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 10 percent experience persistent disabling problems. 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—on the activities 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 concussive 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 121A.57 of Minnesota S.F. No. 612, at www.revisor.mn.gov/laws/?id=90&year=2011&body=1). As a result of the law, primary care providers may see more patients in their practice who have experienced MTBIs. 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 bounces 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 even extreme cases—years. Children and adolescents may take longer to recover than adults do.

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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 bounces the skull, the axons stretch or tear and the neurons fire simultaneously.

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In the past, providers often used loss of consciousness as the hallmark of a concussion diagnosis. Today, however, providers recognize that some MTBIs 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

Gillelee Discontinues Online Baseline Concussion Testing
Immediate Post-concussion Assessment and Cognitive Testing (InFACT) 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 InFACT 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 InFACT 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 to learn more.

To obtain back issues of A Pediatric Perspective, log onto Gillette’s website at www.gillettechildrens.org/pediatricperspective back issues from the present are available.
### Acute Concussion Evaluation (ACE)

**Section A: Injury Characteristics**

**Date/Time of Injury:**

**1a. Location of Injury:**

**1b. Is there evidence of intracranial injury or skull fracture?**

**1c. Location of Impact:**

**2. Headache:**

**3. Loss of consciousness:**

**4. Amnesia After (Bilateral):**

**5. Loss of Consciousness:**

**6. EARLY SIGNS:**

**7. Seizures:**

### Physical (15) vs. Cognitive (4)

<table>
<thead>
<tr>
<th>Physical (0-15)</th>
<th>Cognitive (0-4)</th>
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### Acute Concussion Evaluation (ACE)

**Section B: Symptom Check List**

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

### Emotional (4) vs. Sleep (4)

<table>
<thead>
<tr>
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### Exercise: Do these symptoms worsen?

**Cognitive Activity**

| Overall Rating: How is the person functioning compared to his/her usual self? |

### 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.

### Monitoring by management is appropriate in the following circumstance.

- If the patient has few MTBI symptoms and they are mild
- If the patient’s mild symptoms usually improve or are completely gone within three to five days

### While symptoms are present, or if cognitive testing indicates a delay in daily activities, providers should do the following so they understand that:

- **1. The recovery process is not gradual.** Skipping sports and physical education for a few hours or days is insufficient. Children and adolescents should not return to their activities or classes until symptoms are resolved. When patients return to their activities, they should do so slowly. Patients and health care providers should monitor the effect of resuming activity—al symptoms worsen, the activity needs to be stopped.
- **2. It 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

- **Ongoing problems**
- **More severe symptoms**
- **Symptoms persist or worsen after three to five days**

### The Gillette Children’s Specialty Healthcare Neurotrauma Clinic provides comprehensive care for patients who have moderate to severe head and neck injuries. Depending on individual patient needs, the team may include pediatric rehabilitation physicians, pediatric 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.

### Additionals Rollover Factors Affect Management

- **Acute imbalance—**causes them to feel off balance or unsteady.
- **Level of consciousness—**difficult to assess.
- **Eye movement—**difficult to assess.
- **Nausea/nausea—**difficult to assess.
- **Nervousness—**difficult to assess.
- **Overall Rating:** How is the person functioning compared to his/her usual self?

### Additional Risk Factors Affect Management

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### Case Study – MTBI With Complications

**History**

A 12-year-old girl was injured when she slipped and hit her head while playing with friends on a snow hill. Primarily, she had concussion symptoms, including memory loss, confusion, headaches, nausea, deconditioning 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 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 (HPACT) results 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. Her 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 improve his visual skills and 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 the patient with supportive language suggestions to help address the patient’s comprehension difficulties.

The patient’s endurance has gradually improved, and his visual challenges have decreased. His headaches persist, but his level of attention has improved to the extent that he can manage his schoolwork. His teachers, coaches and employers should be informed that accommodations may be required. He has been referred to occupational therapy for additional support and guidance for proper management of his visual difficulties. He has been referred to occupational therapy for additional support and guidance for proper management of his visual difficulties.

