

# Management of Mild Traumatic Brain Injuries Has Evolved

by Angela Sinner, D.O., Mark Gormley, M.D., and Leslie Larson, P.N.P.

Most patients who sustain mild traumatic brain injuries (MTBI) recover fully, but as many as 15 percent experience persistent disabling problems.<sup>1</sup> Until recently, many school-age athletes, their families and their coaches did not recognize the potential risks of an MTBI—particularly if the athlete did not lose consciousness—so the athletes often resumed play immediately, to their detriment. Now a new Minnesota law requires medical evaluation post-concussion before student athletes return to play.

The law states that young athletes must be removed from play until they no longer exhibit concussion symptoms and behaviors. In addition, athletes must be evaluated by “a provider trained and experienced in evaluating and managing concussions” who must give the athlete “written permission to again participate in the activity” (Section 1. [121A.37] of Minnesota S.F. No. 612, at [www.revisor.mn.gov/laws/?id=90&year=2011&type=0](http://www.revisor.mn.gov/laws/?id=90&year=2011&type=0)). As a result of the law, primary care providers may see more patients in their practice who have experienced MBTIs. This article offers a practical guide for identifying and diagnosing MTBIs. In addition, it includes guidelines for managing injuries and referring patients who have prolonged symptoms.

## Identifying and Diagnosing MTBIs

MTBIs occur when an impact to the head or body causes the brain to quickly move forward and backward, striking the skull and injuring cells, nerves and blood vessels. When the brain hits the skull, the axons stretch or tear and the neurons fire simultaneously.

The injury is not only structural but also metabolic. The cells release potassium and take in calcium. The calcium makes it difficult for cells to produce adenosine triphosphate (ATP), and because the neurons consume glucose to absorb the potassium, the injury ultimately draws on the energy needed for cognition, healing and resisting the effects of another injury. The duration of symptoms varies widely: from minutes to days, weeks, months or—in extreme cases—even years. Children and adolescents may take longer than older patients to recover.

In the past, providers often used loss of consciousness as the hallmark of a concussion diagnosis. Today, however, providers recognize that patients who have MTBIs may or may not lose consciousness. In addition, the results of neuroimaging studies usually are within normal limits.

## Immediate Symptoms

Within 24 hours of an injury, patients may experience some or all of these symptoms:

- Disorientation, temporary confusion or a “dazed” feeling
- Dizziness
- Headache
- Memory problems, including amnesia around the time of injury
- Uncoordinated hand-eye movements
- Nausea and vomiting, which are most often related to blows to the back of the head

## Key Insights

- Patients who have MTBIs may or may not lose consciousness.
- The results of neuroimaging studies usually are within normal limits for patients with MTBIs.
- The neurometabolic cascade and imbalance of an MTBI may take days to subside.
- Children and adolescents may take longer to recover from MBTIs than adults do.
- The duration of MBTI symptoms varies widely—from minutes to days, weeks, months or even years.
- Patients who have experienced an MBTI should rest and refrain from cognitive, physical and social activities until their symptoms subside.
- Athletes are three times more likely to experience a repeated brain injury than nonathletes are.

## Acute Concussion Evaluation (ACE)

### Section A: Injury Characteristics

Date/Time of Injury: \_\_\_\_\_

Reporter:  Patient  Parent  Spouse  
 Other \_\_\_\_\_

#### 1. Injury Description

1a. Is there evidence of a forcible blow to the head (direct or indirect)?  Yes  No  Unknown

1b. Is there evidence of intracranial injury or skull fracture?  Yes  No  Unknown

1c. Location of Impact:  Frontal  Lft Temporal  
 Rt Temporal  Lft Parietal  Rt Parietal  
 Occipital  Neck  Indirect Force

2. Cause:  MVC  Pedestrian-MVC  Fall  
 Assault  Sports (specify) \_\_\_\_\_  
 Other \_\_\_\_\_

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

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

5. **Loss of Consciousness:** Did you/person lose consciousness?  
 Yes  No Duration \_\_\_\_\_

#### 6. EARLY SIGNS:

- Appears dazed or stunned
- Is confused about events
- Answers questions slowly
- Repeats Questions
- Forgetful (recent info)

7. **Seizures:** Were seizures observed?  
 No  Yes  
Detail \_\_\_\_\_

### Subsequent Symptoms

Warning signs that can appear hours or days after an injury include:

- Chronic headaches
- Fatigue
- Sleep difficulties
- Personality or behavioral changes
- Sensitivity to light or noise
- Dizziness when standing quickly
- A poor attention span
- Deficits in short-term memory, problem-solving and general academic functioning

Getting a comprehensive history is vital to determining the severity of a patient's concussion. The Acute Concussion Evaluation (ACE) form, issued by the Centers for Disease Control and Prevention, will help you establish the scope of the injury, so you can manage patients appropriately. Key sections of the form appear at left and on Page 3, and the form is available at [www.cdc.gov/concussion/headsup/pdf/ACE-a.pdf](http://www.cdc.gov/concussion/headsup/pdf/ACE-a.pdf).

