CONDITION

Otosclerosis

Otosclerosis is abnormal bone remodeling around the inner ear that can fix a small hearing bone in place and gradually reduce hearing.

WHAT IT IS
Abnormal bone remodeling that limits movement of the stapes

BODY SYSTEM
Ears and hearing

MAIN SYMPTOMS
Gradual hearing loss, tinnitus, muffled speech, occasional dizziness

WHAT CAUSES IT
Abnormal bone remodeling, with inherited susceptibility

HOW IT IS DIAGNOSED
Audiometry and tympanometry, sometimes temporal-bone CT

MAIN TREATMENT
Hearing aids or ear surgery

CAN IT BE CURED?
No - treatment improves hearing, not bone remodeling

IS IT AN EMERGENCY?
Sometimes - sudden hearing loss needs same-day care

LONG-TERM OUTLOOK
Hearing may worsen slowly; treatment often improves function

Overview

Otosclerosis is a condition in which bone around the structures of the inner ear remodels abnormally. Bone remodeling is the normal process of replacing old bone with new bone. In otosclerosis, this process can interfere with hearing.

It most often affects the stapes, the smallest bone in the body. The stapes sits in the middle ear and should move when sound reaches the eardrum. If abnormal bone fixes the stapes in place, sound cannot pass efficiently into the inner ear. This causes conductive hearing loss , meaning sound is blocked from being conducted through the middle ear.

In some people, otosclerosis also affects the cochlea, the spiral-shaped organ that changes sound vibrations into nerve signals. This can cause sensorineural hearing loss , meaning damage involving the inner ear. A person may have both types, called mixed hearing loss.

Otosclerosis usually develops gradually. It may affect one ear first, but both ears can eventually be involved. It does not usually cause ear pain or discharge.

The condition matters because untreated hearing loss can make conversations, work, study, and social activities harder. Hearing aids and surgery can often improve hearing, although they do not remove the underlying tendency for abnormal bone remodeling.

Symptoms

The main symptom is hearing loss that develops over months or years. Early hearing loss may affect lower-pitched sounds first. Speech can seem quiet or muffled, and it may become difficult to hear soft voices.

Common features include:

Some people notice that conversation seems easier to follow in a noisy place. This may happen because other people naturally speak louder in that setting. It does not mean the hearing loss has improved.

Your own voice may sound unusually loud or different. You may also have trouble judging how loudly you are speaking.

Symptoms can resemble earwax blockage, fluid behind the eardrum, age-related hearing loss, noise-related damage, or other middle- and inner-ear conditions. Symptoms alone cannot confirm otosclerosis.

- Gradual hearing loss in one or both ears
- Tinnitus, such as ringing, buzzing, or humming
- Difficulty following conversations, especially with several speakers
- A need to increase television, phone, or headphone volume
- Occasional dizziness or problems with balance

Causes and risk factors

The exact cause is not fully understood. Otosclerosis appears to result from changes in how bone is maintained around the inner ear.

Inherited susceptibility is important. The condition can run in families, but inheritance is not simple. Having an affected relative does not mean you will definitely develop it, and some people have no known family history.

Symptoms often become noticeable in early or middle adulthood, although they can appear at other ages. Otosclerosis is identified more often in women than in men.

Some people report hearing changes during or after pregnancy. Hormonal effects have been proposed, but evidence that pregnancy consistently starts or accelerates otosclerosis is limited. Pregnancy does not mean that hearing loss will occur.

Past research has also examined possible links with measles infection and other environmental factors. These links have not established a single preventable cause.

Otosclerosis is not caused by poor ear hygiene, listening effort, or anything you did during an ordinary daily activity.

Diagnosis

Assessment usually begins with questions about how quickly your hearing changed, whether one or both ears are affected, and whether relatives have similar hearing loss. The ear canal and eardrum are examined. In many people with otosclerosis, the eardrum looks normal.

An audiologist performs hearing tests. Pure-tone audiometry measures the quietest sounds you can hear through headphones and through a small device placed behind the ear. Comparing these results helps show whether sound is being blocked in the middle ear.

Speech testing measures how well you hear and understand spoken words. Tympanometry checks how the eardrum and middle-ear system respond to changes in air pressure. Acoustic reflex testing measures a small muscle response to sound. A missing reflex can support the diagnosis, although it is not specific to otosclerosis.

A CT scan of the temporal bones may show abnormal bone around the stapes or cochlea. It is not required for every person. It may be considered if the diagnosis is uncertain, symptoms are unusual, or surgery is being planned.

No routine blood test confirms otosclerosis. Genetic testing is not normally needed because several genetic and non-genetic factors may be involved.

Treatment and management

Treatment depends on the type and degree of hearing loss, its effect on your life, the health of your inner ear, and your preferences. Monitoring may be reasonable when hearing loss is mild and is not causing significant difficulty.

Hearing aids amplify sound and can help with conductive, sensorineural, or mixed hearing loss.

They do not stop bone remodeling, but they can make speech and everyday sounds easier to hear. An audiologist can adjust them as hearing needs change.

Stapes surgery may be offered for suitable conductive hearing loss. The most common procedure is a stapedotomy. The surgeon makes a very small opening in the fixed stapes and places a tiny prosthesis that allows sound vibrations to reach the inner ear. A stapedectomy removes more of the stapes before placing a prosthesis.

Surgery often improves the conductive part of hearing loss, but results cannot be guaranteed. It does not restore hearing already lost from inner-ear damage, and hearing may change again over time.

Possible surgical risks include:

If both ears are affected, surgery is generally considered one ear at a time. The second ear can be assessed after the first has healed.

There is no established medicine that reliably reverses stapes fixation. Fluoride and medicines that slow bone breakdown have been studied, particularly for inner-ear involvement, but evidence is limited and they are not routine treatment for everyone.

