

## HEAD INJURY/CONCUSSIONS

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### OVERVIEW

Although most head injuries and concussions are mild, they are potentially serious and may result in death or have long term serious negative consequences. These include:

- Changes in the ability to learn, communicate and think
- Increased mental health problems- depression, anxiety, personality changes, aggression, acting out, and social inappropriateness
- Traumatic brain injury can also cause epilepsy and increase the risk for conditions such as Alzheimer’s disease, Parkinson’s disease, and other brain disorders that become more prevalent with age
- Relative to sports, data shows that many catastrophic head injuries are a direct result of injured athletes returning to play too soon, not having fully recovered from the first head injury. (From California Interscholastic Federation (CIF) - “All concussions are potentially serious and may

result in complications including prolonged brain damage and death if not recognized and managed properly. In other words, even a “ding” or a bump on the head can be serious. .... most sports concussions occur without loss of consciousness.”

## Definitions

### Head injury

Medline Plus - <http://www.nlm.nih.gov/medlineplus/ency/article/000028.htm> )

A head injury is any trauma that injures the scalp, skull, or brain. The injury may be only a minor bump on the skull or a serious brain injury. Head injury can be either closed or open (penetrating).

Head injuries include:

- Concussion
- Scalp wounds
- Skull fractures

Concussion- (from Latin word *concutere* - “shake violently”)

Medline Plus <http://www.nlm.nih.gov/medlineplus/ency/article/000799.htm>

A concussion is a minor traumatic brain injury (TBI) that may occur when the head hits an object, or a moving object strikes the head. It can affect how your brain works for a while. A concussion can lead to a bad headache, changes in alertness, or loss of consciousness.

### Traumatic Brain Injury (TBI)

Centers for Disease Control & Prevention (CDC) <http://www.cdc.gov/traumaticbraininjury/>

A TBI is caused by a bump, blow or jolt to the head or a penetrating head injury that disrupts the normal function of the brain. The severity of a TBI may range from “mild,” i.e., a brief change in mental status or consciousness to “severe,” i.e., an extended period of unconsciousness or amnesia after the injury. The majority of TBIs that occur each year are concussions or other forms of mild TBI.

### Severe TBI

**Closed** – an injury to the brain caused by movement of the brain within the skull. Causes may include falls, motor vehicle crash, or being struck by or with an object.

**Penetrating** – an injury to the brain caused by a foreign object entering the skull. Causes may include firearm injuries or being struck with a sharp object.

## Incidence (TBI)

- According to the CDC, each year, an estimated 1.7 million people sustain a TBI annually.
- TBI is a contributing factor to a third (30.5%) of all injury-related deaths in the United States.

- About 75% of TBIs that occur each year are concussions or other forms of mild TBI.

### **Leading Causes of TBI**

- Falls (35.2%)
  - Falls cause half (50%) of the TBIs among children aged 0 to 14 years
- Motor vehicle – traffic (17.3%)
  - Motor vehicle- traffic crashes resulted in the largest percentage of TBI-related deaths (31.8%)
- Struck by/against events (16.5%)
  - Struck by/against events were the second leading cause of TBI among children aged 0 to 14 years

High School sports most implicated with concussions/TBI include (top 5):

- Football
- Girls' soccer
- Boys' lacrosse
- Boys' soccer
- Girls' basketball

<http://pediatrics.aappublications.org/content/126/3/597.full.pdf+html>

- Assaults (10%)
  - Assaults produced 10% of TBIs in the general population; they accounted for only 2.9% in children aged 0 to 14 years

The above estimates do not include TBI from military blasts. For more information about TBI in the military including an interactive website for service members, veterans, and families and caregivers, please visit: [www.TraumaticBrainInjuryAtoZ.org](http://www.TraumaticBrainInjuryAtoZ.org) . Another site is the Defense and Veterans Brain Injury Center [www.dvbic.org](http://www.dvbic.org)

### **TBI by Age**

- Children aged 0 to 4 years, older adolescents aged 15 to 19 years, and adults aged 65 years and older are most likely to sustain a TBI.
- Almost half a million (473,947) emergency department visits for TBI are made annually by children aged 0 to 14 years.
- Adults aged 75 years and older have the highest rates of TBI-related hospitalization and death.

