10 conditions doctors assess with an EEG

Medically reviewed by Nancy Hammond, M.D. — By Meara Withe on June 19, 2023

What is an EEG? Epilepsy Sleep disorders TBI Brain infection Dementia Degenerative diseases Brain tumor Stroke Metabolic conditions Hormonal conditions Summary

An electroencephalogram (EEG) is a test that records the brain's electrical activity. Doctors use it to help them assess and understand neurological conditions, sleep disorders, and brain trauma.

A person may undergo an EEG if they have seizures, blackouts, or migraine to help identify the underlying causes.

This article discusses why doctors may use an EEG.

It also outlines 10 conditions that an EEG helps doctors understand.

What is an EEG?

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An EEG is a test that an EEG technologist performs to assess neurological conditions such as epilepsy, dementia, and others.

Doctors can also use it to understand the brain's activity after a brain trauma such as a head injury or brain tumor. An EEG looks at what is happening in the brain for the duration of the test rather than the brain's physical structure.

To perform the EEG, the technologist attaches electrodes to the person's head, which picks up electrical signals from the brain's cells. A computer records these signals and shows the electrical activity of the brain.

The electrodes attach to different parts of the head to locate precisely where activity is happening. An EEG is painless and safe.

A routine EEG procedure usually lasts 1 hour, including preparation before the test and 20–40 minutes of recording a person's brain activity. There are several types of EEGs that have varying lengths.

Doctors use EEGs alongside other tests to build a complete picture of a person's condition. The following sections outline 10 conditions that an EEG can help doctors understand.

1. Epilepsy

Epilepsy is a neurological seizure condition that occurs in one of several parts of the brain. The main symptom of epilepsy is recurrent seizures due to unusual electrical brain activity.

A doctor may use an EEG to look for abnormal brain waves and determine which part of the brain the seizure originates from. This helps them diagnose the type of epilepsy a person has.

Read about how doctors diagnose epilepsy.

2. Sleep disorders

Sleep disorders include problems with the amount or quality of sleep a person has, often due to an underlying physical or emotional cause. A sleep disorder can impair a person's cognitive functions, leading to poor physical or mental health and impaired quality of life.

Sleep disorders that may require an EEG include:

- narcolepsy
- insomnia
- sleep apnea

- sleep paralysis
- REM sleep behavior disorder
- restless legs syndrome

Resources for healthy sleep

To discover more evidence-based information and resources on the science of healthy sleep, visit our dedicated hub.

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3. Traumatic brain injuries

Head injuries, or traumatic brain injuries (TBIs), occur when a strong force to the head causes damage to the brain, resulting in temporary or permanent impairment of cognitive, physical, and psychosocial functions.

Doctors may use EEGs when a person has a mild traumatic brain injury (mTBI) to help them assess and monitor cognitive function. However, using EEGs in this way is not commonplace, and research is ongoing into their use in this area.

Read about the causes and effects of TBI.

4. Brain infection or inflammation

Brain inflammation, or encephalitis, primarily occurs after a viral infection. Other causes may involve the immune system mistakenly attacking brain tissue. In rare cases, an attack comes from bacteria, fungi, or parasites.

A brain abscess is a serious and potentially life threatening condition that develops due to bacterial or fungal infection in the brain.

In encephalitis, an EEG may show sharp waves in one or both temporal lobes and abnormalities in people who experience seizures. Doctors may also use an EEG to understand when a person is seizure-free after receiving treatment.

Read more about encephalitis here.

5. Dementia

Dementia involves a decline in a person's cognitive abilities, including symptoms such as forgetfulness and impaired decision-making ability. Dementia is not a disease itself but is due to diseases such as Alzheimer's disease and Lewy body dementia.

Dementia happens due to brain cell damage, and an EEG may detect abnormal brain activity. Dementia increases the risk of seizures, and an EEG can show whether a person with dementia experiences them.

Alzheimer's and dementia resources

To discover more evidence-based information and resources for Alzheimer's and dementia, visit our dedicated hub.

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6. Degenerative diseases

A degenerative disease describes when body parts, such as organs or tissue, lose function and deteriorate over time. A neurodegenerative disease occurs in the central nervous system (CNS). Alzheimer's disease is the most common neurodegenerative disease, affecting more than 6.7 million Americans.

Other common degenerative diseases include:

- Parkinson's disease
- Huntington's disease
- motor neuron disease
- multiple sclerosis

7. Brain tumors

A brain tumor is a growth of abnormal cells in the brain. Brain tumors may also form in other parts of the CNS, such as the spine. A brain tumor can be harmful (malignant) or unharmful (benign). It can affect the brain's ability to perform functions such as thought, speech, movement, and memory.

