

MILD TRAUMATIC BRAIN INJURY “CONCUSSION”

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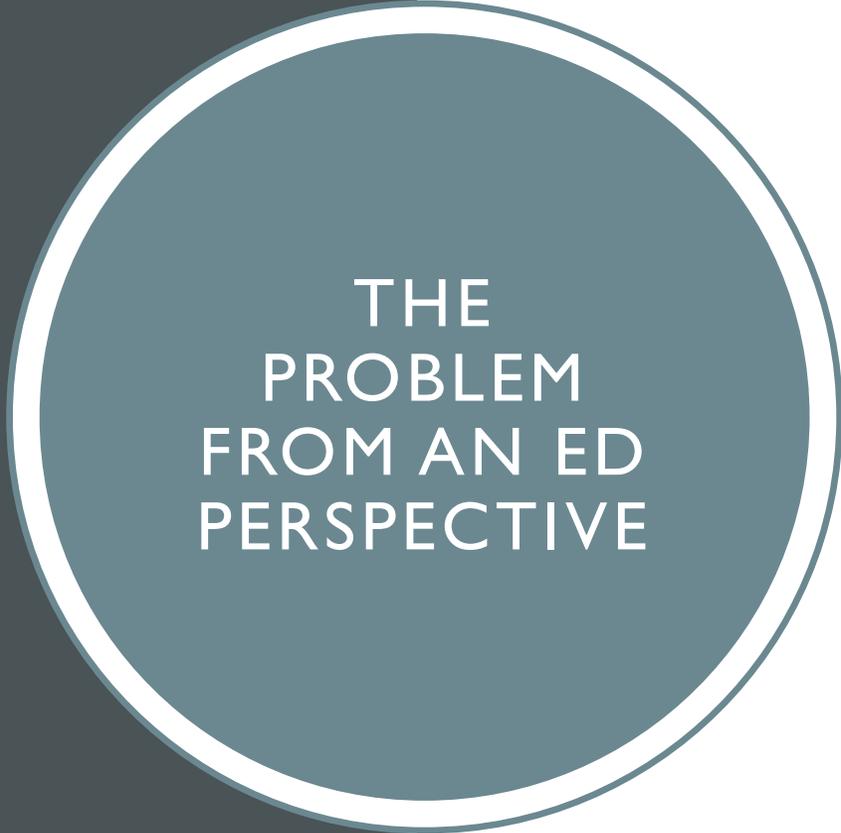
SCOPE

- What is Mild Traumatic Brain Injury (mTBI) - “Concussion”
- Assessment
- Investigation
- Management
- Can we learn from sport and improve in the ED?



THE
PROBLEM
FROM A
SPORTING
PERSPECTIVE





THE PROBLEM FROM AN ED PERSPECTIVE

- Difficult area of Sports Medicine and Emergency Medicine
- Head injury is a common ED presentation
 - 1.4 million presentations to ED's in England/year (Around 40-50% are children)¹
 - Majority fall into the bracket of (mTBI)
 - Likely underestimates the actual scale of the problem!
- Not dealt with well in many cases:
 - Clinician's inexperience
 - Time restraints (late attendance, busy department, "minors" stream)
 - No standardised approach to assessment or management in many cases

DEFINITION

Concussion is a Traumatic Brain Injury with immediate or delayed onset of symptoms which will be variable in their duration. It leads to a functional disturbance

Does not have to be trauma to the head

There are many signs and symptoms that can be associated with concussion

Need to think about it to diagnose it!



WHY WORRY?



