BONK! An Evidence Based Approach to Pediatric Head Trauma

12:45 – 1:30 p.m.

Danny Thomas, MD, MPH
In accordance with the ACCME(R) standard for Commercial Support Number 6, all in control of content have NO relevant financial relationships to disclose with the exception of the following person(s):

Danny Thomas, MD, MPH
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Medical College of Wisconsin

Company: UPMC/NFL
Role: Content Expertise
Objectives

- Review how to use evidence-based medicine in the evaluation and treatment of pediatric head injuries

- Determine who can safely be discharged home and who requires transfer to a Level 1 Trauma Center or admission

- Review research and best practices for the management of acute mild traumatic brain injury
Pediatric Head Trauma: A Significant Burden

- Deaths: 7,000/yr
- Hospitalizations: 95,000/yr
- ED Visits: > 500,000/yr
- Primary Care Office Visits: Assume numerous, No data

- Hospital care costs alone exceed 1 billion/year
- 29,000 permanent disabilities annually

60%↑ in ED visits in last 10 years
Clinical Challenges in the ED

- Identification of children with significant intracranial injury
- Manage children with moderate and severe TBI
- Improving outcomes of mild TBI
Pathology of Head Trauma

• Primary pathology
  – Injury to the brain tissue
  – Degree of force = extent of injury
    • Mild force: Neuronal and circulatory dysfunction
    • Moderate force: Axonal and circulatory injury
    • Results in cerebral edema (local or diffuse)
  – Usually non-operative lesions
  – Often the CT scan is Negative
Pathology of Head Trauma

• Secondary Pathology
  – Operative Lesions
  – Damage to bridging veins, arteries, and dural sinuses
  – Lesions that can be seen on imaging
Secondary Pathology

- **Epidural Hematoma**
  - Better prognosis with mortality rate is up to 50%

- **Subdural Hematoma**
  - Poor prognosis with mortality rates up to 90%
ED Management of Moderate to Severe TBI

Glasgow Coma Scale <12

- Goals = prevent secondary injury
  - Identify operative lesions
  - Manage Airway
  - Manage increased intracranial pressure
  - Prevent Hypoxia / Hypercarbia / Hypoglycemia
  - Prevent Hypotension
  - Adequate Sedation and Analgesia

... no magic bullet
Typical Head Trauma Presentations to the Pediatric ED look like…

<table>
<thead>
<tr>
<th>4 m/o Female</th>
<th>9 y/o Male</th>
<th>15 y/o Male</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hx:</strong> Fall from Dad’s shoulders to linoleum</td>
<td><strong>Hx:</strong> Hit with a baseball bat at recess</td>
<td><strong>Hx:</strong> Head to head contact during a tackle</td>
</tr>
<tr>
<td><strong>Sx:</strong> Brief loss of consciousness, but now has no symptoms</td>
<td><strong>Sx:</strong> No loss of consciousness, headache and vomiting</td>
<td><strong>Sx:</strong> No loss of consciousness, but has significant amnesia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe Headache and dizziness</td>
</tr>
</tbody>
</table>
What Do We Want To Know?

Does *this child* have an *intracranial injury*?

Will *this child* require *emergent surgery*?
## Do They Have an Intracranial Injury?

