



NIDCD Fact Sheet

Pendred Syndrome

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES · NATIONAL INSTITUTES OF HEALTH · NATIONAL INSTITUTE ON DEAFNESS AND OTHER COMMUNICATION DISORDERS

What is Pendred syndrome?

Pendred syndrome is a genetic disorder that causes early hearing loss in children. It also can affect the thyroid gland and sometimes may affect a person's balance. The syndrome is named after Vaughan Pendred, the physician who first described individuals with the disorder.

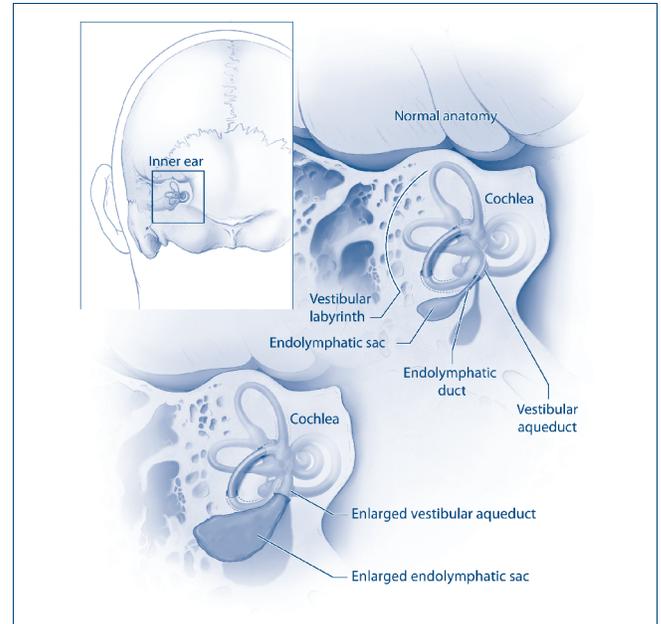
Children who are born with Pendred syndrome may begin to lose their hearing at birth or by the time they are three years old. The hearing loss is progressive, which means that a child will have less hearing over time. Some individuals may become totally deaf.

The loss of hearing often happens suddenly and in stages. Sometimes, after a sudden decrease in hearing, a person's hearing will nearly return to its previous level. Almost all people with Pendred syndrome have bilateral hearing loss, or hearing loss in both ears. The hearing loss often is greater in one ear than in the other.

How does Pendred syndrome affect other parts of the body?

Pendred syndrome can affect the thyroid by causing it to grow too large. An enlarged thyroid gland also is called a goiter. The thyroid is a small, butterfly-shaped gland in the front of your neck, just above your collarbones. The thyroid plays a major role in how your body uses energy from food. In children, the thyroid is important for normal growth and development. Children with Pendred syndrome, however, rarely have problems growing and developing properly even if their thyroid is affected.

Roughly 60 percent of individuals with Pendred syndrome will develop a goiter in their lifetime. Most people with Pendred syndrome are in their teens or twenties before they develop a goiter. If a goiter becomes large, a person may have problems breathing



and swallowing. A health professional is needed to check a person's goiter over time and decide what treatment is necessary.

Pendred syndrome also may affect the vestibular system, which controls balance. About 40 percent of individuals with Pendred syndrome will show some vestibular weakness when their balance system is tested. However, the brain is very good at making up for a weak vestibular system, and most children and adults with Pendred syndrome do not have a problem with their balance or have difficulty doing routine tasks. Some babies with Pendred syndrome may start walking later than other babies. It is not known why some individuals with Pendred syndrome develop a goiter or have balance problems and others do not.

What causes Pendred syndrome?

Pendred syndrome can be caused by changes, or mutations, to a gene known as *SLC26A4* (also referred to as the *PDS* gene) on chromosome 7. Because it is a recessive trait, a child needs to inherit two mutated



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SLC26A4 genes—one from each parent—to have Pendred syndrome. The child’s parents do not need to have Pendred syndrome to be a carrier of a mutation in the *SLC26A4* gene.

Couples who are concerned that they might be able to pass Pendred syndrome on to their children may seek genetic testing. A possible sign that a person may be a carrier of a mutated *SLC26A4* gene is a family history of early hearing loss. Another sign is a family member who has both a goiter and hearing loss. A mutation in the *SLC26A4* gene can be determined by genetic testing that uses a blood sample.

The decision to have a genetic test is complex. Most people receive assistance from a genetic counselor trained to help them weigh the medical, emotional, and ethical considerations. A genetic counselor is a health professional who provides information and support to individuals and families who have a genetic disease or who are at risk for such a disease.

How is Pendred syndrome diagnosed?

A physician called an otolaryngologist or a clinical geneticist will consider a person’s hearing, inner ear structures, and sometimes the thyroid in diagnosing Pendred syndrome. The specialist will evaluate the timing, amount, and pattern of hearing loss. He or she will ask questions such as “When did the hearing loss start?”, “Has it worsened over time?”, and “Did it happen suddenly or in stages?” Early hearing loss is one of the most common characteristics of Pendred syndrome; however, this symptom alone does not mean a child has the condition.

The specialist uses inner ear imaging techniques known as magnetic resonance imaging (MRI) or computed tomography (CT or CAT) to look for two key characteristics of Pendred syndrome. One characteristic might be a cochlea with too few turns. The cochlea is the spiral-shaped part of the inner ear that converts sound into electrical signals that are sent to the brain. A healthy cochlea has two-and-a-half turns, but the

cochlea of a person with Pendred syndrome may have only one-and-a-half turns.