### Additional Risk Factors Affect Management

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### Case Study – MTBI With Complications

**Repeat:**

- **Ongoing problems**
- **More severe symptoms**
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- **Overall Rating:** How is the person functioning compared to his/her usual self?
Acute Concussion Evaluation (ACE)

Section A: Injury Characteristics

Date/Time of Injury:

Reported by: [Patient] [Parent] [Spouse]

1. Injury Description

1a. Is there evidence of concussion or loss of consciousness?
   [Yes] [No] [Unsure]

1b. Is there evidence of intracranial injury or skull fracture?
   [Yes] [No] [Unsure]

Fracture Location:

[ ] Lt Temporal
[ ] Rt Temporal
[ ] Lt Parietal
[ ] Rt Parietal

2. Cause:

[ ] MVC
[ ] Pedestrian/MVC
[ ] Fall
[ ] Assault
[ ] Sports (activity)
[ ] Other ________________________________

3. Amnesia Before (Begram): Are there any events just before the injury that you/your patient had no memory of less than 5 minutes?
   [Yes] [No] [Duration ____________________________]

4. Amnesia After (Atergme): Are there any events just after the injury that you/your patient had no memory of less than 5 minutes?
   [Yes] [No] [Duration ____________________________]

5. Loss of Consciousness: Did your patient lose consciousness?
   [Yes] [No] [Duration ____________________________]

6. EARLY SIGNS

[ ] Appears dazed or stunned
[ ] Inconsolable
[ ] Uncontrollable crying
[ ] Uncontrollable laughing
[ ] Repeated Questions
[ ] Forgetful (inconsistently)

7. Seizures: Were seizures observed?
   [Yes] [No] [Duration ____________________________]

8. Headache(s): Present?
   [Yes] [No] [Unsure]

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
• Nausea with vomiting 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/handout/pdf/ACE.pdf.

We refer patients with concussions to the ACE form as a useful tool to assess and manage symptoms. The ACE is a “‘Do your headaches worsen while reading?’ ‘Do you have problems falling asleep?’ ‘Do you wake up from a sound sleep and have trouble returning to sleep?’ ‘Do you 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 process the questions and respond.’

Additional Risk Factors Affect Management

It is important to evaluate each episode of MTBI in the context of the patient’s history of concussion, 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 priorities for returning to school or work.

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 from a previous concussion. A second impact can occur days or weeks after the first. Second impacts are more likely than initial impacts to lead to serious injury, including death.

Student Athletes May Develop 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 experiencing an MTBI after an initial brain injury is three times that of experiencing the initial brain injury. Repeated impacts 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.

Acute Concussion Evaluation (ACE)

Section B: Symptom Check List

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

[ ] Presence of some symptom [ ] None of these symptoms

Physical (15) 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 0 1
Vision problems 0 1 0 1
Fatigue 0 1 0 1
Sensitivity to light 0 1 0 1
Sensitivity to sound 0 1 0 1
Numbness/Tingling 0 1

Total Physical (0-10) Emotional (0-11) Sleep (0-4)

Physical Total (0-10) 0 0 0 0
Emotional Total (0-11) 0 0 0 0
Sleep Total (0-4) 0 0 0 0

Emotionality: 0 1 2 3 4 5 6

Overall Rating: How different is the person acting compared to his/her usual self? [0-6]

Normal 0 1 2 3 4 5 6

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

• Deficits in short-term memory
• Problem solving
• General academic functioning

Management by monitoring is appropriate in the following circumstances:

• If the patient has few MTBI symptoms and they are mild
• If the patient’s mild symptoms usually improve or are completely gone within three to five days

While symptoms are present, or if cognitive testing indicates a deficit, a detailed provider evaluation is warranted so that they understand:

1. The recovery process is gradual. Skipping sports and physical education for a few hours or days is insufficient. Children and adolescents should not return to their activities or school until all symptoms disappear. When patients return to their activities, they should do so slowly. Patients and health care providers should monitor the effect of resuming activity—some symptoms worsen, the patient needs memory and emotional symptoms and are related to the brain injury, so they may not report them.

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

• “Do you have any difficulty following directions?”
• “Are you able to take notes in class?”
• “Do you notice any difficulty focusing on computer screens or testing?”
• “Do your headaches worsen while reading?”
• “Do you have problems finding words?”

While patients are in the early postinjury phase, they may have more difficulty answering your questions, because their cognitive process is impaired. 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 process the questions and respond.

