

Title: Overview - Shearing Brain Injury

Content Type: Blog Post

Keyword(s): shearing brain injury, diffuse brain injury, recovering from brain injury, rehabilitation for brain injury

With all the news surrounding concussions this seems like a good time to give you an overview of shearing brain injuries, also known as diffuse brain injury. Shearing brain injury is a name given to a type of brain trauma called diffuse axonal injury (DAI), so-named because it is a non-focal injury of the axons of the brain.

What is an Axon?

An axon (nerve fiber) is a thread-like structure in the white matter of the brain that acts as a communication wire between the neurons (brain cells) of the gray matter and muscles, glands, and other neurons. Axons are like the phone lines of the brain sending electrical impulses along their path to the receiving end.

This “phone line” is sheathed in a substance called myelin (MY-UH-LIN) which is what gives the [white matter](#)ⁱ of the brain its color. Gray matter is simply neurons that are not coated in myelin.

What Causes Shearing Brain Injury?

[Diffuse axonal injury](#)ⁱⁱ (DAI), otherwise known as shearing brain injury, is caused when the head accelerates, decelerates, or rotates/changes direction quickly and violently as in an auto accident, a fall, or shaken baby syndrome.

Shearing occurs when brain tissue slides over other brain tissue, stretching the axons within it, especially at the junctions between white matter and gray matter. If you think of how the rubber string on a paddle ball stretches as the ball moves away from the paddle, you have an idea of what might be occurring with the axon.

But instead of snapping back like the rubber string, the axon endures trauma or separation where it communicates with a neuron, ending the communication link. DAI injury affects many, many axons, disrupting communication across a diffuse area of the brain.

However, this is not what causes the majority of the injury. Within minutes or hours of this injury biochemicals from nerve stimulation begin building up at the site of the axonal separation. This biochemical spill creates a toxic environment that causes cell death in the region of the injury resulting in lesions.

How Severe Is Shearing Brain Injury?

[DAI is graded from mild to severe](#)ⁱⁱⁱ depending on the severity of the injury and the extent of the damage. A concussion can be considered a mild case of shearing brain injury. At its mildest, DAI can occur unnoticed.

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As the severity increases, signs and symptoms of brain injury become apparent. The most common immediate symptom is unconsciousness. In the absence of any other symptoms, anyone who becomes unconscious due to a blow to the head should be carefully assessed for DAI injury.

Sadly, severe diffuse brain injury usually results in death or a vegetative state.

How Is Shearing Brain Injury Diagnosed?

Due to the diffuse and microscopic nature of the injury, CT scans and general MRIs are typically negative unless small areas of bleeding within the brain are noted within the cerebral cortex or corpus callosum (tracts of white matter in the brain). If a patient presents with unconsciousness and these tests are negative, the medical facility should move onto a different imaging technique to check for DAI.

A technique called [Diffusion Tensor Imaging](#)^{iv} is a specialized MRI that can map the diffusion of molecules within the tissue and outline areas of obstruction and other details of the tissue.

How Is Shearing Brain Injury Treated?

Immediate treatment of DAI injury includes measures to reduce swelling inside the brain to mitigate further damage. This can be done using hypothermic cooling or with medications such as steroids. Surgery is not indicated, again, due to the diffuse and microscopic nature of the brain injury.

Once the patient is awake and stabilized rehabilitation for brain injury can commence.

Recovering from Brain Injury

In cases of mild to moderate shearing brain injury, recovery and rehabilitation typically yield good results. The more mild the DAI, the fewer noticeable effects there are. As with any brain injury it depends on the area of the brain affected and severity of the damage how extensive the problems will be.

Rehabilitation for Brain Injury

At [CENTER], we use research-backed examinations and testing to identify [functional or cognitive impairments](#). This testing is designed to pinpoint the impairment and begin creating a customized treatment plan. In cases of shearing brain injury, as in any other, we complete a full assessment to help us formulate a path of individual care geared toward the patient's specific problems.

Our [innovative therapies](#) help restore impaired function by leveraging the brain's inherent ability to repair itself. The therapies target affected areas with specific activities to rebuild neural pathways. In milder forms of DAI the brain will attempt to repair itself. Neurons can spontaneously adapt by growing one or more of the remaining nerve fibers into the space where the axon used to be, helping communications to be re-established.

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Types of therapy include:

- Physical therapy
- Occupational therapy
- Recreational therapy
- Speech therapy
- Adaptive equipment training

In more severe cases complete recovery may not be possible. Long term issues include spasticity, memory problems, and seizures. Our teams at [CLINIC] endeavor to help patients recover as much functionality as possible so they can live life to the fullest.

ⁱ Difference Between Grey Matter and White Matter. Retrieved November 18, 2013 from <http://www.differencebetween.net/science/health/difference-between-grey-and-white-matter/>.

ⁱⁱ Diffuse Axonal Injury. Retrieved November 18, 2013 from http://en.wikipedia.org/wiki/Diffuse_axonal_injury.

ⁱⁱⁱ Diffuse Axonal Injury. Retrieved November 18, 2013 from http://en.wikipedia.org/wiki/Diffuse_axonal_injury.

^{iv} Diffusion MRI. Retrieved November 18, 2013 from http://en.wikipedia.org/wiki/Diffusion_MRI.

Other Resources:

Brain Trauma – Axonal Shear Injury – Monograph. Retrieved November 18, 2013 from <http://www.nucleuscatalog.com/view-item?vendorID=MON12>,

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