To diagnose a brain tumor, a doctor may perform an MRI or CT scan. They may also use an EEG to detect abnormal brain activity and assess a person's risk of seizures.

8. Stroke

A stroke is a cerebrovascular disease that occurs when oxygen levels to the brain decrease, often resulting from a blockage in blood supply or a bleed. More than 795,000 people in the United States have a stroke each year, with 610,000 having one for the first time.

A doctor can use an EEG to determine whether a person's symptoms are more likely from a stroke or a seizure.

9. Metabolic conditions that affect brain tissue

A metabolic condition involves the body experiencing abnormalities in its ability to produce certain chemicals it needs to function. Metabolism refers to the many different chemical processes in the body. A metabolic condition can cause a buildup of chemicals that may lead to brain damage.

Metabolic conditions that can affect the brain include:

- diabetes
- Gaucher's disease, types 2 and 3
- phenylketonuria
- mitochondrial disorder
- glutaric acidemia type I

Doctors can use an EEG to understand how various metabolic conditions affect the brain.

10. Hormonal conditions that affect brain tissue

A hormonal condition, or endocrine disorder, involves a disruption to the body's hormone production.

Endocrine conditions typically cause high or low levels of certain hormones resulting in the body not responding correctly. This can sometimes affect the brain's tissue and cause brain tumors.

Hormonal conditions that can affect the brain include:

- hyperthyroidism
- hypothyroidism
- Cushing's syndrome
- acromegaly
- diabetes

Doctors may use an EEG to understand how various hormonal conditions affect the brain.

Summary

An EEG is a test that records the electrical activity of the brain. Doctors use it alongside other examinations and tests to diagnose neurological conditions, degenerative diseases, head injuries, and other conditions that affect the brain.

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Endocrinology Epilepsy Alzheimer's / Dementia Neurology / Neuroscience

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Alzheimer's brain vs. normal brain: What to know

Medically reviewed by Seunggu Han, M.D. — By Zawn Villines on December 22, 2021

Alzheimer's brain Differences in function Summary

There are some important differences between a brain with Alzheimer's and a brain without Alzheimer's.

Alzheimer's disease causes the development of harmful plaques. This kills neurons, causing a portion of the brain to shrink, usually beginning in the hippocampus. The specific brain changes that occur and how easy it is for a doctor to detect them depend on how far along a person is in the disease.

Alzheimer's is a progressive neurological disease that damages the brain. Because of this ongoing damage, the disease is considered fatal. Changes in the Alzheimer's brain begin well before symptoms appear, sometimes a decade or even longer. That said, typical imaging scans such as an MRI may not detect brain changes until later in the disease.

Because no treatment can cure the brain damage Alzheimer's causes, some doctors will diagnose and treat dementia if symptoms are present and may not require invasive tests.

Keep reading to learn more about the changes in the brain caused by Alzheimer's.

What happens to the brain in Alzheimer's?

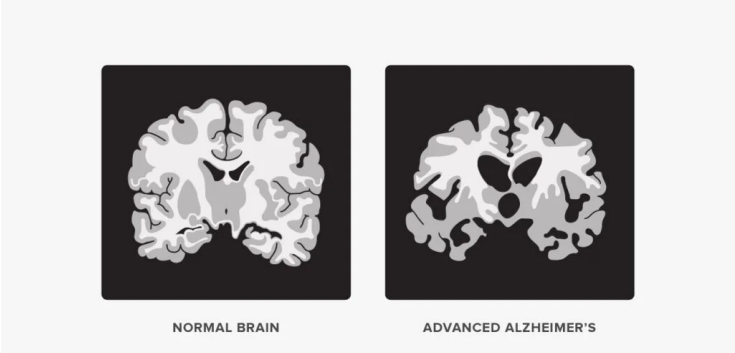

illustration by Diego Sabogal

Over time, a brain with Alzheimer's shrinks. Neurons die, and plaques accumulate in areas such as the hippocampus. The brain may change for up to a decade or longer, prior to symptoms of Alzheimer's manifesting.

Alzheimer's disease usually begins in the hippocampus, which is the part of the brain that plays a role in memory and thinking.

Typical brains metabolize (process) a chemical called amyloid precursor protein (APP). In Alzheimer's, APP turns into a protein called beta-amyloid, which the brain does not clear away.

Instead, the proteins form clumps and tangles that stick between and damage the neurons. The clumps of beta-amyloid protein can also destroy connections between the neurons, causing them to die.