A second characteristic of Pendred syndrome is enlarged vestibular aqueducts (see figure on page 1). The vestibular aqueduct is a bony canal that runs from the vestibule (a part of the inner ear between the cochlea and the semicircular canals) to the inside of the skull. Inside the vestibular aqueduct is a fluid-filled tube called the endolymphatic duct, which ends at a balloon-shaped endolymphatic sac. When the vestibular aqueduct is enlarged, the endolymphatic duct and sac grow large with excess fluid in comparison to their normal sizes. The function of the vestibular aqueduct is not well understood.

When screening for Pendred syndrome, it is not recommended to test the blood for thyroid hormone because the amount usually is the same whether someone has Pendred syndrome or not. Some people may receive a “perchlorate washout test,” a test that determines whether the thyroid is functioning properly. Although this test is probably the best test for determining thyroid function in Pendred syndrome, it is not used often and may be replaced by genetic testing. Individuals who have a goiter may be referred to an endocrinologist, a doctor who specializes in glandular disorders, to determine whether the goiter is due to Pendred syndrome or to another cause. Goiter is a common feature of Pendred syndrome, but many individuals who develop a goiter do not have Pendred syndrome. Conversely, many people who have Pendred syndrome never develop a goiter.

How common is Pendred syndrome?

Scientists estimate that about two to three children out of every 1,000 have early hearing loss, and about half of these cases are inherited. The *SLC26A4* gene, which causes Pendred syndrome, accounts for about five to ten percent of hereditary hearing loss. As researchers gain more insight about the syndrome and its features, they hope to improve doctors’ ability to detect and diagnose the disorder in people.

Can Pendred syndrome be treated?

Treatment options are available for individuals with Pendred syndrome. Because the syndrome is inherited and can involve thyroid and balance problems, many specialists may be involved in treatment. The treatment team may include a primary care physician, an audiologist, an endocrinologist, a clinical geneticist, a genetic counselor, an otolaryngologist, and a speech-language pathologist.

To reduce the likelihood of progression of hearing loss, individuals with Pendred syndrome should avoid contact sports that might lead to head injury; wear head protection when engaged in activities that might lead to head injury (such as bicycle riding or skiing); and avoid situations that can lead to barotrauma (extreme, rapid changes in pressure), such as scuba diving or hyperbaric oxygen treatment.

Pendred syndrome cannot be cured. However, the medical team can help parents and individuals make informed choices about treatment options. They also can help them prepare for increased hearing loss and other possible long-term consequences of the syndrome.

Children with Pendred syndrome should start early treatment to learn skills that will help them communicate, such as learning sign language or cued speech or how to use a hearing aid. Most individuals with Pendred syndrome will have hearing loss significant enough to be considered eligible for a cochlear implant. A cochlear implant is an electronic device that is surgically inserted into the cochlea. A cochlear implant does not restore or create normal hearing. Instead, a cochlear implant helps a person develop a new way of understanding speech. Children over 12 months of age as well as adults are eligible to receive an implant. (For more information, see the National Institute on Deafness and Other Communication Disorders [NIDCD] fact sheet entitled "Cochlear Implants.")

Individuals with Pendred syndrome who develop a goiter need to have it checked regularly. The goiter in Pendred

syndrome is unusual because the thyroid is making the right amount of thyroid hormone, but it is growing in size. Such a goiter often is called a euthyroid goiter. For more information on the treatment of goiters, contact the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) at www.niddk.nih.gov.

What research is being conducted?

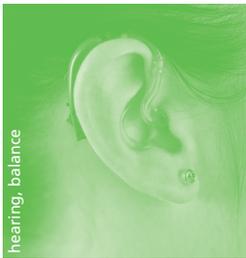
NIDCD has been working to understand hearing loss caused by inherited syndromes such as Pendred syndrome as well as from other causes. Researchers also are looking carefully at the characteristics of the disorder and how the syndrome might cause problems in such different parts of the body as the thyroid and inner ear.

Scientists continue to study the genetic basis of Pendred syndrome. The protein that the *SLC26A4* gene encodes, called pendrin, is found in the inner ear, kidney, and thyroid gland. Researchers have identified more than 90 deafness-causing mutations or alterations of this gene.

Scientists have altered the gene in mice so that the mice have an abnormal *SLC26A4* gene. The study of these mice is providing information on how the abnormal gene affects the form and function of different parts of the body. For example, by studying the inner ears of mice with *SLC26A4* mutations, scientists now realize that the enlarged vestibular aqueduct associated with Pendred syndrome is not caused by a sudden stop in the normal development of the ear. Studies such as this are important because they help scientists rule out some causes of a disorder while helping to identify areas needing more research. Eventually, researchers are hopeful that these studies will lead to therapies that can target the basic causes of the condition.

Where can I get more information?

NIDCD maintains a directory of organizations that can answer questions and provide printed or electronic information on Pendred syndrome. Please see the list of organizations at www.nidcd.nih.gov/directory.



hearing, balance



smell, taste



voice, speech, language

NIDCD supports and conducts research and research training on the normal and disordered processes of hearing, balance, smell, taste, voice, speech, and language and provides health information, based upon scientific discovery, to the public.

Use the following keywords to help you search for organizations that are relevant to Pendred syndrome:

- Hereditary hearing loss
- Genetic diseases/disorders
- Early identification of deafness in children

For more information, additional addresses and phone numbers, or a printed list of organizations, contact:

NIDCD Information Clearinghouse
1 Communication Avenue
Bethesda, MD 20892-3456
Toll-free Voice: (800) 241-1044
Toll-free TTY: (800) 241-1055
Fax: (301) 770-8977
E-mail: nidcdinfo@nidcd.nih.gov

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