Although describing the injury (Section A) is fairly straightforward, you may need to question patients and their families carefully to identify changes in cognitive abilities, emotional function and/or sleep patterns (Section B, Page 3). Symptoms may appear days or weeks after the injury, and patients might not realize that cognitive and emotional symptoms are related to the brain injury, so they may not report them.

The more specific your questions about symptoms are, the better. For example, to learn more about cognitive function, ask questions such as:

- "Do you have more difficulty following directions?"
- "Are you able to take notes in class?"

When asking about headaches or vision problems, ask if the symptoms worsen during various activities:

- "Do you notice any difficulty focusing on computer screens or texting?"
- "Do your headaches worsen while reading?"

To identify potential sleep difficulties, ask questions such as:

- "Do you have problems falling asleep?"
- "Do you wake up from a sound sleep and have trouble returning to sleep?"

While patients are in the early postinjury phase, they may have more difficulty answering your questions, because their cognitive process is impaired—a significant finding. For example, patients may have trouble finding the proper words and may need extra time to understand and answer your questions. Speak slowly and allow patients ample time to express themselves.

### Additional Risk Factors Affect Management

It is important to evaluate each episode of MBTI in the context of a patient's history of concussions, headaches and developmental or psychiatric issues (such as learning disabilities or depression). Patients with a history of those conditions may have a more complicated recovery, and that will affect your decisions about management.

Although second-impact syndrome is rare, it can be serious. Second-impact syndrome refers to a condition that might occur if a second brain injury takes place while someone is still experiencing symptoms and recovering

Excerpted from the Acute Concussion Evaluation (ACE) Physician/Clinician Office Version by Gerard Gioia, Ph.D. & Micky Collins, Ph.D., Children's National Medical Center, University of Pittsburgh Medical Center, available from the Centers for Disease Control and Prevention.

## Acute Concussion Evaluation (ACE)

### Section B: Symptom Check List

Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

Physical (10)		Cognitive (4)	
Headache	0 1	Feeling mentally foggy	0 1
Nausea	0 1	Feeling slowed down	0 1
Vomiting	0 1	Difficulty concentrating	0 1
Balance problems	0 1	Difficulty remembering	0 1
Dizziness	0 1		
Visual problems	0 1	Cognitive Total (0-4)	_____
Fatigue	0 1		
Sensitivity to light	0 1		
Sensitivity to noise	0 1		
Numbness/Tingling	0 1		
Physical Total (0-10)	_____		
Emotional (4)		Sleep (4)	
Irritability	0 1	Drowsiness	0 1
Sadness	0 1	Sleeping less than usual	0 1 N/A
More emotional	0 1	Sleeping more than usual	0 1 N/A
Nervousness	0 1	Trouble falling asleep	0 1 N/A
Emotional Total (0-4)	_____	Sleep Total (0-4)	_____

### Total Symptom Score (0-22)

Add Physical, Cognitive, Emotion and Sleep Totals)

### Exertion: Do these symptoms worsen with:

Physical Activity \_\_\_ Yes \_\_\_ No \_\_\_ N/A

Cognitive Activity \_\_\_ Yes \_\_\_ No \_\_\_ N/A

### Overall Rating: How different is the person acting compared to his/her usual self? (circle)

Normal 0 1 2 3 4 5 6 Very Different

from a previous concussion. A second impact can occur days or weeks after the first. Second impacts are more likely than initial impacts to cause brain swelling and other widespread damage, and second impacts can be fatal.

### Student Athletes May Downplay Symptoms

Because student athletes are eager to return to play, they may minimize the extent of their symptoms and be reluctant to allow enough recovery time. The likelihood of athletes experiencing an MBTI after an initial brain injury is three times that of experiencing the initial brain injury. Repeated injuries increase the risk of symptoms such as headaches, memory loss and difficulty concentrating, and they heighten chances that the patient will experience a serious and permanent brain injury.

## Current Approach to MTBI Management

In the past decade, research has shown that even MTBIs may have lingering effects on cognitive and physical function. In addition, the risks associated with repeated concussions point out the importance of careful management.