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>n</th>
<th>Age, y</th>
<th>Age &lt;2 y, %</th>
<th>Type of Injury</th>
<th>GCS: %</th>
<th>CT Performed as Inclusion</th>
<th>Baseline CT Frequency, %</th>
<th>Abnormal Neurosurgical CT Results, %</th>
<th>Abnormal Neurosurgical Intervention, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atabaki et al(^{27}) (2008)</td>
<td>4 level 1 pediatric trauma EDs in US</td>
<td>1000</td>
<td>0–21</td>
<td>18.8</td>
<td>Minor head injury</td>
<td>15: 85.2</td>
<td>Yes</td>
<td>100</td>
<td>6.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Da Dalt et al(^{28}) (2006)</td>
<td>5 level 3 pediatric EDs in northern Italy</td>
<td>3806</td>
<td>0–16</td>
<td>37</td>
<td>Blunt head trauma of any severity</td>
<td>≥14: 98.7</td>
<td>No</td>
<td>2</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Dunning et al(^{29}) (2006)</td>
<td>3 children's EDs, 3 adult teaching EDs, 4 general hospital EDs in England</td>
<td>22772</td>
<td>0–16</td>
<td>27.3</td>
<td>All head injury</td>
<td>15: 96.6</td>
<td>No</td>
<td>3</td>
<td>1.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Greene and Schutzman(^{30}) (2001)</td>
<td>1 tertiary care children's ED in US</td>
<td>422</td>
<td>0–2</td>
<td>100</td>
<td>Asymptomatic head injury</td>
<td>NA</td>
<td>No</td>
<td>18</td>
<td>17</td>
<td>0.2</td>
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<tr>
<td>Haydel and Shembekar(^{31}) (2003)</td>
<td>1 level 1 trauma center ED in US</td>
<td>175</td>
<td>5–17</td>
<td>0</td>
<td>Nontrivial minor head injury</td>
<td>15: 100</td>
<td>Yes</td>
<td>100</td>
<td>8</td>
<td>0.6</td>
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<td>1666</td>
<td>0–18</td>
<td>12.5</td>
<td>All head injury</td>
<td>15: 6.9</td>
<td>Yes</td>
<td>100</td>
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<td>16.5</td>
<td>Nontrivial head injury</td>
<td>≥14: 91</td>
<td>No</td>
<td>62</td>
<td>4.8</td>
<td>1.4</td>
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## Will They Require Emergent Surgery?

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Pediatric Minor Head Injury: Goal of Management

- Identify intracranial injuries while limiting unnecessary imaging

- Why limit imaging?
  - Radiation
  - Sedation
  - Costs

Your insurance doesn’t cover sedation. But don’t worry, we have a low cost alternative.
PECARN Head Injury Study
Methods and Subjects

• Prospective Cohort Study, < 18 yo
• Presented within 24 hrs blunt head injury
• mTBI = GCS 14 -15
• 1° Outcome = “ci TBI” (“clinically important”)
  – Defined as Death, Neurosurgery, Intubation, Hospital admission > 2 nights
Study Results

- N = 42,412 patients from 25 EDs

- GCS = 15 in 97%

- CT performed in 35.3% (n = 14,969)

- ciTBI in 0.9% (n = 376)
  - Surgery in 0.1% (n = 60)
  - No Deaths
Prediction Rules for No “ciTBI”
Age younger than 2 years

- Normal Mental Status
- No palpable skull fracture
- No scalp hematoma - except frontal
- No LOC or LOC < 5 seconds
- Non-severe injury mechanism
- Acting normally according to parents
  (NPV 100%; Sensitivity 100%)

PECARN Imaging Guidelines (<2 y/o)

GCS=14 or other signs of altered mental status†, or palpable skull fracture

Yes

13.9% of population

CT recommended

4.4% risk of ciTBI

No

Occipital or parietal or temporal scalp haematoma, or history of LOC ≥ 5 s, or severe mechanism of injury‡, or not acting normally per parent

Yes

32.6% of population

Observation versus CT on the basis of other clinical factors including:
- Physician experience
- Multiple versus isolated§ findings
- Worsening symptoms or signs after emergency department observation
- Age <3 months
- Parental preference

0.9% risk of ciTBI

No

53.5% of population
<0.02% risk of ciTBI

CT not recommended¶
Prediction Rules for No “ciTBI”

Age 2 years and older

- Normal Mental Status
- No LOC
- No vomiting
- Non-severe injury
- No basilar fracture
- No severe headache

(NPV 99.95%; Sensitivity 96.8%)
PECARN Imaging Guidelines (>2 y/o)

**GCS=14 or other signs of altered mental status, or signs of basilar skull fracture**

- Yes: 14.0% of population, 4.3% risk of ciTBI, CT recommended
- No: 58.3% of population, ≤0.05% risk of ciTBI, CT not recommended

**History of LOC, or history of vomiting, or severe mechanism of injury, or severe headache**

- Yes: 27.7% of population, 0.9% risk of ciTBI, Observation
- No: 58.3% of population, ≤0.05% risk of ciTBI, CT not recommended

