- Fatigue
- Motor
- Sleep
- Headache/migraine
### Pre-existing Risk Factors that Contribute to a Longer Recovery

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Ashley: Initial Test Results

Executive Fx: hits a wall/lose track/distracted

Memory

Processing speed

Attention

Visual spatial

Language

Ashley: Recommended Treatments

• Vestibular Therapy
  – Included vision exercises

• School:
  – Half Days
  – Essential work
  – Extra time for tests/assignments
  – One test/day
  – Quiet room for tests
  – Note taker/iPad

• No return to play

• Exercise

• Nutritional recommendations
Ashley: One Month Follow-up

- Improvement in headaches and fatigue
  - But headaches are still daily
- Improvement in light/sound sensitivity
- Still difficult to concentrate in a noisy environment
- Overall described as “brighter” by mom
- Described school as very supportive, which helped relieve stress
Ashley: One Month PT Follow-up

• Oculomotor signs:
  – smooth pursuit without symptoms, saccades normal
  – Convergence 10 cm (normal approx. 6cm)
  – Dynamic visual acuity 3 line difference
  – King Devick Score significantly reduced

• Balance Assessment
  – Deteriorated balance with movement and with eyes closed-Dynamic Gait Index 22/24-
  – Activities Balance confidence scale- 85/100
  – Able to walk at 3.5 miles per hour while moving gaze to varied targets and engage in mild cognitive task.
Ashley: One Month Follow-up

Executive Fx: hits a wall/lose track/distracted

Memory

Attention

Visual spatial

Language

Processing speed

Ashley: Recommendations

- Ongoing Vestibular Therapy
  - Vision exercises
- School:
  - Full Days
  - Essential work
  - Extra time for tests/assignments
  - One test/day
  - Quiet room for tests
  - Use of iPad for notes
- No return to play
- Exercise
- Worried about rebound headaches: contact pediatrician
Ashley: Two-Month Follow-Up

*Effort intact; Mood intact
Ashley: Final Result

- Cleared from PT to return to play/sport
- No ongoing adjustments needed at school
- Discussion with Jane and her father about the risks/benefits of contact sports and future concussions.
Case Study #2
“Joey”
Joey: 17 year-old-male

- Developmental & Medical histories:
  - Fraternal twin, Born premature at 30 weeks
  - Between age 2 ½ and 15 he sustained 11 concussions (only 2 with a brief LOC)
  - Age 10: headaches, dx with sleep apnea, CPAP improved the headaches
  - ADHD
  - Age 16: cervical and back pain, stopped crew
  - Age 17: took up tennis, increase in headaches
Joey: 17 year-old-male

• Social/Psychiatric/Substance Abuse histories:
  – Twin and younger brother
  – Parents divorced several years ago
  – Lives primarily with mom
  – Denies psych history
  – Non-smoker
  – Occasional drinking
Joey continued

• Educational history:
  – Senior in high school, college bound
  – Grades: A-

• Previous Testing at age 11:
  – Slowed processing, decreased working memory & executive functioning
Joey continued

• Current Complaints:
  – Slowed processing
  – Distractible
  – Difficulty taking information in
  – Balance not as good as years ago
  – Cervical headaches (resolved when stopped playing tennis)
  – Difficulty understanding accents and foreign languages
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Hydrocephalus

Normal Adolescent MRI

Joey’s MRI
Neuropsych Test Results

Executive Fx:
- Visual spatial
- Language
- Working Memory
- Processing speed
- Attention
- Memory
- (Conceptualize)
- (hits a wall; loses track; distracted; poor strategy & planning; Poor perseverance)

Recommendations

• Updated sleep study
• Accommodations for school
  – Extra time
  – Wave language requirement or consider sign language or Latin
• No contact sports
  – No tennis or rowing, rock climbing?
• Nutrition
• Osteopath/PT
  – Worried about headaches & cervical pain
Case Study #3

“Alice”
Alice: 20 year-old female

• Reason for Referral: 2 concussions w/in 6 months

• Concussion #1:
  – Field hockey (goalie): head to goalpost
  – 5 months to recover: symptoms included headache, fatigue, nausea, slurred speech, sleep disruption, irritability, poor frustration tolerance, ligament injury to her neck.

