About Brain Injury

The Brain Injury Association of America and its state affiliates strive to connect people with useful, accurate information and resources in their area. If you or a family member are struggling with the effects of a brain injury, or think you may have sustained a brain injury, there is help. Here are some useful first steps:

- Contact your State Brain Injury Association. The Brain Injury Association state offices will have information about Programs, support groups, and resources that could be helpful to you. They understand brain injury, and understand the resources available. Use that resource!
- Use this website as a starting point. Brain injury can be complex and overwhelming. We are here to help. Use the navigation menu to the left to find information that might be useful to you. Contact us if you can’t find it!
- Find a list of common issues and suggested publications on our “community” page.
- Find some personal stories in our Marketplace. Read about other people’s experiences with recovery from a brain injury.
- Remember that not all the information you read will be relevant to you. Take what you need and leave the rest.
- Understand that recovery after a brain injury is a journey. You do not have to go it alone. Come back to the website or contact us for different information as you move along your journey.

This page offers helpful definitions and terms you might hear used. Use this page to help you understand brain injury a little better. Use the resources on other pages as well.

Definitions
- Types of brain injury
- Causes
- Outcomes
- Severity of brain injury
- Tips for recovery

Brain Injury Definitions

Traumatic Brain Injury (TBI)
TBI is defined as an alteration in brain function, or other evidence of brain pathology, caused by an external force.

Adopted by the Brain Injury Association Board of Directors in 2011. This definition is not intended as an exclusive statement of the population served by the Brain Injury Association of America.

Acquired Brain Injury
An acquired brain injury is an injury to the brain, which is not hereditary, congenital, degenerative, or induced by birth trauma. An acquired brain injury is an injury to the brain that has occurred after birth.

There is sometimes confusion about what is considered an acquired brain injury. By definition, any traumatic brain injury (eg, from a motor vehicle accident, or assault) could be considered an acquired brain injury. In the field of brain injury, acquired brain injuries are typically considered any injury that is non-traumatic. Examples of acquired brain injury include stroke, near drowning, hypoxic or anoxic brain injury, tumor, neurotoxins, electric shock or lightening strike.

Types of Brain Injury

- Diffuse Axonal Injury (TBI)
- Concussion (TBI)
- Contusion (TBI)
- Coup-contre coup injury (TBI)
- Second Impact Syndrome (TBI)
Open and Closed Head Injuries
Penetrating Injury (TBI)
Shaken Baby Syndrome (TBI)
Locked in Syndrome (TBI)
Anoxic brain injury (ABI)
Hypoxic brain injury (ABI)

Diffuse Axonal Injury

- A Diffuse Axonal Injury can be caused by shaking or strong rotation of the head, as with Shaken Baby Syndrome, or by rotational forces, such as with a car accident.
- Injury occurs because the unmoving brain lags behind the movement of the skull, causing brain structures to tear.
- There is extensive tearing of nerve tissue throughout the brain. This can cause brain chemicals to be released, causing additional injury.
- The tearing of the nerve tissue disrupts the brain’s regular communication and chemical processes.
- This disturbance in the brain can produce temporary or permanent widespread brain damage, coma, or death.
- A person with a diffuse axonal injury could present a variety of functional impairments depending on where the shearing (tears) occurred in the brain.

Concussion

- A concussion can be caused by direct blows to the head, gunshot wounds, violent shaking of the head, or force from a whiplash type injury.
- Both closed and open head injuries can produce a concussion. A concussion is the most common type of traumatic brain injury.
- A concussion is caused when the brain receives trauma from an impact or a sudden momentum or movement change. The blood vessels in the brain may stretch and cranial nerves may be damaged.
- A person may or may not experience a brief loss of consciousness (not exceeding 20 minutes). A person may remain conscious, but feel "dazed" or "punch drunk".
- A concussion may or may not show up on a diagnostic imaging test, such as a CAT Scan.
- Skull fracture, brain bleeding, or swelling may or may not be present. Therefore, concussion is sometimes defined by exclusion and is considered a complex neurobehavioral syndrome.
- A concussion can cause diffuse axonal type injury resulting in permanent or temporary damage.
- It may take a few months to a few years for a concussion to heal.

Contusion

- A contusion can be the result of a direct impact to the head.
- A contusion is a bruise (bleeding) on the brain.
- Large contusions may need to be surgically removed.

Coup-Contrecoup Injury

- Coup-Contrecoup Injury describes contusions that are both at the site of the impact and on the complete opposite side of the brain.
- This occurs when the force impacting the head is not only great enough to cause a contusion at the site of impact, but also is able to move the brain and cause it to slam into the opposite side of the skull, which causes the additional contusion.

Second Impact Syndrome “Recurrent Traumatic Brain Injury”

- Second Impact Syndrome, also termed "recurrent traumatic brain injury," can occur when a person sustains a second traumatic brain injury before the symptoms of the first traumatic brain injury have
healed. The second injury may occur from days to weeks following the first. Loss of consciousness is not required. The second impact is more likely to cause brain swelling and widespread damage.