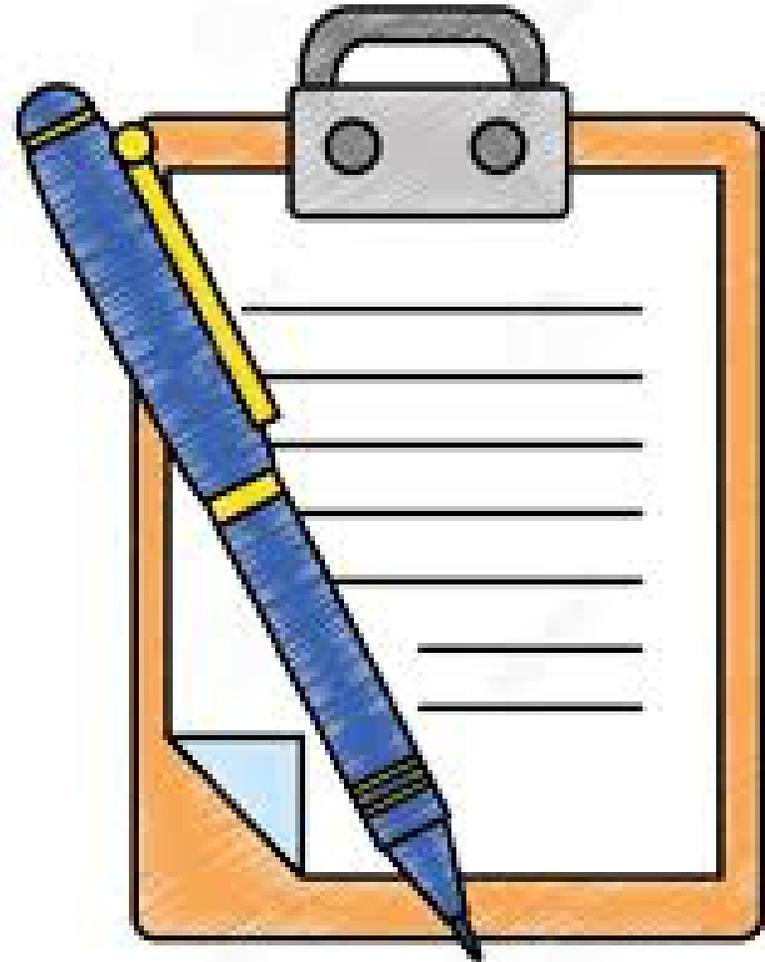
Second Impact Syndrome
Secondary Injury



Chronic
Traumatic
Encephalopathy

Depression
Early onset
dementia

ASSESSMENT



HOW SHOULD WE
ASSESS PATIENTS?

History of the event (?video?)

Patient's past concussion history

Symptoms and Signs

Cognition (Delayed Recall)

Concentration

Neurological screen (?Balance?)

Compare to "normal" baselines

HISTORY OF THE EVENT

- Confirmed loss of consciousness
- Suspected loss of consciousness
- Tonic posturing
- Convulsion
- Balance disturbance/ataxia
- Definite confusion
- Not orientated in time, person or place
- Clearly dazed
- Definite behavioral changes
- Oculomotor abnormalities
- Other on-field of signs or symptoms of concussion

QUESTIONS
TO
CONSIDER

| Indicator | Evidence |
|-----------------------------|--|
| Symptoms | Headache, dizziness, 'feeling in a fog' |
| Physical Signs | LOC, vacant expression, vomiting, inappropriate playing behaviour, slowed reactions, unsteady on legs |
| Behavioural Changes | Inappropriate emotions, irritability, feeling nervous or anxious |
| Cognitive Impairment | Slowed reaction times, confusion/disorientation, poor attention and concentration, amnesia (retrograde or anterograde) |
| Sleep Disturbance | Drowsiness |

Compare to Baselines

AREAS TO EXAMINE

Cognition:

Orientation (Time/Place/Person)

Immediate and delayed word recall

Concentration:

Digits backwards

Months in reverse

Neurological Screen

Neck exam

Upper/Lower limb neurological exam

Balance exam

Child SCAT5_o

SPORT CONCUSSION ASSESSMENT TOOL
FOR CHILDREN AGES 5 TO 12 YEARS
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by



SCAT5_o

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION
DEVELOPED BY THE CONCUSSION IN SPORT GROUP
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Compare to Baselines

ABSENCE OF BASELINES

Symptom checklist:

>1 symptom declared in the symptom list which is not usually experienced by the player

Balance evaluation:

>4 in the tandem test

>6 errors in the single-leg stance test

>1 Error in the double leg stance

Immediate Recall < 16

Concentration score: 2 or less

Delayed recall test: 3 words or fewer



AREAS FOR DEBATE!

- Do we use the SCAT Form?
- Do we modify it for the ED?
 - Balance
 - Concentration and Cognition without baseline
 - Absence of collateral history
- Do we develop something new entirely?

INVESTIGATION

Currently use GCS to guide assessment and management (Unhelpful for mTBI)

mTBI falls outside Head CT criteria in most cases

- The result does not diagnose mTBI

MRI often unavailable and unhelpful

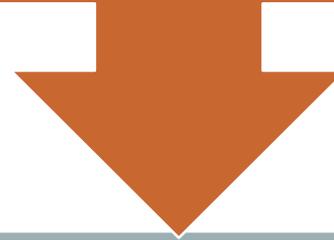
?Potential use of Biomarkers?

Currently leaves the diagnosis and subsequent management up to the clinician's assessment

MANAGEMENT



Often a standard sheet given to patients following diagnosis of concussion



Doesn't usually answer all the patient's questions

What can I do immediately?

When can I drive?

When can I return to work/school?

When can I return to sport?

