Big Changes to Acute Concussion Management: What Every NP Needs to Know for Ideal Outcomes

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Speaker Disclosure

I have no disclosures.

Learning Objectives

1. Recognize key clinical characteristics to aid in the diagnosis of concussion/TBI.
2. Identify specific clinical findings in the targeted concussion exam that help guide concussion treatment.
3. Discuss key findings that necessitate referral to a specialty concussion practice.
4. Formulate integrative health strategies patients can use in order to promote concussion recovery and maintain a healthy lifestyle.
5. Apply what you have learned to create an individualized treatment plan for the patient with concussion.
Concussion Remains a Clinical Diagnosis

I think you have a concussion, but your physical exam is normal.

Clinical Characteristics to Aid in the Diagnosis of Concussion

- Brain fog
- Pressure in head
- Trouble falling asleep
- Sleeping more than usual
- Dizziness
- Light sensitivity
- Sound sensitivity
- Off balance
- Nausea/vomiting
- Mood changes/feels more emotional
- Problems remembering
- Irritable/nervous
- Changes in vision/blurry vision
- All-nighter?
- COVID?
- Mono?
- Broke up with girlfriend?
- Adolescent?

Diagnosing Concussion: Not So Easy

mTBI can be challenging to diagnose in any setting because the acute signs and symptoms of altered mental status (AMS) are often subtle and transient, and available diagnostic tests may be less sensitive in primary care, where patients are often first evaluated days or even weeks after an injury event and factors that may influence presentation are often hard to determine. Common symptoms that appear de novo after initial evaluation may develop, but none have yet been validated for diagnostic purposes. A clinical interview based on patient self-report (and corroborated with medical records, when available) remains the criterion standard for diagnosing mTBI in primary care.
Diagnosing Concussion: Not So Easy

- Many working definitions of concussion
- Created by various working groups:
  - ACRM, American Congress of Rehabilitation Medicine
  - CDC, Centers for Disease Control and Prevention
  - CDE, Demographics and Clinical Assessment Working Group of the International and Interagency Initiative toward Common Data Elements for Research on Traumatic Brain Injury and Psychological Health
  - CISG, Concussion in Sport Group
  - ONF, Ontario Neurotrauma Foundation
  - VA/DoD, Department of Veterans Affairs and the Department of Defense
  - WHO, World Health Organization

Points of discussion:

- Concussion vs mTBI: are they the same?
- Abnormal findings on imaging: is this still concussion/mTBI?
- Onset of symptoms
- Duration of symptoms
- Should observable signs “weigh more” than reported symptoms?
- Add differential diagnosis

Identifying Concussion When it Happens

Hit to the head or body that causes a twisting phenomenon & neuronal stretching

Source: chop.edu/concussion
Identifying Concussion when it happens

**SIGNS:**
- LOC
- Balance problems
- Blank/Vacant stare
- Delayed verbal/motor response
- Confusion
- Slurred speech
- Emotional lability
- Memory deficits

**SYMPTOMS:**
- Headache
- Pressure in the head
- N/V
- Dizziness
- Blurred vision
- Mentally foggy
- Photophobia
- Difficulty concentrating
- Phonophobia
- Sleep disturbance
- Feeling more emotional
- Difficulty remembering
- Balance problems

Making the Diagnosis of Concussion
- Concussion = injury event + signs/symptoms (+visiovestibular deficits on physical exam)
- Critical to treatment
- Have a low threshold of suspicion...

However, not every minor head injury results in a concussion!

Test Your Concussion Knowledge
How can you tell if a patient has sustained a mild or severe concussion after it happens:
A. There is a loss of consciousness (LOC)
B. There is a LOC and amnesia to the event
C. You can't tell how mild or severe a concussion is acutely after the injury
D. Neuroimaging can demonstrate this
Once a Diagnosis is Made: Terminology can Still be Tricky

Concussion Terminology

“Concussion is often used in the medical literature as a synonym for mild traumatic brain injury (TBI), but it probably more accurately describes a subset of milder brain injury. Most practitioners view concussion as the immediate and transient symptoms of a TBI, though many still have some degree of misunderstanding in translating that definition to clinical practice. Because of this, some argue that this loose definition, while widely palatable, is too broad and does not address important variables such as mechanism, severity score, or duration of symptoms.”