- Because death can occur rapidly, emergency medical treatment is needed as soon as possible.
- The long-term effects of recurrent brain injury can be muscle spasms, increased muscle tone, rapidly changing emotions, hallucinations, and difficulty thinking and learning.

Penetrating Injury

- Penetrating injury to the brain occurs from the impact of a bullet, knife or other sharp object that forces hair, skin, bone and fragments from the object into the brain.
- Objects traveling at a low rate of speed through the skull and brain can ricochet within the skull, which widens the area of damage.
- A “through-and-through” injury occurs if an object enters the skull, goes through the brain, and exits the skull. Through-and-through traumatic brain injuries include the effects of penetration injuries, plus additional shearing, stretching and rupture of brain tissue.
- The devastating traumatic brain injuries caused by bullet wounds result in a 91% firearm-related death rate overall.
- Firearms are the single largest cause of death from traumatic brain injury.


Shaken Baby Syndrome

- Shaken Baby Syndrome is a violent criminal act that causes traumatic brain injury. Shaken Baby Syndrome occurs when the perpetrator aggressively shakes a baby or young child. The forceful whiplash-like motion causes the brain to be injured.
- Blood vessels between the brain and skull rupture and bleed.
- The accumulation of blood causes the brain tissue to compress while the injury causes the brain to swell. This damages the brain cells.
- Shaken Baby Syndrome can cause seizures, lifelong disability, coma, and death.
- Irritability, changes in eating patterns, tiredness, difficulty breathing, dilated pupils, seizures, and vomiting are signs of Shaken Baby Syndrome. A baby experiencing such symptoms needs immediate emergency medical attention.

Source: National Center on Shaken Baby Syndrome

Locked in Syndrome

- Locked in Syndrome is a rare neurological condition in which a person cannot physically move any part of the body except the eyes.
- The person is conscious and able to think.
- Vertical eye movements and eye blinking can be used to communicate with others and operate environmental controls.

Anoxic Brain Injury

- Anoxic Brain Injury occurs when the brain does not receive oxygen. Cells in the brain need oxygen to survive and function. Types of Anoxic Brain Injury:
  - Anoxic Anoxia - Brain injury from no oxygen supplied to the brain
  - Anemic Anoxia - Brain injury from blood that does not carry enough oxygen
  - Toxic Anoxia - Brain injury from toxins or metabolites that block oxygen in the blood from being used

Source: Zasler, N. Brain Injury Source, Volume 3, Issue 3, Ask the Doctor
Hypoxic Brain Injury

- Hypoxic Brain Injury results when the brain receives some, but not enough, oxygen. A Hypoxic Ischemic Brain Injury, also called Stagnant Hypoxia or Ischemic Insult, occurs because of a critical reduction in blood flow or low blood pressure leading to a lack of blood flow to the brain.

Source: Zasler, N. Brain Injury Source, Volume 3, Issue 3, Ask the Doctor

Open Head Injury

The following are terms used to describe types of skull fractures that can occur with open head injuries:

- Depressed Skull Fracture - The broken piece of skull bone moves in towards the brain.
- Compound Skull Fracture - The scalp is cut and the skull is fractured.
- Basilar Skull Fracture:
  - The skull fracture is located at the base of the skull (neck area) and may include the opening at the base of the skull.
  - Can cause damage to the nerves and blood vessels that pass through the opening at the base of the skull.
- Battle's Sign
  - The skull fracture is located at the ear's petrous bone.
  - This produces large "black and blue mark" looking areas below the ear, on the jaw and neck.
  - It may include damage to the nerve for hearing.
  - Blood or cerebral spinal fluid may leak out of the ear. This is termed "CSF Oterrhea."
- Raccoon Eyes
  - The skull fracture is located in the anterior cranial fossa.
  - This produces "black and blue" mark looking areas around the eyes.
  - Cerebral spinal fluid may leak into the sinuses. This is termed "CSF Rhinorrhea."
  - Nerve damage for the sense of smell or eye functions may occur.
- Diastatic Skull Fracture
  - The skull fractures that separate the cranial sutures in children prior to the closing of the cranial fissures are termed "diastatic skull fractures."
- Cribiform Plate Fracture
  - The cribiform plate is a thin structure located behind the nose area.
  - If the cribiform plate is fractured, cerebral spinal fluid can leak from the brain area out the nose

Closed Head Injury

When a person receives an impact to the head from an outside force, but the skull does not fracture or displace this condition is termed a "closed head injury". Again, separate terminology is added to describe the brain injury. For example, a person may have a closed head injury with a severe traumatic brain injury.