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1. “Head Up: Facts for Physicians About MTBI Traumatic Brain Injury,” Center for Disease Control and Prevention

Case Study – MTBI With Complications

History

A 12-year-old girl was injured when she slipped and hit her head while playing with friends on a snow-covered hill. On initial evaluation, she had concussion symptoms, including memory loss, confusion, headaches, nausea, dizziness 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 activity also gave her a headache. She sought treatment from her primary 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 (CloseCPT) 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. Her 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 tasks to address both visual and non-visual 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 structured visual and 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 decreased in intensity. She now returns to school full-time.

Acknowledged from the Acute Concussion Evaluation (ACE). Children’s National Medical Center, University of Pittsburgh Medical Center, available from the Centers for Disease Control and Prevention (CDC). Children’s National Medical Center, University of Pittsburgh Medical Center, available from the CDC.

Prepared by: Gerard Gioia, Ph.D. & Mickey Collins, Ph.D., Children’s National Medical Center, University of Pittsburgh Medical Center, available from the CDC.
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Section A: Injury Characteristics
Date/Time of Injury:

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<tr>
<th>Reporter:</th>
<th>Patient</th>
<th>Parent</th>
<th>Spouse</th>
</tr>
</thead>
</table>

1. Injury Description
1a. Is there evidence of a forcible blow to the head (direct or indirect)?
1b. Is there evidence of intracranial injury or skull fracture? 

2. Cause:

3. Amnesia Before (Begatome): Are there any events just prior to the injury that your patient has no memory of? 

4. Amnesia After (Artercome): Are there any events just prior to the injury that your patient has no memory of? 

5. Loss of Consciousness: Did the patient lose consciousness? 

6. EARLY SIGNS

7. SEQUELAE: Were there any events observed? 

Additional Risk Factors Affect Management

It is important to evaluate each episode of MTBI in the context of the patient’s history of concussion, 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 recovery time. Therefore, it is important to consider the patient’s overall health.

Adolescent and young adult impacts are rare. It can be serious. Severe, complicated syndromes refer to a condition that might occur if a second brain injury takes place while someone is still experiencing symptoms and recovering from a previous concussion. A second impact can occur days or weeks after the first. Second impacts are more likely to impact the patient’s ability to perform daily activities and other widespread damage, and can impact cognitive and emotional functioning.

Student Athletes May Develop Symptoms

Because student athletes are eager to return to play, they may minimize the extent of their symptoms and be reluctant to allow sufficient time for rest and recovery. The likelihood of experiencing symptoms is higher after an initial brain injury in the absence of sleep or rest. Patients who have experienced these symptoms may be at risk of developing persistent symptoms. Therefore, it is important to ensure that patients have adequate rest and recovery time before returning to play.

Current Approach to MTBI Management

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

Management by monitoring is appropriate in the following circumstances:

1. If the patient has few MTBI symptoms and they are mild
2. If the patient’s mild symptoms usually improve or are completely gone within three to five days

While symptoms are present, or if cognitive testing indicates a deficit, further evaluation and management should be considered. The following steps outline the protocol:

1. The recovery process must not 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 their cognitive and emotional symptoms improve. When patients return to their activities, they should do so slowly. Parents and health care providers should monitor the effect of returning to activity— especially cognitive symptoms. The patient should provide no memory of the environmental and brain injury associated with the injury.

2. It 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 do not lead to complications. If your patient’s 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 MTBI 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 free, interdisciplinary approach for caring for patients who may have moderate to severe headache and neck injuries. Depending on individual patient needs, the team may include pediatric rehabilitation physicians, occupational therapists, speech-language pathologists, nurse practitioners, physical therapists, neuropsychologists, and child psychologists. The neurotrauma team designs care plans to help patients return to activities successfully.

*“Heads Up: Facts for Physicians About Mild Traumatic Brain Injury,” Center for Disease Control and Prevention

Case Study – MTBI With Complications

History

A 12-year-old girl was evaluated when she slipped and hit her head while playing with friends on a frozen pond. Initially, she had no symptoms, including memory loss, confusion, headaches, nausea, dizziness 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 did feel 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 care provider, but headaches, the 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. Her evaluations 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 help address the patient’s visual-perceptual needs. She was referred to a school-based occupational therapist who provided gut practice. Despite potential difficulties, the patient was able to maintain her interest in the program.

