Concussion: Return to Learn

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Introduction
MTBI/Concussion Severity Grading

American Academy of Neurology (AAN) (1997)

- Grade 1:
  - Transient confusion
  - No LOC
  - Symptoms resolve within 15 minutes

- Grade 2:
  - Transient confusion
  - No LOC
  - Symptoms last longer than 15 minutes

- Grade 3:
  - Any LOC present


- Simple Concussion: Concussion that resolves without complication over 7-10 days
- Complex Concussion: Persistent symptoms, specific complications, LOC of >1 minute, or prolonged cognitive impairments.
- Multiple/Repeat concussions classified as complex
<table>
<thead>
<tr>
<th>SYMPTOMS GRADE</th>
<th>1ST</th>
<th>2ND</th>
<th>3RD</th>
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<tbody>
<tr>
<td><em><strong>RTP time begins after completely asymptomatic</strong></em></td>
<td></td>
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<tr>
<td>&lt;15 MIN/NO PTA*</td>
<td>1</td>
<td>RTP OK 20 min</td>
<td>RTP in 2 wk</td>
</tr>
<tr>
<td>PTA&lt;30MIN/NO LOC**</td>
<td>1</td>
<td>RTP 1 week</td>
<td>RTP 3-4wks</td>
</tr>
<tr>
<td>PTA&gt;30MIN&lt;24HR/LOC&lt;5MIN</td>
<td>2</td>
<td>RTP 1 week</td>
<td>RTP 1 mo or end season</td>
</tr>
</tbody>
</table>
1.2 Classification of concussion

There was unanimous agreement to abandon the simple versus complex terminology that had been proposed in the Prague agreement statement as the panel felt that the terminology itself did not fully describe the entities.
Concussion is Concussion

However, treatment should not be the same for everyone
Concussion

Right vs. Wrong

What we still don’t know
Right or Wrong?
Wrong or Right?

Instructions:
Clearing Baby's Nose

YES

NO
Right or Wrong?
Just plain wrong...
To Discuss…

- Newer ways of thinking about concussion
  - Metabolic
  - Management
    - Cognitive rest
    - Exercise
- Misinformation / misconceptions
- Invaluable Ally ➔ ATC
What is it?

- Zurich 2012: A brain injury defined as a complex pathophysiologial process affecting the brain, induced by biomechanical forces.

- The Centers for Disease Control and Prevention (CDC) defines a concussion as “a complex pathophysiologic process affecting the brain…”
Ol' Luke is excited! Your boy must have got himself a reeeaal doozie!!

Concussion-sniffing dogs.
What is it?

The blow to the head or body results in significant movement of the brain with shear strain disrupting its function due to changes in neurometabolism and neurotransmission.
An acute concussion can be viewed as a **metabolic problem**.

After an acute injury, the metabolic needs of the neurons and axons are very high.
A Metabolic Problem

- Under normal conditions, mitochondria up-regulate production of adenosine triphosphate (ATP) to meet those metabolic demands.

- A concussion injury produces a neurometabolic cascade that results in impaired mitochondrial function.
Model of the pathophysiologic processes that occur at the cellular level after a concussion.

1. Widespread depolarization and neurotransmitter release
2. Potassium efflux
3. Calcium in the cell impairs ATP production in mitochondria, worsening energy crisis
4. Calcium influx also causes axonal swelling and decreased axonal function

Image courtesy of Matthew F. Grady, MD,
A Metabolic Problem

Decreased bioavailability of fuel sources that generate ATP: Glucose / Amino acids

Image courtesy of Matthew F. Grady, MD,
Vulnerability

Shortly after a concussion, the cerebral blood flow and the delivery of those fuel sources is also decreased.
Neurometabolic Cascade

- Prolonged decreased in cerebral blood flow in early adolescents
- High metabolic demand vs. decreased bioavailability
- “Metabolic mismatch phase”
Metabolic Mismatch

Figure 5. Neurometabolic Cascade Following Traumatic Brain Injury

- Calcium
- K+
- Glutamate
- Glucose
- Cerebral Blood Flow

% of normal

2 minutes
6 minutes
12 minutes
20 minutes
30 minutes
6 hours
24 hours
3 days
6 days
10 days
Metabolic Mismatch

- Increased glucose requirements

VS.

- Decreased delivery
Management

OLD

- Keep them home
- Keep in a dark room
- Do nothing

- No school until completely asymptomatic
- No exercise until completely asymptomatic
"You'd better sit out the rest of the game. You might have a concussion."
Management

- Adapt and change
- Experience has helped us change our approach to managing the student with concussion
- Remember the BPS model
  - Biological
  - Psychological
  - Social
Cognitive Rest

What is it?

Complete shut down and no stimulus?