• Concussion #2:
  – 2 weeks after being cleared to RTP, struck in the head with a softball
  – Symptoms more pronounced: forgetful, nausea, tearful
  – 7 months later, still not back to baseline
Alice: 20 year-old female

- Medical histories:
  - Exercise-induced asthma (outgrown)
- Education
  - College student, on medical leave of absence
- Psychiatric history:
  - Denies previous history, now anxious, reporting some suicidal thoughts and saw a therapist a few months prior to the evaluation
Alice continued

• Current Complaints:
  – Slowed processing
  – Impaired attention
  – Sleep disturbance
  – Clumsy
  – Sensitive to light
  – Occasional headaches
  – Irritable
  – Depression (suicidal thoughts)
Pre-existing Risk Factors that Contribute to a Longer Recovery

**Medical**
- Hx of Neurological Trauma or Disease
- Hx of Medical Disease
- **Hx Concussion, w/ LOC, w/ multiple blows**
- Hx Headaches/migraine
- Sleep Disorder
- Genetic vulnerabilities
- **Family history**
- Nutrition

**Neuropsychological**
- ADHD
- Learning Disability
- Developmental Disability
- Mental Health: Depression, Anxiety, Psychosis
- **Family history**
- History of trauma
- Type “A’s”
Alice: 7 months s/p 2nd concussion

IQ

Executive Functioning

Memory

Attention

Processing speed

Language

Visual spatial

Effort Intact
Moderate to Severe Depression & Anxiety

Impression

• Protracted recovery with multiple etiologies:
  – Depression
  – Anxiety
  – Headaches
  – Sleep disruption
  – Possible polycystic ovarian syndrome
Recommendations

• Mood:
  – psychotherapy

• Sleep:
  – melatonin, possible sleep study

• Medical:
  – endocrinologist

• School:
  – Agreed with decision to remain on a medical leave of absence through the summer of 2017. Re-evaluate at that time to aid with accommodations

• Physical therapy:
  – Neck
Case Study #4
“David”
David: 22-year-old male

- Reason for Referral: history of multiple sports-related concussions and complains of cognitive difficulties. Question of CTE.

- Concussion History
  - 3 hockey-related
  - 2 longboard-related
  - Only one LOC, fairly quick recoveries
  - First occurred in 8th or 9th grade, last in 11th
David: 22 year-old male

• Medical histories:
  – Exercise-induced asthma (outgrown)

• Education:
  – Dropped out of college, B student in High school

• Psychiatric history:
  – Depression starting at age 16. Mood up and down, gets into funks and thinks about all the problems in the world. Panic attacks once a month for the last two years. No treatment, but smokes marijuana at night to sleep.
David continued

- Current Complaints:
  - Impaired attention
  - Forgetful
  - Word finding
  - Sleep disturbance
  - More emotional
Pre-existing Risk Factors that Contribute to a Longer Recovery

**Medical**
- Hx of Neurological Trauma or Disease
- Hx of Medical Disease
- **Hx Concussion, w/ LOC, w/ multiple blows**
- Hx Headaches/migraine
- Sleep Disorder
- Genetic vulnerabilities
- Family history
- Nutrition

**Neuropsychological**
- ADHD
- Learning Disability
- Developmental Disability
- **Mental Health: Depression, Anxiety, Psychosis**
- Family history
- History of trauma
- Type “A’s”
Neuropsych Test Results

- Memory
- Attention
- Processing speed
- Executive Fx
- Visual spatial
- Language

Effort intact
Mood: Mild Depression
Suicidal ideation

Impression & Recommendations

- Not CTE
- Likely Bipolar Disorder
- Referred to a psychiatrist for further evaluation
http://rivervalleyneuropsychology.com