MANAGEMENT

RETURN TO SCHOOL OR WORK

- Children should return to academic studies before they return to sport



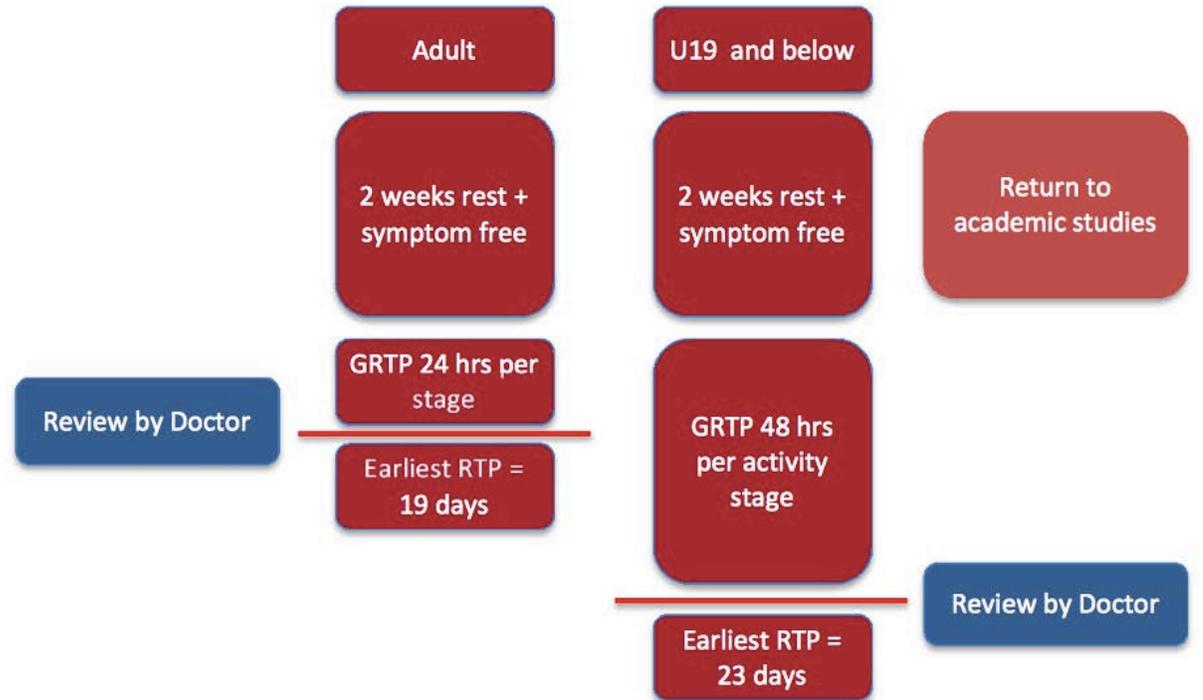
| Mental Activity | Activity at each step | Goal of each step |
|---|--|---|
| 1. Daily activities that do not give the child symptoms | Typical activities that the child does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up. | Gradual return to typical activities. |
| 2. School activities | Homework, reading or other cognitive activities outside of the classroom. | Increase tolerance to cognitive work. |
| 3. Return to school part-time | Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day. | Increase academic activities. |
| 4. Return to school full-time | Gradually progress school activities until a full day can be tolerated. | Return to full academic activities and catch up on missed work. |

RETURN TO SPORT

- Current RFU Guidelines:
- Non-elite setting



Recover and Return - RTP guidelines:



RETURN TO SPORT

- Suggested RTP Program:



| Rehabilitation stage | Functional exercise at each stage of rehabilitation | Objective of each stage |
|---|--|---|
| 1. No activity, minimum 24 hours following the injury where managed by a medical practitioner, otherwise minimum 14 days following the injury | Complete physical and cognitive rest without symptoms | Recovery |
| 2. Light aerobic exercise during 24-hour period | Walking, swimming or stationary cycling keeping intensity, <70% maximum predicted heart rate. No resistance training. Symptom free during full 24-hour period. | Increase heart rate |
| 3. Sport-specific exercise during 24-hour period | Running drills. No head impact activities. Symptom free during full 24-hour period. | Add movement |
| 4. Non-contact training drills during 24-hour period | Progression to more complex training drills, e.g. passing drills. May start progressive resistance training. Symptom free during full 24-hour period. | Exercise, coordination, and cognitive load |
| 5. Full Contact Practice | Following medical clearance participate in normal training activities | Restore confidence and assess functional skills by coaching staff |
| 6. After 24 hours return to play | Player rehabilitated | Recovered |

FOLLOW UP

Review by a doctor is recommended before return to playing matches (contact)

Potential for multi-professional “concussion return clinics” facilitating more in-depth concussion assessment and management

Buffalo
Concussion
Treadmill Test

Vestibular
rehabilitation

Cervicogenic
rehabilitation

Visual
processing

Education

Help identify and treat refractory cases
Return to work and sport more safely and sooner
Reduce potentially significant long-term complications

SPECIALIST
OPINION

Failure to progress through GRTP due to symptoms

Persistent symptoms

Adult - > 14 days

Children - > 28 days

More than 2 concussions in 12 months

Children

Athletes

KEY POINTS

Very common –
Need to think
about it!