**Conclusion:**
Observation versus CT on the basis of other clinical factors including:
- Physician experience
- Multiple versus isolated findings
- Worsening symptoms or signs after emergency department observation
- Parental preference

Isolated factors **NOT** predictive of CiTBI

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Severe Mechanism</td>
<td>Prolonged Vomiting</td>
</tr>
<tr>
<td>Loss of Consciousness</td>
<td>Amnesia</td>
</tr>
<tr>
<td>Scalp hematomas (&lt;2 y/o)</td>
<td>Not acting Normal per parent</td>
</tr>
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- No need to admit for observation after normal CT
- VP Shunt and Bleeding disorder alone do not increase risk of CiTBI
- Observation for patients with intermediate risk could save $92 million per year over current practice
Benefits of Brief ED Observation

• In ED observation reported in 5433 (14%) patients in PECARN study

• OBSERVED GROUP:
  – ~4% less likely to get a CT
  – **No difference in rate significant TBI**

• Observation can reduce CT use
  – Why?: Patients seen immediately, look “sicker” than ones that arrive 1 hr post injury.
How long do we need to observe?

- After 6 hours no risk of significant bleed
  - 8 year retrospective study of ~18 000 pts ( < 14 y/o)
  - Rate of delayed deterioration (> 6 hours)
    - Without altered GCS = 0 (0%)
    - With altered GCS = 5 (0.03%)

1. PEDIATRICS Vol. 126 No. 1 July 2010, pp. e33-e39
A Negative CT Does Not Equal Absence of Intracranial Injury.

- CT scans address the tip of the iceberg
- Majority of patients still have persistent symptoms and functional impairment
- Deficits can be detected on fMRI, PET scan and with neurocognitive testing.
Concussion Definition

• Blow to head or indirect force through neck or to body
• Trauma-induced alteration in neurologic function
  – Amnesia (retrograde or anterograde)
  – LOC, dazed, stunned, confused, forgetful
  – Headache, Nausea, Visual changes, Balance, etc…
• Typical Clinical Presentation
  – Rapid short-lived impairment
  – Normal physical examination and neuroimaging
    ➢ Neurometabolic dysfunction, not structural injury
Factors Influencing mTBI Outcomes

**Patient Factors**
- Severity of injury
- Risk factors
- Pre-injury cognition

**Physician Factors**
- Identify Injury
- Discharge education
- Appropriate follow up

**Parental Factors**
- Parenting style
- Family Functioning
- Socio-economic status
Addressing the Bottom of the Iceberg

Improving Concussion Management

1. Concussion Recognition
2. Assessment of Injury
3. Post-injury Management

Deaths: 7,000/yr
Hospitalizations: 95,000/yr
ED Visits: > 500,000/yr
Primary Care Office Visits: Assume numerous, no data
Care Not Sought
Recognizing the Problem

“What arrow? I am here about my headaches.”
Case: Female Soccer Player

- Off field: 1-5 minutes of post traumatic amnesia and confusion
- Over the next 1 hr: Severe headache, visual disturbance, balance problems
- Transported to the ED for evaluation
Biomechanics of Concussion

Time = 0.038999
Contours of Max Prin Strain
min=-3.71562e-06, at elem# 3920
max=0.0238272, at elem# 2606
1. Release of neurotransmitters and ↓↓ cerebral blood flow
2. Neuron depolarized
3. Excess K+ in the extracellular space
4. Neurons become refractory
5. Na+/K+ ATP pump activated
6. Increase need for ATP and glucose
7. Mismatch leads to lactate production
8. Cerebral glucose metabolism ↓↓ to match blood flow.
Neurometabolic Changes in Concussion:

\[\uparrow\text{glucose utilization} \quad \text{and} \quad \downarrow \text{CBF}\]

Concussed rats 2 hours post-injury

*J Cereb Blood Flow Metab, Vol. 21, No. 7, 2001*
Concussion Recognition: Immediate Signs/Symptoms

