Traumatic Brain Injury (TBI)

A topic in the Alzheimer's Association series on understanding dementia.

About Dementia
Dementia is a condition in which a person has significant difficulty with daily functioning because of problems with thinking and memory. Dementia is not a single disease. It's an overall term — like "heart disease" — that covers a wide range of specific medical conditions, including Alzheimer's disease. Disorders grouped under the general term "dementia" are caused by abnormal brain changes. These changes trigger a decline in thinking skills, also known as cognitive abilities, severe enough to impair daily life and independent function. They also affect behavior, feelings and relationships.

Brain changes that cause dementia may be temporary, but they are most often permanent and worsen over time, leading to increasing disability and a shortened lifespan. Survival can vary widely, depending on such factors as the cause of the dementia, age at diagnosis and coexisting health conditions.

Traumatic Brain Injury (TBI), Cognitive Change and Dementia
Traumatic brain injury (TBI) results from an impact to the head that disrupts normal brain function. TBI is a significant threat to cognitive health in two ways:
(1) A TBI's direct effects — which may be long-lasting or even permanent — can include unconsciousness, inability to recall the traumatic event, confusion, difficulty learning and remembering new information, trouble speaking coherently, unsteadiness, lack of coordination and problems with vision or hearing.
(2) Certain types of TBI may increase the risk of developing Alzheimer's or another form of dementia years after the injury takes place.

Falls are the leading cause of TBI for all ages. Those aged 75 and older have the highest rates of TBI-related hospitalization and death due to falls. Other common causes of TBI include vehicle accidents and sports injuries. TBI may also be caused by indirect forces that jolt the brain violently within the skull, such as shock waves from battlefield explosions. In addition, TBI can result from bullet wounds or other injuries that penetrate the skull and brain.

Doctors classify TBI as mild, moderate or severe, depending on whether the injury causes unconsciousness, how long unconsciousness lasts and the severity of symptoms. Although most TBIs are classified as mild because they're not life-threatening, even a mild TBI can have serious and long-lasting effects.

Prevalence
The Centers for Disease Control and Prevention (CDC) identifies TBI as a serious public health issue. The CDC estimates that 1.7 million Americans annually experience TBI severe enough to cause death or require emergency room care or hospitalization, and that 5.3 million are living with some level of TBI-related disability. These figures don't include people with

mild TBI who don't seek medical attention, those treated at a doctor's office or monitored at home, or members of the armed forces treated at Department of Defense or Veterans Administration (VA) hospitals.

Symptoms

The severity of TBI symptoms depends on whether the injury is mild, moderate or severe.

A mild TBI (MTBI), also known as a concussion, either doesn't knock you out or knocks you out for 30 minutes or less. Mild TBI symptoms may include inability to remember the cause of the injury or events that occurred immediately before or up to 24 hours after it happened; confusion and disorientation; difficulty remembering new information; headache; dizziness; blurry vision; nausea and vomiting; ringing in the ears; trouble speaking coherently; and changes in emotions or sleep patterns. These symptoms often appear at the time of the injury or soon after it but sometimes may not develop for days or weeks. Mild TBI symptoms are usually temporary and clear up within hours, days or weeks, but they can last months or longer.

Moderate TBI causes unconsciousness lasting more than 30 minutes, and severe TBI knocks you out for more than 24 hours. Symptoms of moderate and severe TBI are similar to those of mild TBI but more serious and longer-lasting.

In all levels of TBI, cognitive changes are among the most common, longest-lasting and most disabling symptoms that can result directly from the injury. The ability to learn and remember new information is often affected. Other commonly affected thinking skills include the capacity to pay attention, organize thoughts, plan effective strategies for completing tasks and activities, and make sound judgments.

In addition, more severe decline in thinking skills characteristic of dementia may develop years after the injury took place and the person seems to have recovered from its immediate effects.

Diagnosis

TBIs injure your brain even if you don't lose consciousness and your symptoms clear up quickly. If you or someone you're with experiences an impact to the head and develops any symptoms of TBI, seek medical advice even if symptoms seem mild. Call emergency services for anyone who's unconscious for more than a minute or two or who experiences seizures, repeated vomiting, or symptoms that seem to worsen as time passes. Also seek emergency care for anyone whose head was injured during ejection from a vehicle, who was struck by a vehicle while on foot or who fell from a height of more than 3 feet.

Evaluations by health care professionals typically include:

- Questions about the circumstances of the injury
- Assessment of the person's level of consciousness and confusion

- Neurological examination to assess memory and thinking, vision, hearing, touch, balance, reflexes and other indicators of brain function

Depending on the nature of the TBI and the severity of symptoms, brain imaging with computed tomography (CT) may be needed to determine if there's bleeding or swelling in your brain.