Concussion Terminology: Complicated vs Uncomplicated

Abstract
Introduction: A complicated mTBI is defined as mild by all clinical severity indicators but is complicated due to a traumatic intracranial abnormality visible on neuroimaging. Researchers have debated whether neuropsychological and functional outcomes following complicated mTBI are worse than, or similar to, outcomes following uncomplicated mTBI.

<table>
<thead>
<tr>
<th>Complicated mTBI</th>
<th>Uncomplicated mTBI</th>
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<tbody>
<tr>
<td>GCS 13-15</td>
<td>GCS 13-15</td>
</tr>
<tr>
<td>Traumatic abnormality found on neuroimaging</td>
<td>No abnormality on neuroimaging</td>
</tr>
</tbody>
</table>

21 days Post injury: Cognitive testing
Symptom Checklist
No difference between: Complicated Uncomplicated No imaging
How do we make changes to our practice that can affect outcomes now?

Concussion Care: Point of Entry to Care

• Point of Health Care Entry for Youth With Concussion Within a Large Pediatric Care Network

Clinical setting of initial concussion visits, 2016-2018

- Specialty Care
- Urgent Care
- Primary Care
- Hospital

Medication at initial visit: 12-16 (15 years)


Does a Delay in Diagnosis effect outcomes?

• Retrospective chart review 6-18 yr
• Diagnosed with concussion on their 1st ED or UC visit and patients requiring a 2nd visit for diagnosis
• N= 85 patients with delayed concussion diagnosis
• N= 159 with immediate diagnosis
• Immediate diagnosis had more symptoms inquired at initial visit and a higher likelihood of receiving concussion-specific physical examinations
• Delayed diagnosis had more medical visits during recovery, longer average time to symptom resolution (21 vs. 11 days), and a higher likelihood of having persistent concussion symptoms
• 76.5% of delayed diagnosis patients had at least 1 symptom at follow-up visit that was not inquired about at initial visit

Source: chop.edu/concussion
Clinical Findings in the Concussion Exam That Help Guide Treatment

**Visio-Vestibular Exam**

<table>
<thead>
<tr>
<th>Smooth Pursuit</th>
<th>Tracking a moving object</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal &amp; Vertical Saccades</td>
<td>Eyes jump from target to target</td>
<td>Tracking/Scanning/Embedding new info/memory</td>
</tr>
<tr>
<td>Horizontal &amp; Vertical VOR</td>
<td>Gaze stability &quot;steady cam&quot;</td>
<td>Running or walking where head moving up and down</td>
</tr>
<tr>
<td>Near Point of Conversion &amp; Monocular Accommodation</td>
<td>Looking far to near and vice versa</td>
<td>Looking at teacher/board and back down to take notes</td>
</tr>
<tr>
<td>Gait/Balance Testing</td>
<td>Tandem heel-to-toe gait</td>
<td></td>
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</tbody>
</table>

**Clinical Findings in the Concussion Exam That Help Guide Treatment**

• Patients with **cervicogenic symptoms** → have a disproportionate rate of **prolonged symptoms**

• **G-Force Concussion vs G-Force Whiplash**

• Systematic review (1443→23 articles): cervicogenic symptoms ranged from 7-69% AND increased to 90% with prolonged symptoms

• Neck pain at initial eval increased risk of developing prolonged symptoms by 2.58 to 6.36 times

• Treatment → Cervical manual therapy
Clinical Findings in the Concussion Exam that Help Guide Treatment

CHOP Clinical Pathway for Head Trauma

Clinical Findings in the Concussion Exam that Help Guide Treatment

Acute Concussion Care: How Can We Guide Treatment?

• What should we do right now?
• How do we help our patients as they recover?
• Understand the injury
• Manage the symptoms
• How do we support and help them adjust activities as they recover?

Test Your Concussion Knowledge

Rest after concussion is best when it is:
A. Should be at least 3-5 days
B. Limited to 2 days
C. All lights out, in the dark and no electronics for 2 days
D. For a few days, about 24-48 hours and symptom limited activity
Rest After Concussion

"After a brief period of rest during the acute phase (24-48 hours) after injury, patients can be encouraged to become gradually and progressively more active...The exact amount and duration of rest is not yet well defined in the literature and requires further study."