Potential for
devastating short
and long term
sequelae

Need for a
standardised
assessment?

Need for
consistent patient
advice/education?

Follow up!

THANK YOU



Traumatic brain injury best practices and opportunities: From acute evaluation to post-discharge

2. Natural history and management of concussions

December 7, 2020

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Disclosure statement

- ⦿ Support for this program is provided by Abbott
- ⦿ Speaker is presenting at the request of Abbott

Learning objectives

- ⊗ Discuss the typical recovery course for patients who sustain concussions
- ⊗ Identify 3 risk factors for prolonged recovery
- ⊗ Describe interventions for three common post-concussion sequelae

Outline

- ⊗ Definitions and demographics
- ⊗ *Evaluation*
- ⊗ Natural history of recovery from mild TBI
- ⊗ General strategies regarding management
- ⊗ Risk factors for slow recovery

Mild TBI definitions

- ⊗ Mild TBI - GCS 13-15*, Post-traumatic amnesia < 24 hours
- ⊗ Complicated mild TBI – GCS 13-15 with HCT evidence of injury
 - ⊗ Greater degree of cognitive deficits
 - ⊗ Outcome more closely resembles moderate TBI than mild TBI
- ⊗ Concussion - a clinical syndrome characterized by immediate and transient alteration in brain function, including alteration of mental status and level of consciousness, resulting from mechanical force or trauma.

* Please refer to the GCS level corresponding to mild TBI per your national or institutional guidelines in your country of practice

Incidence/Cost

- ⊗ Depends on criteria
- ⊗ CDC estimates 3.8 million sports/recreational concussions per year in the United States (population 316 million)
- ⊗ 1.4 million other traumatic brain injuries (not including concussions)
- ⊗ This is probably an underestimate as diagnosis is often uncertain
- ⊗ \$12 billion dollars (US) annually
 - ⊗ Direct medical and indirect (lost productivity)

Concussion Symptoms

High school and collegiate athletes within 3 days of injury

- ⊗ Headache (71%)
- ⊗ Visual blurring/diplopia (49%)
- ⊗ Feeling slow (58%)
- ⊗ Photophobia (47%)
- ⊗ Difficulty concentrating (57%)
- ⊗ Memory deficits (43%)
- ⊗ Dizziness (55%)
- ⊗ Balance problems (43%)
- ⊗ Fogginess (53%)
- ⊗ Fatigue (50%)

USE A CHECKLIST

Lovell et al, 2004

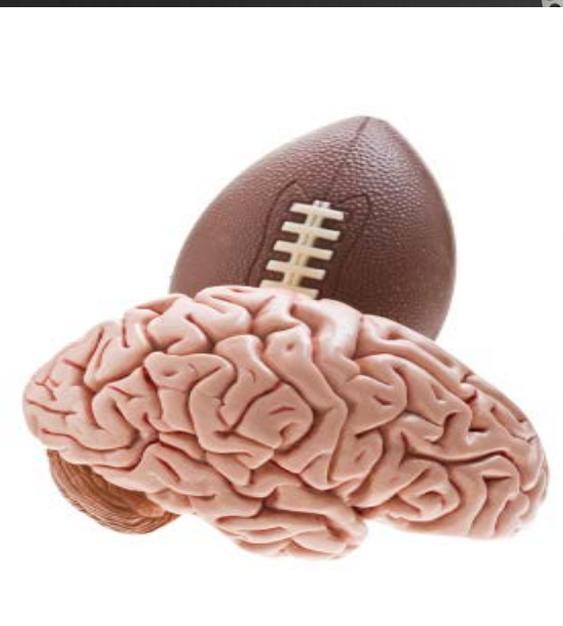
Evaluation of cognitive deficits

- ⊗ Multiple etiologies after concussions
 - ⊗ Brain injury, poor sleep, psychological sequelae, physical symptoms impacting function, medications
- ⊗ Neuropsychological testing
- ⊗ Other standardized tests (MMSE, SLUMS, MOCA)
- ⊗ Computer-based neuropsychological testing
 - ⊗ Benefit of baseline testing
 - ⊗ Ability to repeat testing
- ⊗ On-site evaluations
 - ⊗ Vocational or school re-entry
 - ⊗ Evaluations in a “natural” setting