If you've ever had a TBI, make sure your experience becomes part of your permanent medical record, and mention it whenever you're familiarizing a new doctor with your medical history.

Causes and Risk Factors

Preventing TBI

Falls are the most common cause of TBI, and falling poses an especially serious risk for older adults. According to a CDC special report analyzing data from several federal agencies, 56,000 seniors are hospitalized as a result of head injuries sustained in falls and 8,000 die each year. When a senior sustains a serious TBI in a fall, direct effects of the injury may result in long-term cognitive changes, reduced ability to function and changes in emotional health.

Measures to reduce the risk of falls include using a walker or other assistive device to compensate for mobility problems, muscle weakness or poor balance; having your vision checked regularly and using glasses or contact lenses that correct for changes; working with your doctor to watch for medication side effects or interactions among drugs you're taking; and avoiding household hazards such as clutter, loose rugs or poor lighting.

Vehicle crashes are another common cause of TBI. You can reduce your risk by keeping your vehicle in good repair, following the rules of the road and always buckling your seat belt. You can also protect your head by wearing a helmet and other protective equipment when biking, inline skating or playing contact sports.

Dementia and TBI

Over the past 30 years, research has linked moderate and severe TBI to a greater risk of developing Alzheimer's disease or another type of dementia years after the original head injury. One of the key studies showing an increased risk found that older adults with a history of moderate TBI had a 2.3 times greater risk of developing Alzheimer's than seniors with no history of head injury, and those with a history of severe TBI had a 4.5 times greater risk. Other studies — but not all — have also found a link between moderate and severe TBI and elevated risk.

There's no evidence that a single mild TBI increases dementia risk. However, emerging evidence does suggest that repeated mild TBIs, such as those that can occur in sports like American football, hockey and soccer, may be linked to a greater risk of a type of dementia called chronic traumatic encephalopathy (CTE). Previous research has shown that boxers have an increased risk of CTE, which was originally called dementia pugilistica or punch-drunk syndrome.

The risk of CTE in boxers seems most closely tied to the number of rounds boxed, not to the number of times a boxer was knocked out, suggesting that even repeated mild TBIs that don't cause unconsciousness may increase dementia risk. Researchers don't yet know whether CTE is most likely to occur following a small number of severe TBIs, a large number of mild or very mild TBIs, or some other pattern of head trauma.

Although there's no known strategy to reduce the possible long-term risk of dementia once you've experienced a moderate or severe TBI, or repeated mild TBIs, it's important to understand that not everyone who experiences a head injury in one of these categories develops dementia. More research is needed to confirm the possible link between TBI and dementia and to understand why moderate, severe and repeated mild TBIs may increase risk.

Current research on how TBI changes brain chemistry indicates a relationship between TBI and hallmark protein abnormalities linked to Alzheimer's. Within hours after injury, severe TBI has been shown to increase levels of beta-amyloid, one hallmark Alzheimer's protein. And CTE, the dementia linked to repeated mild TBI, appears to be most strongly characterized by deposits of tau protein, another Alzheimer's hallmark. Beta-amyloid deposits are also found in some individuals with CTE.

Some research suggests that TBI may be more likely to cause dementia in individuals who have a variation of the gene for apolipoprotein E (APOE) called APOE-e4. More research is needed to understand the strength of the link between APOE-e4 and dementia risk in those who've had a TBI.

Outcomes

Alzheimer's disease and other dementias that may occur as a long-term result of TBI are progressive disorders that worsen over time. As with all dementias, they affect quality of life, shorten lifespan and complicate the effort to manage other health conditions effectively.

Treatment

The most serious TBIs require specialized hospital care and can require months of inpatient rehabilitation. Most TBIs are mild and can be managed with either a short hospital stay for observation or at-home monitoring followed by outpatient rehab, if needed.

Treatment of dementia in a person with a history of TBI varies depending on the type of dementia diagnosed. Strategies for treating Alzheimer's or another specific type of dementia are the same for individuals with and without a history of TBI. Because CTE is a relatively new area of exploration for researchers and physicians, formal clinical guidelines for diagnosing and managing this condition do not yet exist. Several major research initiatives are under way to gain further insight into the patterns of injury and brain changes that may be implicated in CTE, and to develop new strategies for prevention, diagnosis and treatment.

Learn More

For more information about traumatic brain injury and other topics in the Alzheimer's Association series on understanding dementia, visit www.alz.org, or call our toll-free, 24/7 Helpline at 800.272.3900.

The Alzheimer's Association is the world's leading voluntary health organization in Alzheimer's care, support and research.