Evidence For "Brief Period of Rest"

**Benefits of Strict Rest After Acute Concussion: A Randomized Controlled Trial**

- **N = 99**
- RCT of 11-22 yo seen in ED within 24 hours of concussion
- Usual recs (1-2 days rest) vs 5 days of strict rest
- 5 day group had greater symptom burden and slower symptoms resolution

Evidence For "Brief Period of Rest"

- **N = 125**
- RCT 12-25 yo, seen within 24 hours of concussion in ED
- "Screen time" vs "no screen time" for 48 hrs
- Screen time group took longer to recover (8 days vs 3.5 days)
- Limitations to the study***

Source: https://injury.research.chop.edu/blog/post/concussion-virtual-classroom-how-we-can-support-our-students
Test Your Concussion Knowledge

Acute concussion recovery patient education should include all of the following except:
A. A strict protocol
B. An individualized action plan
C. Flexible and fluid action plan
D. Recommendations based on symptoms and concussion physical exam findings

Individualized Treatment Plan for the Patient with a Concussion

Creating an Action Plan

- Education and reassurance to the family are key
- Create a concrete "Action Plan" for returning to usual activities of daily life
- It is ok to return to activities with symptoms
- Start with Symptom-limited activities of daily life
- Scale back on volume/length of activities
- Gradually advance back to usual life activities based on symptoms, not letting symptoms get greatly worse
- When to follow up with health care provider?

Key to Success: Symptom Management
Individualized Treatment Plan for the Patient with a Concussion

Return to Usual Activities:

- Keep symptoms at **manageable** levels
- Avoid **greatly increasing** symptoms or **spikes** in symptoms
- Teach the patient to pace themselves through activities
- Follow the "2-point rule" for symptom management

2 Point Rule:
When symptoms increase by 2 points ➔ Rest, Recover & then Return to activity

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Individualized Treatment Plan for the Patient with a Concussion

Lifestyle Management

Maximizing healthy lifestyle behaviors

- Physical Activity
- Emotional Health
- Sleep
- Social/Family
- Academics
- Hydration

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Individualized Treatment Plan for the Patient with a Concussion

Sleep

- After the first 1-2 days ➔ return to usual sleep schedule
- Good sleep hygiene is key
  - Sleep routine
  - Relaxation breathing
  - Meditation
  - Daily fitness

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Individualized Treatment Plan for the Patient with a Concussion

**Physical Activity**

Is exercise medicine for concussion?

Guided exercise therapy is an important part of concussion recovery

Exercise Effects on the Brain: Central and Systemic Physiology

- **Adverse effects of Concussion & Deconditioning**
  - Alters Autonomic Nervous System
  - Decreases Cerebral Blood Flow
  - Alters Neuroplasticity
  - Alters Psychological functioning
  - Alters sleep

- **Beneficial Effects of Exercise**
  - Improves Autonomic Nervous System balance & control
  - Improves regulation of Cerebral Blood Flow
  - Upregulates BDNF genes
  - Improves Mood
  - Improves sleep

Aerobic Exercise Prevents Persistent Symptoms

- RCT heart rate-targeted aerobic exercise vs placebo stretching
- N = 118, 13-18 yo within 10 days of injury with SRC
- Aerobic exercise group more likely to recover by 4 weeks & 48% reduced risk of having prolonged symptoms

Dotted lines represent percentage of sample not recovered by Day 29 for each intervention
### Individualized Treatment Plan for the Patient with a Concussion

#### Physical Activity
- It is **ok to return** to aerobic activity with mild symptoms
  - (**This is not "organized sport" or sport training**)
- Create an individualized, progressive sub-symptom threshold aerobic exercise program
- Guided exercise
  - Start with low-risk activity → walking or stationary bike
  - Gradually increase volume & intensity as tolerated based upon symptoms
- Guidance on return to recreational activity