### **TBI by Gender**

- In every age group, TBI rates are higher for males than for females.

- Males aged 0 to 4 years have the highest rates of TBI-related emergency department visits, hospitalizations, and deaths.

<http://www.cdc.gov/traumaticbraininjury/statistics.html>

## Signs/Symptoms

The symptoms of a head injury can occur right away, or develop slowly over several hours or days and can last for weeks to months. Even if the skull is not fractured, the brain can bang against the inside of the skull and be bruised. The head may look fine, but problems could result from bleeding or swelling inside the skull.

### Concussion Early Symptoms (minutes to hours)

- Headache
- Vertigo (dizziness)
- Nausea
- Vomiting /**repeated vomiting\***
- **Disorientation (acting confused, feeling spacey, or not thinking straight)\***
  - Place
  - Date
  - Time
- **Changes in alertness and consciousness \***
- **Convulsions (seizures)\***
- **Muscle weakness on one or both sides\***
- **Unequal pupils\***
- **Unusual eye movements\***
- **Walking problems\***

**\* Emergency symptoms of a concussion. Seek immediate medical care**

## First Aid

- Check the person's airway, breathing, and circulation. If necessary, begin rescue breathing and CPR.
- If the person's breathing and heart rate are normal but the person is unconscious, treat as if there is a spinal injury.
  - Stabilize the head and neck by placing your hands on both sides of the person's head, keeping the head in line with the spine and preventing movement.
  - Wait for medical help.

- Stop any bleeding by firmly pressing a clean cloth on the wound. If the injury is serious, be careful not to move the person's head.
    - If blood soaks through the cloth, do NOT remove it. Place another cloth over the first one.
  - If you suspect a skull fracture, do NOT apply direct pressure to the bleeding site, and do NOT remove any debris from the wound. Cover the wound with sterile gauze dressing.
  - If the person is vomiting, roll the head, neck, and body as one unit to prevent choking. This still protects the spine, which you must always assume is injured in the case of a head injury. (Children often vomit once after a head injury. This may not be a problem, but call a doctor for further guidance.)
  - Apply ice packs to swollen areas.
- Do NOT wash a head wound that is deep or bleeding profusely.
  - Do NOT remove any object sticking out of a wound.
  - Do NOT move the person unless absolutely necessary.
  - Do NOT shake the person if he or she seems dazed.
  - Do NOT remove a helmet if you suspect a serious head injury.
  - Do NOT pick up a fallen child with any sign of head injury.

Medline Plus – First Aid <http://www.nlm.nih.gov/medlineplus/ency/article/000028.htm>

**Centers for Disease Control & Prevention (CDC) recommended steps:**

1. Observe student for signs and symptoms of concussion for a minimum of 30 minutes.
2. Complete the *Concussion Signs and Symptoms Checklist* and monitor students consistently during the observation period. The form includes an easy-to-use checklist of signs and symptoms that you can look for when the student first arrives at your office, fifteen minutes later, and at the end of 30 minutes, to determine whether any concussion symptoms appear or change.
3. Notify the student's parent(s) or guardian(s) that their child had an injury to the head. (Phone call)
  - If signs or symptoms are present: refer the student right away to a health care professional with experience in evaluating for concussion. Send a copy of the *Concussion Signs and Symptoms Checklist* with the student for the healthcare professional to review. Students should follow their health care professional's guidance about when they can return to school and to physical activity.
  - If signs or symptoms are not present: the student may return to class, but should not return to sports or recreation activities on the day of the injury. Send a copy of the *Concussion Signs and Symptoms Checklist\** with the student for their parent(s) or guardian(s) to review

and ask them to continue to observe the student at home for any changes. Explain that signs and symptoms of concussion can take time to appear. Note that if signs or symptoms appear, the student should be seen right away by a healthcare professional with experience in evaluating for concussion.