- Loss of consciousness 27%
- Amnesia 61%
- On Field Signs 22%
  - Confusion
  - Dazed or stunned
  - Answers questions slowly
  - Repeating questions

- Symptoms 95%
  - Headache
  - Dizziness/Off-balance
  - Nausea/Vomiting
  - Behavior/Personality Change
  - Vision changes
  - Poor Concentration
  - Poor memory
  - Sensitive to light/sound
  - Numbness /tingling

*Thomas 2011
Neurometabolic Changes in Concussion: ↓ glucose utilization over time

Concussion Recognition

• Acute Concussion Evaluation (ACE) and ACE Care Plan
  – Validated to identify mTBI
  – Provides discharge instructions for children and adults
• Available free on CDC website in 2007
### ACE Form

#### A. Injury Characteristics

**Date/Time of Injury:**

**Reporter:** __Patient__ __Parent__ __Spouse__ __Other__

1. **Injury Description:**

2. **Is there evidence of a forcible blow to the head (direct or indirect)?**
   - Yes
   - No
   - Unknown

3. **Is there evidence of intracranial injury or skull fracture?**
   - Yes
   - No
   - Unknown

4. **Location of Impact:**
   - Frontal
   - Lft Temporal
   - Rt Temporal
   - Lft Parietal
   - Rt Parietal
   - Occipital
   - Neck
   - Indirect Force

5. **Cause:**
   - MVC
   - Pedestrian-MVC
   - Fall
   - Assault
   - Sports (specify)
   - Other

6. **Amnesia Before (Retrograde):**
   - Are there any events just BEFORE the injury that you/ person has no memory of (even brief)?
     - Yes
     - No
     - Duration ___________

7. **Amnesia After (Anterograde):**
   - Are there any events just AFTER the injury that you/ person has no memory of (even brief)?
     - Yes
     - No
     - Duration ___________

8. **Loss of Consciousness:**
   - Did you/ person lose consciousness?
     - Yes
     - No
     - Duration ___________

9. **Early Signs:**
   - Appears dazed or stunned
   - Is confused about events
   - Answers questions slowly
   - Repeats Questions
   - Forgetful (recent info)

10. **Seizures:**
    - Were seizures observed?
      - Yes
      - No
      - Duration ___________
### B. Symptom Check List

Since the injury, has the person experienced **any** of these symptoms any more than usual? Indicate presence of each symptom (0=No, 1=Yes).

<table>
<thead>
<tr>
<th></th>
<th>PHYSICAL (10)</th>
<th>COGNITIVE (4)</th>
<th>SLEEP (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1</td>
</tr>
<tr>
<td>Nausea</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1 N/A</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1 N/A</td>
</tr>
<tr>
<td>Balance problems</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1 N/A</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0 1</td>
<td><strong>COGNITIVE Total (0-4)</strong></td>
<td><strong>SLEEP Total (0-4)</strong></td>
</tr>
<tr>
<td>Visual problems</td>
<td>0 1</td>
<td><strong>EMOTIONAL (4)</strong></td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>0 1</td>
<td>0 1</td>
<td>0 1</td>
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<td>Numbness/Tingling</td>
<td>0 1</td>
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(Add Physical, Cognitive, Emotion, Sleep totals)

**Total Symptom Score (0-22) ** ___
ACE Care Plan

E. Follow-Up Action Plan

✓ Referral to PCP for Office Monitoring

___ Neuropsychological Testing (recommended for Return to Sport decisions and academic/behavioral management)

___ Physician: Neurosurgery___ Neurology___ Sports Medicine___ Psychiatry___ Psychiatry___

___ Other___

Acute Concussion Evaluation (ACE) Care Plans

ACE (Acute Concussion Evaluation) care plans help guide a patient’s recovery.