#### Driving After Concussion

<table>
<thead>
<tr>
<th>Stage</th>
<th>Graduated Return to Driving Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No driving (first 48 hours); be a passenger in the car</td>
</tr>
<tr>
<td>2*</td>
<td>Drive shorter distances on your local or neighborhood roads. Limit night driving and busy time of day. Have a passenger in the car WITH driver to assist as needed.</td>
</tr>
<tr>
<td>3</td>
<td>Drive longer distances on highways farther from home. Advance to night driving. Have a passenger in car WITH driver to assist as needed.</td>
</tr>
<tr>
<td>4</td>
<td>Short distances WITHOUT passenger.</td>
</tr>
<tr>
<td>5</td>
<td>Longer distances WITHOUT passenger (full return)</td>
</tr>
</tbody>
</table>

*After cleared by a health care provider to start driving. Key is to have a low symptom burden and manageable symptom exacerbation.*
Individualized Treatment Plan for the Patient with a Concussion

**Psychosocial and Emotional Support**

- Longer time out of school = Longer time students feel isolated & alone
- Prolonged symptoms → high risk for anxiety, depression & other behavioral health concerns (stress or the organic nature of the injury)

  - Gornal et al, Br Jn Sports Med, 2021
  - Systematic review and meta analysis peer reviewed studies 1980-2020
  - Mental health outcomes after pediatric concussion (40 articles, 33 studies)
  - N=6819 concussed patients
  - Experienced higher level of mental health difficulties vs controls
  - Injury → major stressor for athletes who are already balancing academics and sport
  - Stress can play a role to their response to injury and their rehab
  - Psychological response → trigger and/or unmask mental health issues: depression, SI, anxiety, disordered eating, and substance use/abuse

**Academic Support**

- Front-loading academic adjustments based on symptoms and physical exam findings
- Flexible and fluid
- Applied when needed → lifted when no longer needed

**Academic Adjustments**

- Symptom Management - pacing through the day (BREAKS)
- Extra time for tests and assignments
- Copy of notes
- Enlarged font
- Decrease volume of workload
- Eliminate non-essential work
- Decrease semi-essential work
**Individualized Treatment Plan for the Patient with a Concussion**

**Information Sharing: Knowing the Plan of Care**

  - Collaboration among health care providers, schools, coaches, employers & families is essential to optimizing outcomes
- Bacon, et al. *Interprof Care*, 2017
  - Interprofessional Conc Mngt Team was vital in promoting optimal outcomes
- School Nurse and ATC must collaborate

**Medications**
- Limit OTCs, best medicine is to take a break, rest, recover

**Fitness**
- Daily, non-contact, low intensity/low volume to start

**School**
- RTS/RTL; Front load Academic Adjustments; No clearance needed

**Sleep**
- Sleep hygiene

**Emotional Health**
- Be social with friends & family/Provide resources as needed

**Rehab**
- Home Exercise Program (HEP), Vestibular Therapy, Vision Rehab

**Driving**
- When is it ok to return? Provide guidance

**Pacing**
- Expose & recover; 2-point rule

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**Test Your Concussion Knowledge**

Which of the following have been shown to demonstrate efficacy in concussion management:

A. Certain ways of eating, i.e. Keto, anti-inflammatory
B. Acupuncture
C. Relaxation breathing
D. Cold water exposure
Integrative Health Strategies that Promote Concussion Recovery

From the Andrew Weil Center for Integrative Medicine

"...healing-oriented medicine that takes account of the whole person, including all aspects of lifestyle. It emphasizes the therapeutic relationship between practitioner and patient, is informed by evidence, and makes use of all appropriate therapies."

- Psychology
- Neuropsychology
- Physical Therapy
- Vision Rehab
- Exercise

- Balancing the Autonomic Nervous System
  - Vagus Nerve
    - Main nerve of the parasympathetic nervous system (PNS)
    - Connects your brain to your internal organ systems (AKA – “The Gut-Brain Connection”)
    - It controls the secretions of digestive juices, smooth intestinal contractions, heart rate variability, breath depth etc.
    - Excess sympathetic (SNS) activity (i.e., stress and anxiety) suppresses PNS activity (vagus nerve function) leading to impaired function
Integrative Health Strategies that Promote Concussion Recovery

• **Nutrition**
  - No evidence in humans in mTBI
  - Avoid refined carbs and sugars (inflammatory)
  - Each meal should include protein, vegetables, good fats, whole grain
  - More veggies & fruits (antioxidants that reduce nerve damage)
  - Good fats (Omega 3)
  - Healthy spices (ginger and turmeric reduce inflammation)
  - Various ways of eating: anti-inflammatory diet

• **Supplements**
  - Mostly no evidence in humans mTBI
  - Omega 3 fatty Acids (EPA/DHA)
  - Magnesium: helps make ATP
  - Melatonin: are they taking it correctly?