- CDC Fact Sheet for School Nurses  
[http://www.cdc.gov/concussion/pdf/tbi\\_factsheet\\_nurse-508-a.pdf](http://www.cdc.gov/concussion/pdf/tbi_factsheet_nurse-508-a.pdf)
- CDC Fact Sheet for Teachers, Counselors, and School Professionals  
[http://www.cdc.gov/concussion/pdf/TBI\\_factsheet\\_TEACHERS-508-a.pdf](http://www.cdc.gov/concussion/pdf/TBI_factsheet_TEACHERS-508-a.pdf)
- Concussion Signs and Symptoms Checklist  
[http://www.cdc.gov/concussion/pdf/TBI\\_schools\\_checklist\\_508-a.pdf](http://www.cdc.gov/concussion/pdf/TBI_schools_checklist_508-a.pdf)

\*Note- the *Concussion Signs and Symptoms Checklist* is only available in English. Alternate parent/guardian notification forms are available in this section (see forms).

## **Follow-up and educational implications**

For a mild head injury, no treatment may be needed. However, the symptoms of a serious head injury can show up later. As a result:

Parents or caregivers of children will need to learn how to watch the child after a head injury, and know when the child can go back to being active and taking part in sports.

Due to possible long term effects of a TBI, students may need accommodations upon return to school. By addressing student needs early, long term difficulties may be prevented.

The following is taken directly from <http://www.brainline.org/content/2010/06/reentry-to-school-after-a-concussion-or-closed-brain-injury.html> :

“Creating a system to identify and track students who are returning to school after a concussion or closed brain injury is an important step to helping them. Often students return to school with subtle cognitive, academic, or behavioral needs. By addressing these changes and meeting students’ needs soon after their return to school, many long-term difficulties can be prevented.”

*Identification* - Initially, it is important to inform a designated person in the school that a student has had a possible brain injury which will most likely resolve over a few days. The identified person then watches for any of the possible red flags listed below:

- Increased absences
- Cognitive difficulties compared to pre-injury performance
- Trouble paying attention

- Difficulty remaining on task
- Slowed responses and/or processing of information
- Difficulty shifting attention
  - from task to task or from topic to topic in conversations
  - reduced mental flexibility
- Organization challenges
- Reduced academic performance
- Social difficulties compared to pre-injury
  - Impulsive behaviors
  - Initiation difficulties (trouble starting things)
  - Changes in mood
  - Depression
  - Defiance
  - Fatigue
  - Confusion

**Accommodations** - If red flags appear, the designated staff person can alert the teacher to minimal temporary accommodations for the brief time that symptoms exist. Such accommodations might include:

- Reduced assignment load
- Increased time to complete assignments or exams
- Use of an organizer to track assignments
- Check with teacher at the end of the day to make sure assignments are recorded
- Rest periods during the day
- Directions in both oral and written formats
- Clear expectations
- Large tasks broken into smaller components

If the student continues to have academic difficulty after a month, the student's concerns should be further evaluated by a team, and the evaluation process for more formalized support such as a 504 plan or IEP begun. At this point, gathering more information about TBI and/or contacting a person who is knowledgeable about TBI to participate in planning is advisable.

This information was synthesized from Ylvisaker, M., *Traumatic Brain Injury Rehabilitation*, 2nd ed. Pages 381–384.”

## Sports

### *Education Code*

In 2011 California Assembly Bill 25 (A.B. 25) added to the education code (E.C. 49475) a mandate that schools must now follow:

- On a yearly basis, a concussion and head injury information sheet shall be signed and returned by the athlete and the athlete's parent or guardian before the athlete's initiating practice or competition.
- An athlete who is suspected of sustaining a concussion or head injury in an athletic activity shall be immediately removed from the activity for the remainder of the day, and shall not be permitted to return to the activity until he or she is evaluated by a licensed health care provider, trained in the management of concussions, acting within the scope of his or her practice. The athlete shall not be permitted to return to the activity until he or she receives written clearance to return to the activity from that licensed health care provider.