Download

ACE Care Plan - Work version

ACE Care Plan - School version

- Evidence based discharge instructions
- Specific recommendations regarding:
  - Return to school
  - Return to work
  - Sports and exertion
  - Follow up plan
Use of Modified Acute Concussion Evaluation Tools in the Emergency Department

• Evaluate feasibility of the ACE and ACE Discharge Instructions (DI) in ED setting

• Developed a standardized assessment tool based on the ACE

• Implemented a screening program in two pediatric emergency departments

Zuckerbraun et al. Pediatrics 2014
ACE ED: Methods

- **Design**: Prospective Observational Study
  
  *Pre and Post implementation of intervention*

- **Subjects**: mTBI Patients 5-22 y/o discharged from two children’s hospital EDs

- **Methods**: Chart Review and Patient Phone surveys at 1, 2, 4 weeks post D/C

- **Outcomes**: Follow-up and recovery behavior

Zuckerbraun et al. Pediatrics 2014
ACE ED: Intervention

- Pediatric Emergency Medicine National Expert Panel to developed ACE ED form
- Embedded into electronic health record
- Clinician and Nurse Concussion Education
- Improve Discharge instructions
  - Emphasized keys to recovery
    - Resting the brain
    - No additional forces to head/brain
    - Managing/ facilitating physiological recovery

Zuckerbraun et al. Pediatrics 2014
Use of Modified Acute Concussion Evaluation Tools in the Emergency Department

- Improved Rate of Diagnosis & Concussion-Specific Discharge Instruction Administration

- More patients recalled received concussion specific, sports-related, and school-related discharge instructions

- Increased follow up with PCP up to 30%

Zuckerbraun et al. Pediatrics 2014
ACE ED and ACE Care form

- Available free on CDC website
- Can be adapting it for ED use
- Improves patient identification in the ED

- Unfortunately, ACE ED does not assess the severity of a patients concussion.
Improving Assessment of Injury:

- Useful higher level neurocognitive testing can take over an hour to complete
- Efficient products may lack predictive utility
- Better assessment of Balance and Visual motor control
- Better assessment of risk factors for prolonged recovery
Does it show acute findings…

- MRI
  - Contusions, edema, DAI
- fMRI
  - Changes in task based activation
- Resting state fMRI
  - Changes in connectivity
- QEEG
- PET
  - Changes in glucose metabolism

What do they mean…

- Unknown
- Current pattern of resolution
  - Symptoms resolve (days)
  - Neurocognitive performance improved (weeks)
  - Imaging findings resolve (months)
Symptom Management

• There is no standardized approach to the management of acute concussion symptoms.

• Sleep and Rest may be the most effective strategy to acute symptom management.
Fatigue/sleepiness immediately follows mTBI suggests that it serves some biologic purpose

mTBI is metabolic mismatch

Sleep has restorative benefits
  – Decreased synaptic activity (Cirelli et al)
  – Increased ATP stores (Dworak et al)
Post Concussive Symptoms

**Headache**
- Oral analgesic
  - NSAID (Ibuprofen, naproxen)
  - Acetaminophen
  - Opiates

**Nausea / Vomiting**
- Oral antiemetics
  - Ondansetron
  - Prochlorpromazine

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**IV ED Migraine Pathway**
- IV fluid bolus
- NSAID (e.g. Ketorolac)
- Dopamine receptor antagonist (e.g. Prochlorpromazine, metoclopramide)
- Ergotamine, Triptans, Opiates
Case 2: Soccer player
Normal ED Eval...Discharge home

• What are our discharge instructions?
• Any special advice for athletes?
• Where should parents go for help?
Improving Post-Injury Management

• Decreasing post-concussive symptoms
• Prevent cumulative effects of injury
• Prevent complications
  – Post-Concussion Syndrome
  – Second Impact Syndrome
• Risk can be reduced by ensuring proper recovery prior to return to full activity
Post-Concussive Symptoms
4 Major Categories

**PHYSICAL**
- Headache
- Nausea and vomiting
- Balance problems
- Slowed reaction time
- Dizziness
- Sensitivity to light
- Sensitivity to sound
- Fuzzy or blurry vision

**THINKING AND REMEMBERING**
- Difficulty concentrating
- Difficulty remembering
- Confusion
- Feeling “mentally foggy”
- Feeling slowed down

**MOOD DISRUPTION**
- More emotional
- Irritable
- Sad
- Nervous
- Depressed

**SLEEP**
- Sleeping more or less than usual
- Trouble falling asleep
- Feeling fatigued or drowsy
Vulnerable during the Post-Concussive Period

• 4 X more likely to have another concussion

• Dangers of Second Concussion
  – Post-concussion syndrome
    • More severe and prolonged recovery ( > 14 days)*
  – Second Impact Syndrome?
    • Occurs in young athletes with prior concussion following often relatively minor second impact
    • Catastrophic increase in intracranial pressure

Dangers of Repeat Concussion
Bowden et al. 2003

Catastrophic TBI in Football

- 97% occurred at the high school level
- ~60% had previous head injury before catastrophic event
- ~40% were playing with residual neurologic symptoms.