Management by monitoring is appropriate in the following circumstances:

- If the patient has few MBTI symptoms and they are mild
- If the patient's mild symptoms steadily improve or are completely gone within three to five days

While symptoms are present, or if cognitive testing indicates deficits, providers should educate patients so they understand that:

- 1- The recovery process must be gradual.** Skipping sports and physical education for a few hours or days is insufficient. Children and adolescents should not return to their activities until they are symptom-free. When patients return to their activities, they should do so slowly. Parents and health care providers should monitor the effect of resuming activity—if symptoms worsen, the patient needs to do less and rest more.
- 2- Rest is necessary for recovery.** Patients should get plenty of sleep and may need to take naps. If the patient's attention span or reaction time is affected, driving is not safe. Symptoms may return or worsen when patients are fatigued.
- 3- Patients should limit all of their activities—including cognitive, social, work and physical.** Teachers, coaches and employers should be informed that accommodations may be required.

## When to Refer a Patient to a Specialist

Often, sports-related concussions resolve without complications. If your patients' symptoms are mild and improve within three to five days after the injury, there is no need to refer the patient to a specialist. Consider referring MBTI patients when:

- Initial symptoms are moderate or severe
- Symptoms persist or worsen after three to five days

The Gillette Children's Specialty Healthcare Neurotrauma Clinic provides a multidisciplinary approach to caring for patients who have moderate to severe head and neck injuries. Depending on individual patient needs, the team may include pediatric rehabilitation medicine specialists, neurologists, neuropsychologists, psychologists, nurse practitioners, physical therapists, occupational therapists, and speech and language pathologists. The neurotrauma team designs care plans to help patients return to activities successfully.

<sup>1</sup> "Heads Up: Facts for Physicians About Mild Traumatic Brain Injury," Centers for Disease Control and Prevention

## Case Study – MBTI With Complications

### History

A 12-year-old girl was injured when she slipped and hit her head while playing with friends on a frozen pond. Initially, she had concussive symptoms, including memory loss, confusion, headaches, nausea, dizziness, visual difficulties and sensitivity to light and noise. She also had neck pain. She was examined by an ER physician who ordered a CT scan and an MRI. The tests showed no evidence of a hematoma.

Subsequently, the girl had difficulty returning to school, because of fatigue, headaches while reading and difficulty finding words. Physical activities also gave her a headache. She sought treatment from her primary health care provider, but the headaches, verbal issues and visual disturbances persisted, so she could not attend school full-time. Approximately six months post-injury, her primary care provider referred her to Gillette's Neurotrauma Clinic.

### Evaluation

Her Immediate Post-concussion Assessment and Cognitive Testing (ImPACT) scores indicated lower than expected results for a student with her academic standing. She was also evaluated by a speech and language pathologist, an occupational therapist and a physical therapist. Their assessments revealed that her language skills were significantly above average, except for verbal comprehension. Her visual-perceptual and vestibular skills were compromised and she was deconditioned.

### Treatment

Our occupational therapist set up a home program of organized visual activities to gradually increase the demand on visual-perceptual skills. The patient attended physical therapy for three sessions and continued therapy at home between appointments. Our speech and language pathologist provided school personnel with supported language suggestions to help address the patient's comprehension difficulties.

The patient's endurance has gradually improved and her visual challenges have decreased. Her headaches persist, but have diminished in intensity. She has been referred to our staff psychologist for pain management and is planning to return to school full-time after the semester break.

# Author PROFILES



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Angela Sinner, D.O., is a pediatric rehabilitation medicine specialist at Gillette. She has a special interest in spina bifida, neurotrauma and spasticity management. She received her doctor of osteopathic medicine degree from Des Moines University's College of Osteopathic Medicine in Des Moines, Iowa. She completed a physical medicine and rehabilitation

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Volume 20, Number 3 2011

**A Pediatric Perspective** focuses on specialized topics in pediatrics, orthopedics, neurology and rehabilitation medicine.

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## Gillette Discontinues Online Baseline Concussion Testing

Immediate Post-concussion Assessment and Cognitive Testing (ImPACT) is an important tool for evaluating the scope of traumatic brain injury, but the baseline results are most reliable when the baseline test is proctored. Consequently, the baseline portion of the test will no longer be offered online at Gillette.

Instead, we recommend that primary care providers, coaches, athletic associations and teams work directly with ImPACT personnel to develop baseline testing programs in their schools or communities. Gillette will continue to provide interdisciplinary neurological assessments of people who have experienced a concussion, and postinjury ImPACT testing will remain one of our neurocognitive assessment tools.

## Neurotrauma Webinar Available for Clinicians

Gillette offers an on-demand webinar for providers interested in learning more about treating neurotrauma. The webinar provides participants with an understanding of the pathophysiology of a brain injury, appropriate assessment techniques, neurocognitive screening tools, postinjury management strategies and return-to-play guidelines. The webinar training is eligible for CME credit. Please visit [www.gillettechildrens.org/Neurotrauma](http://www.gillettechildrens.org/Neurotrauma) to learn more.

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