Typical recovery course

Sports concussions

- ⊗ Recovery time can depend on age & other factors
 - ⊗ High school football players (*Collins et al., 2006*)
 - ⊗ 40% recovered by one week
 - ⊗ 60% recovered by two weeks
 - ⊗ 80% recovered by three weeks
 - ⊗ **20% took more than three weeks to recover**

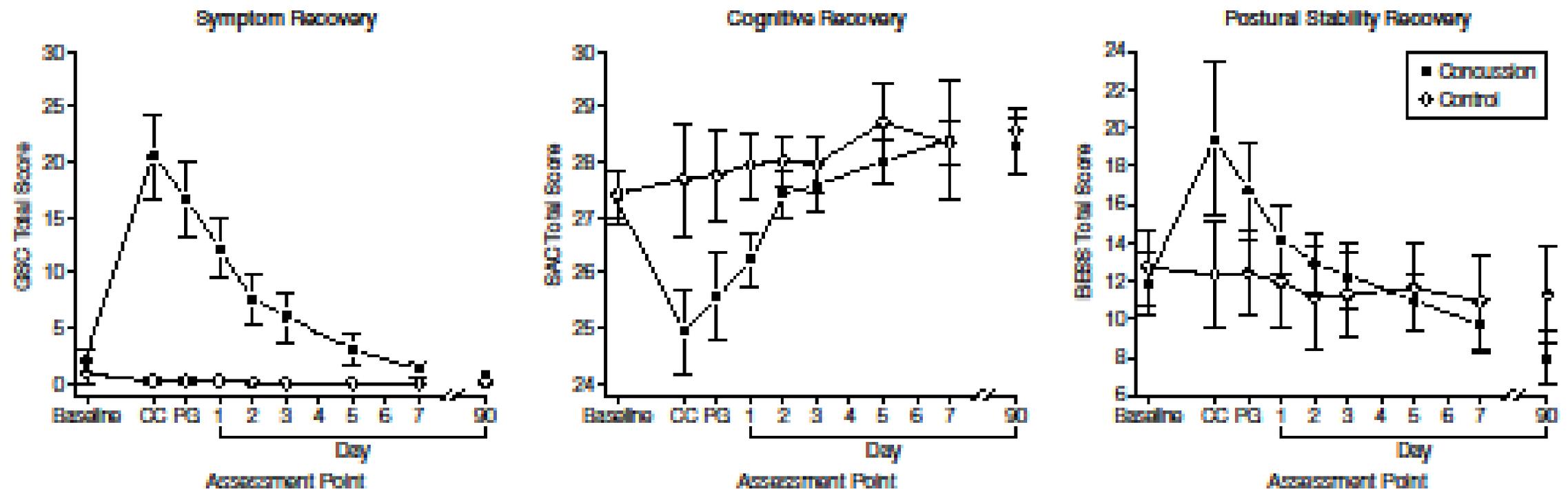


Typical recovery course

- ⊗ The most severe symptoms are typically evident in minutes of injury, & improvement evident w/in hours (McCrea, 2008)
- ⊗ Delayed symptom onset is relatively rare
- ⊗ Combination of physical and cognitive symptoms is most common, and follow gradual course to complete recovery within several weeks
- ⊗ PTA is 4x more predictive than LOC or concussion symptoms

Symptoms and other measures of recovery

Figure. Symptom, Cognitive, and Postural Stability Recovery in Concussion and Control Participants