This section does not apply to an athlete engaging in an athletic activity during the regular school day or as part of a physical education course required pursuant to subdivision (d) of Section 51220.

### *Annual Notification*

San Diego County Office of Education- see listing under Annual Notification 2013-14 (Health Education, Pupil Services and Parents' and Students' Rights)

Mandatory Signature Forms for Athletes (English/Spanish)

<http://www.sdcoe.net/ssp/support/?loc=welfare&m=5>

### *California Interscholastic Federation (CIF)*

On May 7, 2010, the California Interscholastic Federation council passed by law 313;

A student-athlete who is suspected of sustaining a concussion or head injury in a practice or game shall be removed from competition at that time for the remainder of the day. A student-athlete who has been removed from play may not return to play until the athlete is evaluated by a licensed health care provider trained in the evaluation and management of concussion and **receives written clearance** to return to play from that health care provider.

*Written Clearance (CIF) – Return to Play Recommended*

*Form- Acute Concussion Evaluation (ACE) Care Plan -form:*

[http://205.214.168.16/health\\_safety/concussion/ACE\\_CarePlan.pdf](http://205.214.168.16/health_safety/concussion/ACE_CarePlan.pdf)

Once a person suffers a concussion, he or she is more likely to sustain a second one. After several concussions, it takes less of a blow to cause the injury and requires more time to recover.

## **Second Impact Syndrome**

- Occurs within minutes of a concussion in an athlete still symptomatic from a previous brain injury suffered minutes, days, or weeks before
- Vascular engorgement leads to massive increase in intracranial pressure and brain herniation resulting in severe brain damage or death
- May occur with associated small subdural hematoma
- Except for boxing, most cases in literature occur in adolescents

A second concussion suffered before a previous one has completely healed can lead to a catastrophic injury called second impact syndrome (SIS). SIS is characterized by rapid swelling of the brain after injury, requiring immediate, emergency surgery. Many who suffer SIS do not survive, and those that do are often permanently neurologically impaired. SIS is preventable.

The second injury can be caused by a seemingly minor blow, and although most cases involve adolescents, it is impossible to predict who will suffer SIS and who will not.

Second impact syndrome is very rare.

Messaging to parents: *“Don't take a chance. Make sure your child's concussion has completely healed before they return to physical activity.”*

## **Prevention**

Any athlete who still shows signs of concussion should not be allowed to return to play. Such signs include fatigue, headache, disorientation, nausea, vomiting, feeling “in a fog” or “slowed down,” as well as other differences from a patient’s baseline. If there are any doubts about the severity of injury, the patient or athlete should not be allowed to resume play.

“The difficulty lies in deciding the appropriate return to play when the athlete is completely asymptomatic. Parents, teachers and the coach must observe the athlete closely. High school athletes and those with scholarship possibilities, especially, will try to convince parents and coaches that they feel fine, in order to resume play. There are differences of opinion as to when it is appropriate for a post-concussive patient to resume play. Currently the guidelines suggested by the American Academy of Neurology are the most widely disseminated and used.” (West J Emergency Med. 2009 February; 10(1): 6–10. Second Impact Syndrome, Tareg Bey, MD\* and Brian Ostick, MD†)

Guidelines for the Management of Sport-Related Concussion. These guidelines reflect the latest consensus opinion and are not evidence based. Adapted from the American Academy of Neurology guidelines where newer guidelines are expected to be published in the future. (<http://www.aan.com>)