Bowden et al The American Journal of Sports Medicine, Vol. 35, No. 7
Risks of Exertion During Recovery

- Risks associated with return to sports
- Animal models show early physical and mental exertion impairs healing
- Few human studies has suggest exertion may have negative effects.
Effect of Exertion on Recovery

- 5 point activity scale coded on chart review

- Athletes with moderate levels of post-injury activity had the best performance at follow-up

- Athletes with highest and lowest levels of cognitive and physical activity had more symptoms and worse neurocognitive performance

*Majerske 2008*
Concussion Management

• Based on expert consensus*

• Recommend:
  – 24-48 hours of rest
  – Gradual step-wise return to activity

• Some clinicians advocate “Cocoon Therapy”

*International Symposium on Concussion in Sport, Vienna 2001 to Zurich 2013

http://www.stamfordadvocate.com/default/article/Local-doctor-has-novel-approach-to-concussions-190953.php
Patient presenting to ED and assessed for eligibility (N= 1376)

Neurocognitive tests and BESS in ED (N = 99)

Randomization

Control (N=43)
1-2 days Rest

Intervention (N= 45)
5 days Strict Rest

Patient completes 3 Day Activity / Symptom Diary

3 Day Follow up assessment; Diary collected

Patient completes 4-10 Day Activity / Symptom Diary

10 Day Follow up assessment; Diary collected
Results: Compliance

- Both groups exhibited ~20% decrease in energy expenditure and physical activity level in the first 5 days post injury.

- Intervention group reported less school and after school activity for days 2-5 post concussion (3.8 vs. 6.7 hours total, p < 0.05)
Results: Efficacy

- No significant difference between groups in neurocognitive or balance scores at 3 or 10 days
- Intervention group reported more daily PCSS and slower symptom resolution
Results: Total and daily PCSS

- Intervention group reported greater symptoms over the course of the study (187.9 vs 131.9, p <0.03)
- Difference in mean daily PCSS was significant at Day 4
It took 4 days longer for 50% of the intervention group to report symptom resolution.
Study Conclusions

• First study to test recommending strict activity limits as an intervention to improve acute concussion outcomes

• **Strict activity limits** immediately after mTBI offer **no benefit** over current standard of care

• Adolescents’ symptom reporting may be influenced by limiting activity
It’s hard to find the right balance
Concussion Is Treatable

Individualized approach is key!

- Step 1: “When in doubt, sit them out”
- Step 2: Resume Activities of Daily living
- Step 3: Get back to school (+/- support)
- Step 4: Get back to sport (w/ clearance)

Not recovering fast enough, see a specialist

- Tx: Rehab, PT, OT, CBT, Medications
ED Discharge Instructions

• Inform patients on Red flag symptoms
• Inform patients of common post-concussive symptoms
• Encourage academic and physical rest no more than 1-2 days
• Encourage step-wise return to activity
• Encourage follow up for formal clearance
Improving Post-injury Management:
Stepwise return-to-play for high risk activities

1. Rest until asymptomatic
   - No signs or symptoms at rest

2. Stepwise return to play
   1. Light aerobic activity (e.g. walking, stationary bike)
   2. Sport-specific activity (e.g. running in soccer, skating in hockey)
   3. Non-contact training drills
   4. Full-contact practice training
   5. Game Play

Other Considerations in Concussion Management

• Support outside the athletic arena
  – Alert and educate key school personnel
  – Gradual reintegration back to school
  – Educational Support

• Informal accommodations for most

• Formal interventions in few cases
Thank You
Questions?
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