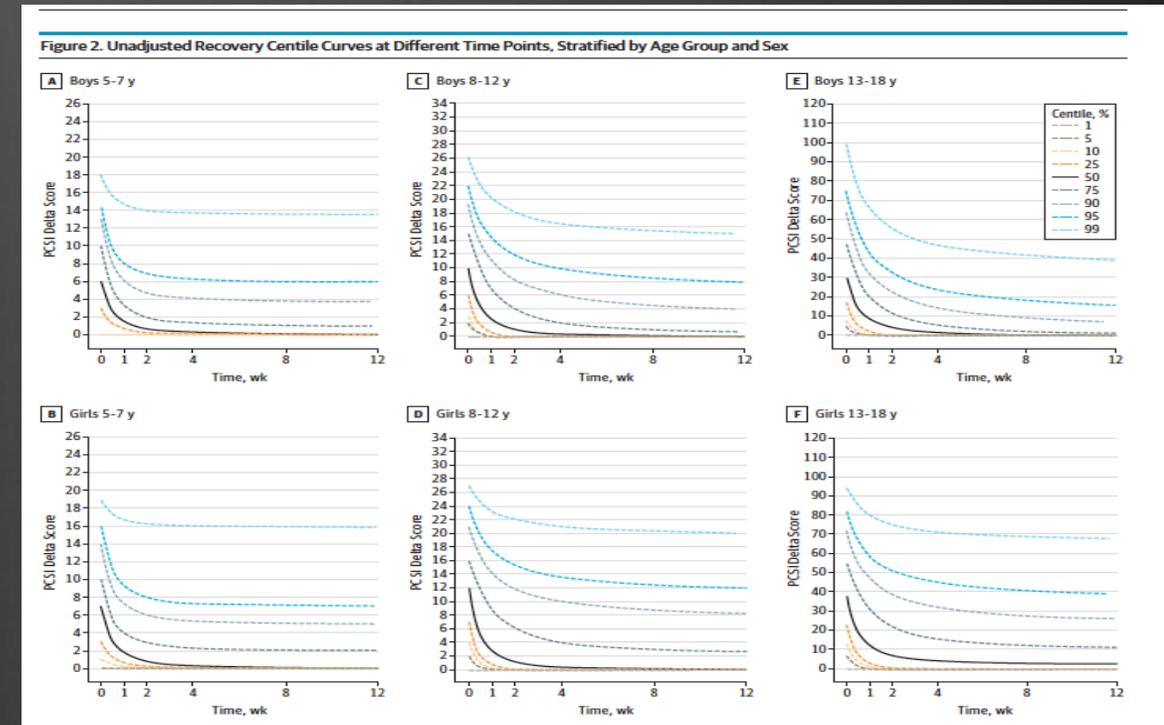
Higher scores on the Graded Symptom Checklist (GSC) indicate more severe symptoms; lower scores on the Standardized Assessment of Concussion (SAC) indicate poorer cognitive performance; and higher scores on the Balance Error Scoring System (BESS) indicate poorer postural stability. Error bars indicate 95% confidence intervals. CC indicates time of concussion; PG, postgame/postpractice. On the BESS, multiple imputation was used to estimate means and 95% confidence intervals for control participants for the CC and PG assessments.

Evaluation of Recovery

- ⊗ Symptoms
 - ⊗ Post-concussive symptoms checklist
- ⊗ Signs
 - ⊗ Balance, vision, cognition
 - ⊗ Computerized cognitive assessments
- ⊗ Functional assessments
 - ⊗ Performance at work, school
 - ⊗ Spousal, parental roles, etc.

Risk factors for slow recovery

- ❁ Collins (2009)
 - ❁ Cognitive symptoms most important
 - ❁ Specifically, “fogginess” was most predictive
 - ❁ Disturbed sleep, nausea, vomiting, dizziness and headaches also predictive
- ❁ Prior concussions/brain injuries
- ❁ Iverson et al (2017)
 - ❁ Age may also be a factor (teens)
 - ❁ Severity of injury, correlates with severity of acute symptoms
 - ❁ Subacute/pre-existing problems with migraine headaches or depression/mental health issues
- ❁ Specific neurological injuries that are not resolving (vision, vestibular, etc)



LeDoux, 2018

Relationship between recovery time and history of prior concussions

| Recovery time (days) | Prior concussions | 0 | 1 | 2 | 3 |
|-----------------------------|--------------------------|----------|----------|----------|----------|
| <1 | 30.3 | 39 | 33.3 | 0 | |
| 1-7 | 62.3 | 46.3 | 46.7 | 70 | |
| >7 | 7.4 | 14.6 | 20 | 30 | |