- No television, cell phones, video games, no schoolwork
- No interaction with friends

Leads to psychological and social issues
Milwaukee, Wisconsin – Medical College of Wisconsin

- strict rest (5 days of no school, work or physical activity) did not improve symptoms, neurocognitive, and balance outcomes

- reported more symptoms and slower symptom resolution
"While vigorous cognitive exertion appears detrimental to recovery, more moderate levels of cognitive exertion do not seem to prolong recovery substantially."

"This seems to suggest that, while limiting cognitive activity is associated with a shorter duration of symptoms, complete abstinence from cognitive activity may be unnecessary."

William P. Meehan, III, MD, Director of the Sports Concussion Clinic at Boston Children's Hospital
Cognitive rest - When?

1 TO 3 DAYS POST INJURY

The time frame when the brain’s dysfunction and resultant energy crisis is at its greatest.
Cognitive Rest

Full cognitive rest in the first three to five days after injury

Focus on Hydration and Nutrition

Gradual return to cognitive activity

Reading / television / computer

Light Activities about the house

Getting ready for return to school
Academic Accomodations

- Gradual return to school
  - Limited / Half / Full
- No PE class – no gymnasium
- No tests / one per day – untimed/open book
- Preprinted class notes
- Reduced workload
- Modified homework – focus on concepts
Academic Accommodations

- Extended time on projects
- Leave class early – *why?*
- Quiet lunch environment
- Sunglasses
- Rest as needed to quiet environment –
  - Athletic training room
  - Nurses’ office
Return to School: Invaluable Ally

❖ ATC can play a role in assisting the student
❖ Review accommodations and help to understand
❖ Encourage student to use accommodations
❖ Encourage students to communicate with teachers
❖ Speak with teachers
   ❖ Inform / educate about situation
❖ Review recovery plan
Return to School

An athlete can depend on the ATC for their psychological needs –

When a student returns to school, what stands in their way? …….
“I don’t think people understand how stressful it is to explain what’s going on in your head when you don’t even understand it yourself.”
### Top ways teens deal with stress

<table>
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<th>Activity</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Play sports</td>
<td>28%</td>
</tr>
<tr>
<td>Watch TV or movies</td>
<td>36%</td>
</tr>
<tr>
<td>Exercise</td>
<td>37%</td>
</tr>
<tr>
<td>Spend time online</td>
<td>43%</td>
</tr>
<tr>
<td>Play video games</td>
<td>46%</td>
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Notice what’s missing from list? Reading the Bible, prayer, talking to parents, etc. Teens need help choosing positive ways to deal with stress.
Exercise

- Restoration of normal cerebral blood flow
- Aerobic exercise at 60-80% max heart rate

The reason they believed a controlled, graded, symptom-free exercise protocol worked was because it restored the regulatory system responsible for maintaining cerebral blood flow

Dr. John Leddy - Univ. of Buffalo’s Concussion Management Clinic
In Post Concussion Syndrome

- Symptoms related disturbed cerebral autoregulation
- Exercise raises blood pressure, enabling brain to better regulate blood flow
Exercise

“We think progressive stepwise aerobic training may improve cerebral autoregulation by conditioning the brain to gradually adapt to repetitive mild elevations of systolic blood pressure.” — Dr. John Leddy
Exercise

- Low level activity about the house
  - Lax toss / stick handling
  - Baseball throw
  - Basketball free throw / ball handling
- Physical therapy
  - Low level exertion
Misinformation

- 3 concussions and you are “done” ***
- Keep out of school until completely asymptomatic
- Not aware of return to play protocol
- ImPACT test was normal so he doesn’t have a concussion anymore
- She’s not as symptomatic as the last time so she can return sooner
- He didn’t lose consciousness so there’s no concussion
Misinformation

Are participation numbers declining because parents are not receiving all the facts? Scared about long term effects?

- Former NHL defenseman Steve Montador found dead at 35; fought concussions, depression – AP February 16, 2015

- He suffered a concussion in February 2012
‘Voila! ... Concussion-proof!’
Where’s my player?

- Difficulties faced during management of the athlete with concussion
  - Clinicians that aren’t aware of current concussion management guidelines, including RTP.
  - Academic management – keeping students out too long – waiting until completely asymptomatic
  - Clinicians who depend solely on neurocognitive testing
Where’s my player?

- Physicians not experienced in the management of concussion
  - Too much rest – strict rest
  - Too cautious with activities – no exercise
  - Return too soon – usually without accommodations or not explained
Points to Remember

- Initial focus on nutrition and hydration
- Gradual return to activities / school
- Explain Accommodations
- Be aware of the stress factor
- Know your allies.
References

Grady, MF; Master, CL; Gioia GA; Concussion Pathophysiology: Rationale for Physical and Cognitive Rest. Pediatric Annals 2012; 41(9) 377-378, 380-382

Thomas, DG; Apps, JN; Hoffmann, RG; McCrea, M; Hammeke, T; Benefits of Strict Rest After Acute Concussion: A Randomized Controlled Trial. Pediatrics 2015;135(2).

