Neuropsychological Assessment in Sports-Related Concussion: Part of a Complex Puzzle

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Objectives

- Biopsychosocial risk factors for Post-Concussion Syndrome
- Value of NP assessment in sports-related concussion (SRC)
- Domains assessed in NP evaluation
Integrated Recovery Model

1 Courtesy of Michael McCrea, PhD, ABPP-CN
Post-Concussion Syndrome

- Somatic (headache, fatigue, dizziness, sleep disturbance)
- Cognitive (inattention, forgetfulness, slowed processing)
- Affective Symptoms (irritability, disinhibition, labiality, anxiety, depression, apathy)
Post-Concussion Syndrome: A Biopsychosocial Model

1 Adapted from Iverson, 2012

Post Injury Factors
- Neurocognition
- Mental Health
- Vestibular Injury
- Social Factors
- Sleep Disturbance
- Chronic Pain

Pre Injury Factors
- Personality Characteristics
- Resilience
- Vulnerability
- Preexisting Mental Health
- Substance Abuse
- Prior Brain Injuries
- Prior Medical/Neurological
Multidimensional Model of Concussion Assessment

1 Echemendia, et al, 2013
Neuropsychological Assessment in SRC

• Neuropsychology: What is it?
  – Basic scientific discipline that studies how the structure and function of the brain relates to cognition, emotion, and behavior

• What do we do?
  – Examine how changes in brain influence behavior
Neuropsychological Assessment in SRC

“Look on the bright side. For on brief, glorious moment, you forgot you were on the Cubs”
Neuropsychological Assessment in SRC

• Cognitive domains most implicated in SRC
Neuropsychological Assessment

What is an isosceles triangle?
In what year was the Great Wall of China built?
Who invented dental floss?

It must be a concussion. He didn’t get even 1 question right.

Hot Pursuit of Better Signal Detection

Courtesy of Michael McCrea, PhD, ABPP-CN
Neuropsychological Assessment

• Brief Screening
  – e.g., Standardized Assessment of Concussion (SAC), SCAT2
• Computerized Testing (e.g., ImPACT)
• Traditional Testing
  – Brief Evaluation
  – Comprehensive Evaluation
Neuropsychological Assessment

Computerized Testing (e.g., ImPACT) ¹

Advantages
• Quick
• Administer as group
• Data Collection - portable, efficient
• Immediate

Limitations
• Limited Information
• Performance differences
• Data Collection - psychometric concerns, equipment variability
• Automatic Interpretation

¹ Echemendia, et al., 2013
Neuropsychological Assessment

Traditional Testing

Advantages
• Thorough and sensitive
• Specialized
• Integrated Interpretation

Limitations
• Time consuming
• Face to face examination
• Labor intensive

\(^1\) Echemendia, et al., 2013
Hybrid Approach\(^1\)

**Pre Injury**

- Baseline Computerized Testing

**Post Injury**

- Follow-up Computerized Testing
- Traditional Testing

\(^1\) Echemendia, et al., 2013
Hybrid Approach\textsuperscript{1}

- Administration vs Interpretation
- Interpretation requires advanced knowledge:
  - Psychometrics, Standardized procedures,
  - Factors that influence performance: situational, cultural, linguistic barriers, pre-existing or co-occurring conditions

\textsuperscript{1} Echemendia, et al., 2013
Hybrid Approach\textsuperscript{1}

- Administration vs Interpretation
- Interpretation requires advanced knowledge

- Neuropsychologist are the professionals best trained to interpret cognitive tests \textsuperscript{2, 3, 4, 5}

\textsuperscript{1} Echemendia, et al., 2013; \textsuperscript{2} Echemendia, et al., 2009; \textsuperscript{3} McCrea, 2007; \textsuperscript{4} AACN, 2007; \textsuperscript{5} Herring, et al., 2011
When to refer...

- Injury & Persistent Symptoms
- Brief Testing
- Comprehensive Testing
When to refer…

**Injury & Persistent Symptoms**

- 80-90% concussions resolve in 7-10 days \(^1\)
  - May be longer in children and adolescents \(^2\)
- Physical complaints
  - Headaches, nausea, dizziness, balance problems, sleep disturbance
- Cognitive complaints
  - Concentration, memory, processing speed, word-finding

\(^1\) McCrory, et al. 2013; \(^2\) McCrory, et al., 2005
When to refer...

Injury & Persistent Symptoms

- Physical & cognitive

14 days to 3 months post injury

Brief Testing

Comprehensive Testing
When to refer...

For co-occurring complications

- History of psychiatric, cognitive, developmental, or medical issues
- Complex injury:
  - LOC > 10 min, Post-traumatic amnesia > 12 hrs after medical stabilization
  - Abnormal imaging

Comprehensive Testing
When to refer...

Injury & Persistent Symptoms

• Physical & cognitive

Brief Testing

14 days to 3 months post injury

Comprehensive Testing

> 3 months post injury
When to refer...

- **Interview with parent/guardian & child**
- **Results integrated with developmental, medical and psychosocial history**
- **Feedback, recommendations, and education on concussion provided**
When to refer…

- One appointment - 2 to 3 hours
- Assessment:
  - Estimate of baseline functioning
  - Attention & Executive functioning
  - Fluency
  - Processing Speed
  - Memory
  - Mood/Effort
When to refer...

- One or multiple appointments
  - 4 to 8 hours
- Assessment:
  - Intellectual, academic, and adaptive functioning
  - Neuropsychological domains from brief screen
  - Emotional, behavioral, social functioning
When to refer...

ALL TESTING
- Review of developmental, medical and psychosocial history
- Feedback, recommendations, education

BRIEF
- No complications
- Refer 14 days to 3 months post injury
- One appointment- 2 to 3 hrs

COMPREHENSIVE
- Complications/pre-existing factors
- Refer > 3 months post injury
- One or multiple appointments- 4 to 8 hrs
What info it provides

• Help determine return to play
• Determine possible further referrals
  – Psychotherapy, Vestibular rehabilitation therapy, Cognitive Rehabilitation
• School accommodations
  – Establish plan for graduated return to academics
  – Student Support Teams (SST)
  – Individualized Education Plan (IEP)/504 Accommodation Plan
Multidimensional Model of Concussion Assessment

1 Echemendia, et al, 2013
Preventing Post-Concussion Syndrome

- PRIOR to injury:
  - Education on psychological symptoms of concussion IN ADDITION to physical

- FOLLOWING injury:
  - Seeking medical attention
  - Rest for body AND mind
  - Addressing co-morbid factors
Conclusions

• NP testing is key element of a comprehensive concussion evaluation and management program
• NP instruments should not be used in stand-alone manner to make return-to-play decisions
• Brief cognitive screening tests (e.g., SCAT-2) not substitutes for comprehensive NP assessment
• NP tests can be administered by properly trained paraprofessionals, but interpretation of test data complex and ideally performed by trained NP
Future directions

• Evaluation and management of concussion in young children
• Computerized NP testing - more research needed to determine utility of baseline data with different age groups, across different test instruments, among different cultures and languages, and those with preexisting psychological, educational, and medical difficulties
• Psych factors have important and pervasive impact on athlete’s recovery - need research on psych functioning in athletes and how these factors affect postconcussion recovery