The patient’s endurance has improved and her visual challenges have decreased. Her headaches persist, but have diminished in intensity over time. She was referred to our staff psychologist for pain management and is planning to return to school full-time later this semester.
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Most patients who sustain mild traumatic brain injuries (MTBI) recover fully, but as many as 15 percent experience persistent disabling problems. 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—on the athletic field. 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 concussive 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 121A.57) of Minnesota S. F. No. 52, at www.revisor.mn.gov/laws/?id=90&year=2011&mode=1)

As a result of the law, primary care providers may see more patients in their practice who have experienced MTBIs. 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 injury cells, nerves, and blood vessels. When the brain hits the skull, the atoms stretch or tear and the nerves fire simultaneously.

The injury is not only structural but also metabolic. The cells release potassium and calcium in the brain. 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—extreme cases—even years. Children and adolescents may take longer to recover than adults do.

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In the past, providers often used loss of consciousness as the hallmark of a concussion diagnosis. Today, however, providers recognize that loss of consciousness may or may not lose consciousness. In addition, the results of neuroimaging studies usually are not 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 lack of the head

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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 closely with ImPACT personnel to develop baseline testing programs in their schools or communities. Gillette will continue to provide inter-disciplinary neurological assessments of people who have experienced a concussion, and post-injury ImPACT testing will remain one of our neurocognitive assessment tools.

To obtain back issues of A Pediatric Perspective, log on to Gilbert’s website at www.gillettchildrens.org/pediatrics/perspective. Issues from 1999 to the present are available.

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, post-injury management strategies and return-to-play guidelines. The webinar training is eligible for CME credit. Please visit www.gillettchildrens.org/Neurotrauma to learn more.
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Management of Mild Traumatic Brain Injuries Has Evolved

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

Most patients who sustain mild traumatic brain injuries (MTBI) recover fully, but as many as 12 percent experience persistent disabling problems. Furthermore, 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—on the field at the time of injury. 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 concussive 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.”

In contrast to Minnesota, the states of Maine, Oklahoma, Texas, Kentucky and Michigan have established programs that require all athletes participating in high school football, soccer, rugby, hockey, and wrestling to undergo a baseline neurocognitive assessment to identify MTBI and are required to undergo a follow-up test after an injury. The law also prohibits a child from returning to the game without proper evaluation and clearance. If a child exhibits any of the symptoms described below, then he or she must be removed from the game.

Most children sustain MTBIs at home, school or play, and the typical patient seen by a primary care provider is under 10 years old. MTBIs are the most common cause of traumatic brain injury in children and one of the leading causes of disabilities in the United States. The cost of treating children with MTBIs is estimated at $5 billion per year. These injuries can lead to permanent disabilities, such as learning difficulties, behavioral problems and emotional disturbances. The mnemonic C.D.O.T. (confusion, disorientation, amnesia and lack of consciousness) was developed by Dr. Barry Maroon of the University of Pittsburgh and is still widely used to identify MTBI.

Many clinicians and researchers believe the number of MTBIs and the tools to care for these patients have increased over the last 15 years.

Recently, the American Academy of Neurology has published a series of documents that define MTBIs, outline the clinical features and describe a management protocol. The most recent document, released in 2009, is titled “Headache, Mild Traumatic Brain Injury, and the Recognition and Management of Concussion in Sports.”

According to the Centers for Disease Control and Prevention’s Neurotrauma Corner, the most common causes of MTBIs in children are falls, motor vehicle crashes, assault, and sports-related injuries. In children under 10 years old, sporting events account for 68 percent of MTBIs, which is consistent with the Minnesota law. In 2009, 14,000 high school football players in Minnesota were examined for concussions, with more than 1,000 diagnosed with MTBIs.

In the past, most clinicians believed that many MTBIs were benign and that the recovery was rapid. More recently, however, it has become clear that many MTBIs lead to long-term disabilities that may not become evident for many years. In addition, the results of new imaging studies usually are within normal limits for patients with MTBIs. The neuroendocrine cascade and imbalance of an MTBI may take days to weeks, even months.

There is no clear consensus on the best treatment approach for MTBIs. The consensus is to identify an MTBI and monitor the patient for the duration of symptoms. The patient may require observation, counseling, cognitive training and physical therapy. The patient should refrain from taking part in any activities that risk future head injury.

The American Academy of Neurology recently published a series of documents that define MTBIs, outline the clinical features and describe a management protocol, which is widely used to identify MTBI.