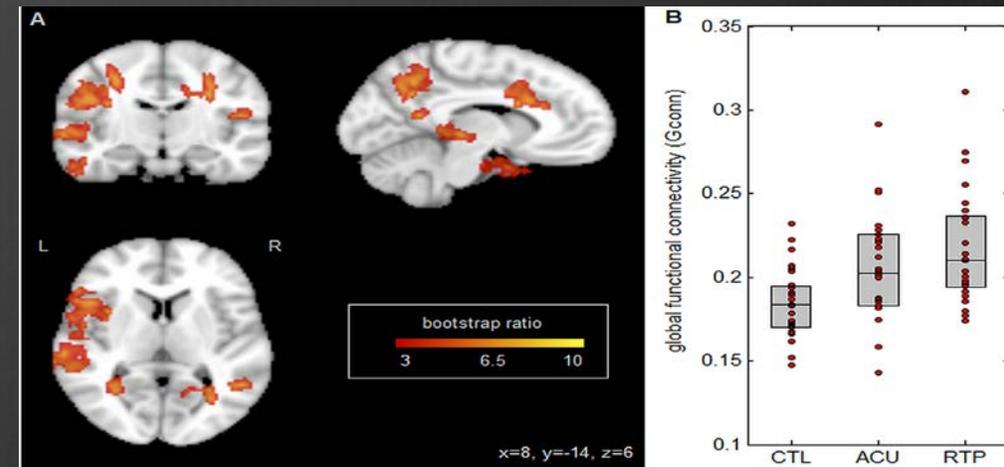
Guskiewicz et al, 2003

Etiologies of delayed recovery

- ⊗ PCS is initiated by the pathophysiological effects of mild TBI, but the development and maintenance of persistent PCS appears to be “more directly the result of psychological, psychosocial, & other non-MTBI-specific factors”
- ⊗ If *cognitive* difficulties persist the cause is due to other factors such as depression, post-traumatic stress disorder, chronic pain, & psychological factors

(McCrea,2008; Friedland, 2015)