For severe hearing loss that hearing aids or stapes surgery cannot manage, a cochlear implant may sometimes be considered. This device sends electrical signals directly to the hearing nerve.

- Temporary dizziness or changes in taste
- Tinnitus that continues or becomes more noticeable
- Injury to the eardrum or middle-ear structures
- Hearing that does not improve
- Rarely, severe permanent hearing loss or facial nerve injury

Complications

The most common complication is progressive hearing loss. Conductive loss may become more pronounced as the stapes becomes less mobile. If the cochlea is involved, permanent inner-ear hearing loss may develop.

Hearing loss can contribute to fatigue, misunderstandings, reduced confidence, and withdrawal from conversations. Tinnitus may disturb concentration or sleep. These effects are reasons to seek assessment even when the hearing change is gradual.

Balance symptoms are less common and may have another cause. Persistent or worsening

vertigo should not automatically be attributed to otosclerosis.

Complications after stapes surgery are uncommon but can be important. These include infection, a displaced prosthesis, persistent dizziness, changes in taste, or further hearing loss. New symptoms after surgery should be discussed with the surgical team according to the instructions provided at discharge.

Prevention

There is no known way to prevent otosclerosis. Its inherited susceptibility and abnormal bone remodeling are not caused by a behaviour that can be avoided.

Protecting your hearing from excessive noise will not prevent otosclerosis, but it can reduce additional noise-related inner-ear damage. Use suitable hearing protection around loud machinery, concerts, firearms, or other intense sound.

Avoid putting cotton swabs or other objects into the ear canal. This does not affect otosclerosis, but it can injure the canal or eardrum and make hearing problems more complicated.

If otosclerosis runs in your family, routine genetic screening is not generally used to predict who will develop symptoms. A baseline hearing test may be useful if you have noticed a change in hearing.

Living with it and what to expect

Otosclerosis usually changes slowly over months or years. Hearing may remain stable for a time and then worsen, or it may decline more steadily. One ear may be more affected than the other.

Regular hearing tests can show whether hearing has changed and whether a hearing aid needs adjustment. Follow-up is usually routine rather than urgent unless hearing changes suddenly or new symptoms develop.

Many people continue their usual work, education, travel, exercise, and relationships. Practical changes can reduce listening effort. Face the person speaking, reduce background noise where possible, use captions, and let people know which side is easier to hear from.

Remote microphones, telephone settings, television listening systems, flashing or vibrating alerts, and workplace adjustments can also help. These tools may be useful with or without hearing aids.

Tinnitus may improve when hearing is treated because outside sounds become easier to hear. If it continues, background sound, hearing aids, sleep support, or tinnitus-focused therapy may make it less intrusive.

Surgery can provide long-lasting improvement in sound conduction, but it does not guarantee normal hearing or stop all future inner-ear change. Some people continue to use a hearing aid after surgery. Others manage well with a hearing aid alone and do not choose surgery.

When to get medical help

Arrange a routine hearing assessment if you have gradually worsening hearing, persistent tinnitus, or difficulty following conversations. These symptoms have several possible causes and need proper hearing tests rather than self-diagnosis.

Seek same-day urgent medical assessment if hearing drops suddenly over hours or a few days, even if the ear does not hurt. Sudden hearing loss is not typical of otosclerosis and may need time-sensitive treatment.

Contact the surgical team promptly after ear surgery if you develop worsening pain, fever, discharge, facial weakness, severe or persistent vertigo, or a sudden reduction in hearing.

Call emergency services for hearing loss accompanied by signs such as facial drooping, weakness on one side, difficulty speaking, confusion, inability to walk, or a severe sudden headache. These symptoms may indicate a neurological emergency rather than otosclerosis.

Common questions

Can otosclerosis make me completely deaf?

Most people do not lose all hearing. However, the condition can sometimes cause severe conductive, sensorineural, or mixed hearing loss. Hearing aids, stapes surgery, and, in selected cases, cochlear implants can provide options at different levels of hearing loss.

Does otosclerosis always affect both ears?

No. It may begin in one ear and remain uneven. Both ears are affected in many people over time, but they may not change at the same rate.

Will a hearing aid stop otosclerosis getting worse?

No. A hearing aid improves access to sound but does not change bone remodeling. It can still provide effective long-term support and can be adjusted if your hearing changes.

Is stapes surgery a permanent fix?

The improvement can last for many years, but surgery cannot guarantee permanent normal hearing. The prosthesis may rarely develop a problem, and inner-ear hearing loss can still progress.

Can I fly if I have otosclerosis?

Otosclerosis itself usually does not prevent air travel. After stapes surgery, pressure changes may be restricted during healing. Follow the surgeon's instructions about flying, diving, heavy lifting, and getting water in the ear.

Is otosclerosis the same as age-related hearing loss?

No. Otosclerosis usually begins with a mechanical problem involving the stapes, while age-related hearing loss mainly affects inner-ear sensory cells and nerve pathways. A person can have both conditions.

Sources

- National Institute on Deafness and Other Communication Disorders. "Otosclerosis."
- American Academy of Otolaryngology-Head and Neck Surgery. "Clinical Indicators: Stapedectomy/Stapedotomy."
- Quesnel AM, Ishai R, McKenna MJ. "Otosclerosis: Temporal Bone Pathology." Otolaryngologic Clinics of North America . 2018;51(2):291-303.
- Foster MF, Backous DD. "Clinical Evaluation of the Patient with Otosclerosis." Otolaryngologic Clinics of North America . 2018;51(2):319-326.
- Rudic M, Keogh I, Wagner R, and colleagues. "The Pathophysiology of Otosclerosis: Review of Current Research." Hearing Research . 2015;330:51-56.