- With a closed head injury, when the brain swells, the brain has no place to expand. This can cause an increase in intracranial pressure, which is the pressure within the skull.
- If the brain swells and has no place to expand, this can cause brain tissues to compress, causing further injury.
- As the brain swells, it may expand through any available opening in the skull, including the eye sockets. When the brain expands through the eye sockets, it can compress and impair the functions of the eye nerves. For instance, if an eye nerve, Cranial Nerve III, is compressed, a person's pupil (the dark center part of the eye) will appear dilated (big). This is one reason why medical personal may monitor a person's pupil size and intracranial pressure.
Causes

According to the [Centers for Disease and Control Injury Prevention Center](https://www.cdc.gov), the leading causes of traumatic brain injury are:

- **Falls**: 35.2%
- **Unknown/Other**: 21%
- **Motor Vehicle**: 17.3%
- **Struck by/Against**: 16.5%
- **Assault**: 10%

Outcomes After Brain Injury

Brain injury can result in a range of outcomes:

- 52,000 die;
- 275,000 are hospitalized; and
- 1,365,000 are treated and released from an emergency department.

Among children ages 0 to 14 years, TBI results in an estimated

- 2,685 deaths;
- 37,000 hospitalizations; and
- 435,000 emergency department visits.

The number of people with TBI who are not seen in an emergency department or who receive no care is unknown.

Source: [Centers for Disease Control and Injury Prevention](https://www.cdc.gov)

Severity of Brain Injury

Emergency personnel typically determine the severity of a brain injury by using an assessment called the Glasgow Coma Scale (GCS). The terms Mild Brain Injury, Moderate Brain Injury, and Severe Brain Injury are used to describe the level of initial injury in relation to the neurological severity caused to the brain. *There may be no correlation between the initial Glasgow Coma Scale score and the initial level of brain injury and a person’s short or long term recovery, or functional abilities.* Keep in mind that there
is nothing "Mild" about a brain injury—the term "Mild" Brain injury is used to describe a level of neurological injury. Any injury to the brain is a real and serious medical condition. There is additional information about mild brain injury on our mild brain injury page.

**Glasgow Coma Scale (GCS)**

<table>
<thead>
<tr>
<th>Eye Opening (E)</th>
<th>Verbal Response (V)</th>
<th>Motor Response (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4=Spontaneous</td>
<td>5=Normal conversation</td>
<td>6=Normal</td>
</tr>
<tr>
<td>3=To voice</td>
<td>4=Disoriented conversation</td>
<td>5=Localizes to pain</td>
</tr>
<tr>
<td>2=To pain</td>
<td>3=Words, but not coherent</td>
<td>4=Withdraws to pain</td>
</tr>
<tr>
<td>1=None</td>
<td>2=No words......only sounds</td>
<td>3=Decorticate posture</td>
</tr>
<tr>
<td></td>
<td>1=None</td>
<td>2=Decerebrate</td>
</tr>
</tbody>
</table>

The scale comprises three tests: eye, verbal and motor responses. The three values separately as well as their sum are considered. The lowest possible GCS (the sum) is 3 (deep coma or death), while the highest is 15 (fully awake person). A GCS score of 13-15 is considered a "mild" injury; a score of 9-12 is considered a moderate injury; and 8 or below is considered a severe brain injury.

**Mild Traumatic Brain Injury (GCS of 13-15)**

Some symptoms of mild TBI include:

- Headache
- Fatigue
- Sleep disturbance
- Irritability
- Sensitivity to noise or light
- Balance problems
- Decreased concentration and attention span
- Decreased speed of thinking
- Memory problems
- Nausea
- Depression and anxiety
- Emotional mood swings

This information is not intended to be a substitute for medical advice or examination. A person with a suspected brain injury should contact a physician immediately, go to the emergency room, or call 911 in the case of an emergency. Symptoms of mild TBI can be temporary. The majority of people with mild TBI recover, though the timetable for recovery can vary significantly from person to person.

**Moderate Brain Injury (GCS of 8-12)**

A moderate TBI occurs when there is a loss of consciousness that lasts from a few minutes to a few hours, when confusion lasts from days to weeks, or when physical, cognitive, and/or behavioral impairments last for months or are permanent. Persons with moderate TBI generally can make a good recovery with treatment and successfully learn to compensate for their deficits.

Severe Brain Injury (GCS Below 8)

Severe brain injury occurs when a prolonged unconscious state or coma lasts days, weeks, or months. Severe brain injury is further categorized into subgroups with separate features:

- Coma
- Vegetative State
- Persistent Vegetative State
- Minimally Responsive State
- Akinetic Mutism
- Locked-in Syndrome

Tips to Aid Recovery

- Get lots of rest. Don't rush back to daily activities such as work or school.
- Avoid doing anything that could cause another blow or jolt to the head.
- Ask your doctor when it's safe to drive a car, ride a bike, or use heavy equipment, because your ability to react may be slower after a brain injury.
- Take only the medications your doctor has approved, and don't drink alcohol until your doctor says it's OK.
- Write things down if you have a hard time remembering.
- You may need help to re-learn skills that were lost. Contact the [Brain Injury Association](#) in your state to learn more about the programs, supports and services available to people with brain injury and their families.

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