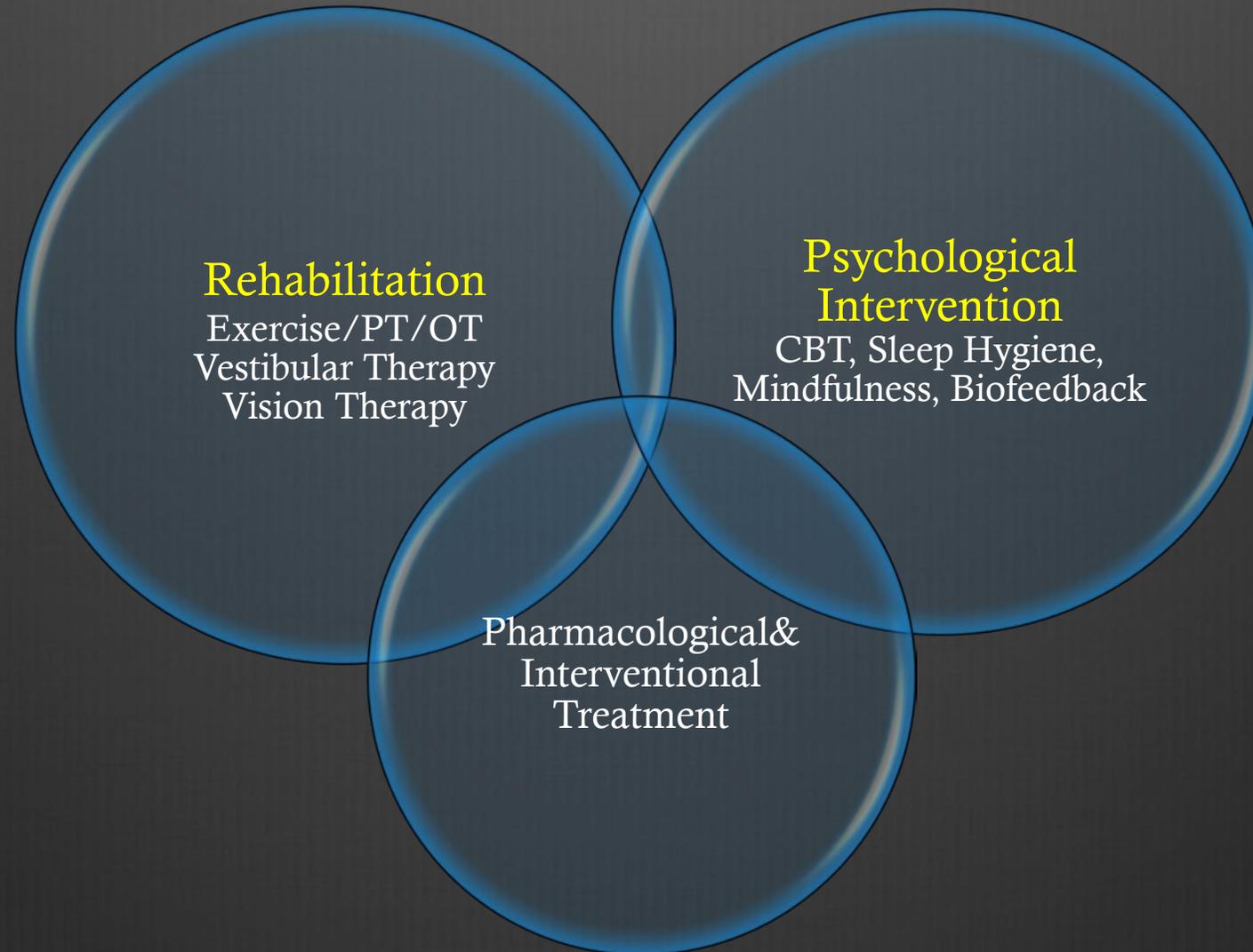
Churchill et al, 2017



Post-Acute Concussion Management

- ❖ Each concussion is unique & should be managed on an individual basis
- ❖ Refer to Concussion Specialist
 - ❖ “Referral...is appropriate if symptom reduction is **not** evident within 3 to 5 days post injury, or sooner, and if the type or severity of symptoms is of concern” (*CDC Physician Toolkit, 2007*)
- ❖ 2016 guidelines: 10-14 days for adults, 4 weeks for children
- ❖ Concussion management plans should involve *all aspects of life* including home, school, work, and social-recreational activities (*CDC Physicians Toolkit, 2007*)

Management strategy



Consensus Statement in Concussion in Sport, 2016

Pediatric population

- ⊗ “Brief period” of physical and cognitive rest
- ⊗ Return to school prior to return to play
- ⊗ Expected symptom duration of up to 4 weeks; likely longer time frame than adults
- ⊗ Early introduction of symptom-limited activity
- ⊗ Children and adolescents should never return to play on the day of injury

Inadequate rest/healing time is a primary reason for a slow recovery, but extended inactivity may prolong recovery

- ⊗ Lack of understanding of what rest means
 - ⊗ Physical rest
 - ⊗ Cognitive rest
- ⊗ Poor compliance with recommendation for rest
- ⊗ Slow identification of the presence of a concussion
- ⊗ Need to identify and address specific complications (vestibular, visual, post-traumatic headaches, stressors)

Why rest?

- ⊗ Prevent re-injury
- ⊗ Activity may compromise the restoration of normal function and neural repair
- ⊗ Functional imaging studies have suggested that brain activity is less efficient after injury, leading to the concern that a lesser amount of effort may lead to greater degrees of “exertion”, slowing recovery and worsening post-concussive symptoms
- ⊗ Animal studies have demonstrated that rats that began to exercise soon (within a week) after injury) had worse outcomes (Griesbach et al)
- ⊗ Moderate to vigorous activity in the first 3 days after concussion prolonged medical clearance for RTP (Lischynski, 2017)

Complications of inactivity

- ⊗ Deconditioning
- ⊗ Fatigue
- ⊗ Depression
- ⊗ Maintenance of anxiety regarding resuming activity
- ⊗ Reinforces the idea of being injured
- ⊗ Prolonged bed rest in healthy people can induce symptoms commonly seen after concussion

Potential advantages of activity after concussion

- ⊗ Decreased stress
- ⊗ Improved sleep
- ⊗ Improved self-esteem
- ⊗ Increased production of neurotrophic factors such as brain-derived neurotrophic factor (BDNF)



Benefits of aerobic activity

- ⊗ Has been demonstrated to be an effective intervention for:
 - ⊗ Chronic fatigue
 - ⊗ Depression
 - ⊗ Anxiety
- ⊗ May improve cognition in older well adults as well as persons with various neurological disorders



Activity and recovery acutely after concussion

- ⊗ Majerske et al, J Athl Train (2008)
 - ⊗ Retrospective evaluation of recovery in students (mean age 16 years old) after concussion
 - ⊗ Compared low, moderate and high amount of academic and physical activity
 - ⊗ The “moderate” group performed best on neuropsychological outcome measures (ImPACT) and symptoms (PCSS)
- ⊗ Grool et al, JAMA, 2016
 - ⊗ Children and adolescents, n=3063
 - ⊗ Physical activity and symptoms (PCSS) evaluated 7 and 28 days after concussion
 - ⊗ Activity resumption within 7 days of injury reduced risk of persistent symptoms at 28 days

Recommendations

- ⊗ Rest for 1-2 days is appropriate. Severity of symptoms may be a reason to lengthen this interval, but initiate symptom-limited activity soon after this time.
- ⊗ Symptoms should be improving or and least not worsening at rest before initiating activity
- ⊗ Start activity at a level that does not worsen symptoms, advance as tolerated
- ⊗ Patients should have resources available if symptoms are not resolving within 7-14 days



Summary

- ⊗ Identification of mild TBI/concussion can be difficult
- ⊗ Symptom evaluation is an important tool to identify mild TBI and monitor recovery, but has limitations
- ⊗ Some aspects of a patient's history and presentation may help determine risk for slow recovery
- ⊗ While rest early appears beneficial, at some point it may be appropriate to initiate activity (physical and cognitive) to aid in recovery, even in the presence of sequelae of concussion

Thank you



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