



DEPARTMENT OF
NEUROLOGY

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Ataxia

Ataxia is derived from the Greek word meaning "irregularity" or "disorderliness" but when used medically, the term describes a condition characterized by poor coordination of movements. Ataxia may cause involuntary eye movements (nystagmus), incoordination of hands, difficulty with fine motor tasks (such as eating or writing), slurring of speech and an unsteady walk. It may make the person appear "drunk". Ataxic patients are unable to walk in a straight line and tend to bump into things. In advanced stages, they may need a walker or even a wheelchair. Patients also may have difficulties with vision due to the eye movement abnormalities. Damage or degeneration in the back part of the brain called the cerebellum results in ataxia. It can also occur because of problems with the sensory system (abnormal perception of a position of a body part in space) and vestibular system (abnormal balance). A neurologist can usually differentiate between the two types of ataxia: motor and sensory.

There are about 150,000 patients affected by some form of ataxia in the United States.

Diagnosis

The diagnosis of ataxia is made after a careful, detailed clinical examination by a neurologist. Once the presence of ataxia has been determined, the cause is determined based on the time course and other neurological features (described below). Several laboratory tests can help aid diagnosis. MRI and spinal fluid analysis can also be helpful. In many cases, genetic testing is required.

Cause

There are many causes of ataxia but most can be categorized as sporadic (no specific cause), genetic (also referred to as hereditary or running in families) or secondary to a medical illness, certain drugs or an injury to the brain. Congenital ataxias occur in children, and they are most commonly due to structural abnormalities in the brain that occur before or during birth. These include cerebral palsy (often associated with brain injury at birth due to lack of oxygen or blood supply), hydrocephalus (increased pressure caused by blockage or buildup of cerebrospinal fluid), brain tumors, and other injuries to the brain.

Ataxia can occur suddenly (acute), over weeks (subacute) or slowly progressive over months to years (chronic). In acute cases the most common cause is either stroke or hemorrhage in or around the cerebellum. Patients usually have headache, vomiting, neck stiffness or loss of consciousness. In children, bacterial or viral infections can cause acute ataxia and this usually improves with time. They develop fever, problems with walking and slurred speech over a period of hours to days and recover over weeks. Subacute onset of ataxia is usually seen in paraneoplastic cerebellar degeneration. This is a condition in which cancer in the breast, lungs, ovaries or other areas in the body produces antibodies that affect the cerebellum and cause ataxia.

Hereditary or genetic ataxias occur because of gene mutations that lead to abnormal proteins making neurons function abnormally. You may inherit this from one parent and be affected (autosomal dominant inheritance, 50% chance of transmission to children) or from both parents (autosomal recessive inheritance, 25% chance of transmission to children if both parents carry the gene mutation and do not have symptoms). Sometimes there may be no clear family history.

Autosomal dominant ataxias include the spinocerebellar ataxias and episodic ataxias. Spinocerebellar ataxias (SCA) represent the most common form of chronic progressive ataxia in adults. They result from degeneration of pathways between the spinal cord and cerebellum. There are many types (SCA 1 to 37 have been recognized) and the number continues to grow based on new research. All patients with these disorders must undergo genetic counseling. SCA-2 is most common in the US and SCA-3 is most common in Japan, Germany, Portugal and France. Typical age of onset of these syndromes is 4-60 years with average of 40 years. Patients can become disabled by five years, bedridden by ten years and death occurs anywhere between 10-20 years after the onset of disease. The common clinical problems in SCA are gait ataxia, eye movement abnormalities (nystagmus or jerkiness and double vision), and dysarthria (speech difficulty). Some of the SCAs (SCA1, 2, 3, 4, 7 and 8) also cause peripheral neuropathy (damage to the peripheral nerves which causes the patient to have numbness or tingling in the hands and feet). Some SCA's can result in blindness by causing damage to the retina and the macula in the eye (SCA 7).