People with Alzheimer's also often have abnormal tangles of a protein called tau. This protein usually resides inside neurons in people with healthy brains. But in Alzheimer's, beta-amyloid interacts with tau proteins to cause abnormal clumps and tangles of the protein. This creates plaques in the brain, which are areas of reduced neurons and brain death.

Beta-amyloid and tau

Researchers are still working to fully understand how tau and beta-amyloid interact, as well as why some people's brains respond abnormally to these proteins.

A 2020 study found that the presence and location of tau protein in the brain may predict future brain damage and help with predicting the course of Alzheimer's. Drawing on brain scans of 32 people with Alzheimer's disease, researchers concluded that tau might play a more direct role in brain damage than beta-amyloid.

Additionally, people with Alzheimer's tend to have inflammation in their brains. Inflammation accumulates in the brain as people age, but it is more severe in dementia.

Some research suggests that this happens because the brain becomes less able to clear waste. In healthy brains, cells called microglia destroy toxins. The brains of people with Alzheimer's do not do this as well.

A gene called TREM2 instructs microglia to get rid of beta-amyloid plaques in healthy brains, reducing inflammation. But abnormal functioning of this gene can reduce the action of microglia, leading to plaques and inflammation.

While research continues to look at the role of beta-amyloid and tau, researchers have also found plaques and tangles in the brains of people who do not have Alzheimer's. Moreover, some people with symptoms of dementia do not have these changes in their brains.

This suggests that a complex interaction of many factors is the cause of dementia, and that it may not always be possible, especially in the early stages, to distinguish an Alzheimer's brain from a healthy brain.

Blood flow

In some cases, changes in the blood vessels of the brain and in blood flow to the brain may increase the risk of dementia. People with blood vessel blockages in the brain are more likely to develop dementia.

Changes in blood flow to the brain can further damage the brain, making it even more likely that the brain will struggle to clear toxins, which can lead to harmful effects. This means that Alzheimer's may cause vascular changes in the brain, and also that it may happen because of these changes.

Other types of dementia

Alzheimer's is not the only type of dementia. Other types of dementia affect the brain in slightly different ways.

For example, fronto-temporal dementia affects the frontal or temporal lobes of the brain. This initially affects behavior, speech, or both. As the disease progresses, it may look more like Alzheimer's, causing memory loss and other forms of brain dysfunction.

To differentiate Alzheimer's from other dementias, a doctor may look at a combination of symptoms and brain changes.

Learn more about Alzheimer's here.

Differences in function

Alzheimer's fundamentally changes how the brain works. In the popular imagination, it primarily affects memory. But this is just in the early stages. As it moves through the cerebral cortex, it can affect virtually every aspect of functioning, ultimately causing the brain to fail.

In the early stages, some differences in brain function may include:

- memory problems that begin as short-term memory difficulties and progress to more serious issues, such as not remembering a loved one
- word-finding difficulties
- frequently losing things
- wandering
- getting lost

Learn more about the early signs of Alzheimer's and other types of dementia here.

In the middle stages of the disease, some manifestations of brain changes may include:

- sleep difficulties, such as not being able to sleep or wandering at night
- confusion about time and place
- becoming withdrawn or apathetic
- incontinence of the bladder and bowels

- personality changes that may cause suspiciousness, anger, or depression
- delusions and hallucinations

As Alzheimer's progresses further, it begins to affect other areas of functioning, including the brain's ability to coordinate the body's functions. Some symptoms may include:

- not being able to engage in self-care such as bathing and getting dressed
- needing help with eating
- problems with physical functions such as walking
- swallowing issues
- organ failure
- frequent infection, such as pneumonia
- death

Alzheimer's proceeds in relatively predictable stages based on how the brain damage progresses. A person in late stage Alzheimer's will always have great difficulty with basic functions. But the speed at which a person progresses and the specific symptoms that are most noticeable in each stage varies from person to person.

Summary

Understanding the differences between the brains of people with and without Alzheimer's may eventually help researchers discover a cure. Current treatments aim to slow Alzheimer's-related brain changes, such as by slowing the damage to the brain, or helping nerve cells better communicate with one another.

But these treatments do not cure or reverse Alzheimer's.

One of the challenges of understanding Alzheimer's and the brain is that it is not easy to see the brain, and doctors cannot view all changes until after a person has died.

Additionally, researchers continue to find that there is no clear factor that differentiates a person with Alzheimer's from one without the disease, since some people have plaques and tangles without symptoms, and others have symptoms without brain changes.

Alzheimer's is a complex disease, and many questions about how it works in the brain remain.