Symptoms	First Concussion	Second Concussion
<u>Grade 1</u> : No loss of consciousness, transient confusion, resolution of symptoms and mental abnormalities in <15 min	Remove from play. Examine at 5-min intervals. May return to play if symptoms disappear and results of mental-function exam return to normal within 15 min	Allow return to play after 1 week if there are no symptoms at rest or with exertion.
<u>Grade 2</u> : as above, but with mental symptoms for >15 min	Remove from play and disallow play for rest of day. Examine for signs of intracranial lesion at sidelines and obtain further exam by a trained person the same day. Allow return to play after 1 week if neurological exam is normal.	Allow return to play after 2-week period of no symptoms at rest or with exertion. Remove from play for season if imaging shows abnormality.
<u>Grade 3</u> : any loss of consciousness (LOC)	Perform thorough neurological exam in hospital and obtain imaging studies when indicated. Assess neurologic status daily until post-concussive symptoms resolve or stabilize. Remove from play for 1 week if LOC lasts seconds; for 2 weeks if it lasts minutes; must be asymptomatic at rest and with exertion to return to play.	Withhold from play until symptoms have been absent for at least 1 month.

The best and most sensible approach to prevention is to prevent the first concussion. Experts advise wearing a helmet during high-impact contact sports and preventing or mitigating especially head-to-head contact. The prevention of high impacts during sport is the goal for young athletes. When in doubt after a severe concussion, the athletes should not resume play. *“When in doubt, sit them out.”*

<http://www.sportsconcussions.org/ibase/second-impact-syndrome.html>

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2672291/>

## Resources

### *School Resources*

CIF <http://www.cifstate.org/index.php/the-latest-news/concussions>

CDC “Heads Up- Schools” <http://www.cdc.gov/concussion/HeadsUp/schools.html>

CDC “Heads Up- Youth Sports” <http://www.cdc.gov/concussion/HeadsUp/youth.html>

CDC “Head Up- High School Sports” [http://www.cdc.gov/concussion/HeadsUp/high\\_school.html](http://www.cdc.gov/concussion/HeadsUp/high_school.html)

American Academy of Neurology - Sports Concussion Toolkit

<http://www.aan.com/go/practice/concussion>

### *Assessment Tools*

Sports Concussion Assessment Tool 2 (SCAT 2) - <http://www.cces.ca/files/pdfs/SCAT2%5B1%5D.pdf>

IMPACT Test <http://www.impacttest.com/>

Glasgow Coma Scale <http://www.brainline.org/content/2010/10/what-is-the-glasgow-coma-scale.html>

### *For Health Professionals*

Heads Up to Clinicians: Addressing Concussion in Sports among Kids and Teens

[www.preventingconcussions.org](http://www.preventingconcussions.org)

CDC “Heads Up- Brain Injury in Your Practice”

[http://www.cdc.gov/concussion/HeadsUp/physicians\\_tool\\_kit.html](http://www.cdc.gov/concussion/HeadsUp/physicians_tool_kit.html)

### *Additional References/Resources:*

*Sport-Related Concussion in Children and Adolescents*

DOI: 10.1542/peds.2010-2005

Pediatrics 2010;126;597; originally published online August 30, 2010;

Mark E. Halstead, Kevin D. Walter and The Council on Sports Medicine and Fitness

<http://pediatrics.aappublications.org/content/126/3/597.full.pdf>

Brain Injury Resource Center

<http://www.headinjury.com/>

CDC- Learn to Prevent & Recognize Concussions

<http://www.cdc.gov/features/concussion/>

CDC- Traumatic Brain Injury

<http://www.cdc.gov/traumaticbraininjury/>

Medline Plus- Concussion

<http://www.nlm.nih.gov/medlineplus/ency/article/000799.htm>

Head Injuries in Football, New York Times, 12/10/12

*In the news (2012)*

[http://topics.nytimes.com/top/reference/timestopics/subjects/f/football/head\\_injuries/index.html](http://topics.nytimes.com/top/reference/timestopics/subjects/f/football/head_injuries/index.html)

### **Legal References**

Education Code - Section 49475