Episodic ataxia (EA) is a disorder with intermittent spells of ataxia with complete recovery between episodes. The best characterized are types 1 and 2. They are caused by genetic mutations within a voltage gated potassium channel gene (KCNA1 on chromosome 12) and the cerebral P/Q type calcium channel gene (CACNL1A4 on chromosome 19) respectively. Patients have spells of walking difficulty, dysarthria (difficulty with speech) and nystagmus (abnormal eye movements) with complete recovery between episodes. They may be triggered by stress, being startled or a sudden movement. EA type 1 involves brief episodes lasting seconds or minutes. EA type 2 episodes are longer, lasting minutes to hours. EA types 3 through 7 are also recognized. Genetic episodic ataxias are

responsive to medical treatment. Drug ingestion, multiple sclerosis and other causes can also lead to episodic ataxia in some cases.

Friedrich's ataxia is an example of autosomal recessive ataxia. It is a disorder due to excessive repeats of nucleotides GAA in the DNA. Patients have ataxia along with spasticity, speech problems, nystagmus, weakness of lower extremities, and sensory problems. Patients with Friedreich's ataxia also may develop scoliosis (curvature of spine), cardiomyopathy (enlargement of the heart), and diabetes and bowel and bladder dysfunction. This is a slow, progressive disorder but most patients become wheelchair bound within 10-20 years after onset. There is a marked variability in the presentation and progress of the disease. Other recessively inherited ataxias include vitamin-E deficiency (due to alpha tocopherol transfer protein deficiency or abetalipoproteinemia), ataxia telangiectasia, ataxia with oculomotor apraxia type I and II, and infantile onset spinocerebellar ataxia among others.

There are other inherited disorders that can cause ataxia, including DRPLA (dentatorubro-pallidoluysian atrophy). This is a rare neurodegenerative disorder that causes difficulties with walking (ataxia), problems with speech, dementia, chorea (involuntary writhing type of movements) and jerkiness of muscles (myoclonus). Some of the younger patients have seizures.

Ataxia can be a part of Fragile X-associated tremor/ataxia syndrome (FXTAS). This is a genetic disorder with a gene located on X-chromosome (female sex chromosome). It affects mainly males but can occur in female carriers of the mutation. The clinical spectrum of FXTAS includes progressive ataxia, tremor, cognitive decline and other features.

Other causes of chronic progressive ataxia include several disorders like degeneration of cerebellum due to alcohol, vitamin E or copper deficiency. Vitamin B12 deficiency causes sensory ataxia in addition to muscle weakness.

Treatment

Of all the movement disorders, ataxia is among the most resistant to medical therapy. Clonazepam may help tremor and balance problems. It has side effects such as sedation, fatigue or loss of libido among others. Other medications such as buspirone or 5-hydroxytryptophan have been studied but they have not been shown to be very beneficial. Phenytoin, an anticonvulsant, is useful for some episodic ataxias. Acetazolamide is useful in some of the rare forms of episodic ataxias.

Genetic ataxias do not have any definitive treatments. Some of the disorders have been reported to be slowed by taking antioxidants such as vitamins A, E, B12, idebenone, and coenzyme Q10. Vitamin E is the treatment of choice in ataxia caused by vitamin E deficiency. Vitamin B12 or copper supplements are used to

treat ataxia related to vitamin B12 or copper deficiency respectively. When associated with parkinsonism, such as seen in the cerebellar form of multiple system atrophy, levodopa may be helpful.

Weakness and spasticity contribute to the difficulties the patient may experience in ataxia. Physical therapy to maximize strength and flexibility are helpful. General physical therapy and regular exercise are highly recommended. Early therapy may help patients avoid developing contractures. Patients with ataxia can benefit from gait training during the earlier stages of the disease. Adaptive devices such as canes, wheelchairs and communication aids can help. Adjustments at home can be discussed with the occupational therapist. Speech therapy can be helpful for some patients.

Care of the bed-ridden patient in advanced stages of the progressive ataxia is very important. Skin care and eventual placement of PEG tube (feeding tube) in patients with swallowing difficulties will help prevent lung infections.

For more information, see [Appendix - Classification of Spinocerebellar Ataxias](#).

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