Test Your Concussion Knowledge

Which intervention has demonstrated quicker recovery and return to usual daily activities after concussion:

A. Taking OTCs for headache management
B. Starting school without academic adjustments
C. Taking Omega 3 supplements
D. Limited time between injury and referral to specialty care practice
What Promotes Quicker Recovery and Return to Life and Sport?

• Immediate removal from play (not continuing to play after an injury)

• Seeking care with a specialist sooner

Referral to a Specialty Concussion Practice: When is the right time?


Earlier referral may be helpful when (1) patients have high symptom burden or known risk factors for prolonged recovery, such as a preexisting mental health disorder (2) patients are unable to progress with their return to activity or are attempting to return to high-stakes roles soon after injury (e.g., competitive sport or university examinations)...

Referral to individual medical specialists or to a specialized multidisciplinary mTBI clinic is appropriate for patients with persistent symptoms (lasting more than 4-6 weeks) that do not respond to treatment in a primary care...

Referral to a Specialty Concussion Practice:

• N= 1213 Adolescents (482 female) who sustained SRC
• < 30 days from injury
• Primary outcome measure: Discharge from care; complete RTS RTP and pass Gapski-Goodman test without symptom exacerbation

• Athletes assessed < 10 days → mean 23.5 days
• Athletes assessed 10-30 days → mean 37.1 days

Early evaluation = Faster discharge
Factors that Affect Trajectory of Recovery after Concussion

- Kontos, et al. JAMA Neurology, 2020
  - 162 athletes (ages 12-22) who presented within 7 days from time of injury to care recovered faster and less likely to have protracted recovery (>30 days)
  - Earlier initiation of active rehabilitation strategies → Specialty care or those with experience with Concussion Management

  - N=341, 7-18 yo presented to Specialty Concussion Clinic
  - Evaluated: early (<14 days), mid (14-28 days), and late (>28 days)
  - Participants receiving late evaluation took three times longer to recover (mean 148.0 days) compared to early (mean 38.7 days) and mid (mean 51.5 days) evaluation
  - There was a strong positive correlation between recovery time and evaluation time

Test Your Concussion Knowledge

Once a person’s concussion symptoms have resolved, they would be considered recovered.
A. True
B. False

Concussion Recovery

- Symptom resolution DOES NOT EQUAL concussion recovery
- Defining “Recovery” → Controversial, with varied practices of measure
- Participating in all life activities successfully (work, school, sport, social)
- Different systems (emotional, cognitive, physical) recover at different rates
- Important to continue monitoring your patient until not only all symptoms have dissipated, but until all systems are back to baseline
Quest for the Holy Grail:
Objective Physiological Biomarkers for Concussion Diagnosis and Prognosis

• Visual biomarkers
• Neuroimaging biomarkers
• Blood biomarkers

Why Is This So Important?

Lack of definitive indicators as to when children can safely return to sports

Diagnosis is key → RIGHT treatment at the RIGHT time

Health care providers are often uncertain in how to manage mTBI

Return to sports too soon? → Risk for repeat injury OR exacerbation of current symptoms, and delayed recovery

Restrict too long? → Risk adverse health outcomes

Summary: Big “Changes” to Concussion Care

Exercise is medicine for concussion

Know the role of “rest” after concussion

Objective biomarkers may be in the future, but they are not ready for prime time yet!

Individualized Health Plan based on concussion-specific physical exam/symptoms

Early evaluation and referral to specialty

Explore integrative measures that can support your current practice

Know your tools, know your patient, know how it all fits together

The Secret Sauce: The right amount of activity, emotional regulation & matching the volume of work to the energy
CHOP Concussion Resources

CHOP.edu/concussion

- Practical Content
  - Families
  - Schools
  - Coaches
  - Clinicians
  - Summer Camp

- Downloads
  - Infographics
  - Fact sheets
  - Video FAQ