THE NEW YORK OTOLARYNGOLOGY GROUP, P.C.
The Ear, Nose and Throat Specialists

Neil M. Sperling, M.D.
Otology/Neuro-Otology

Diseases of the Ear
Facial Nerve
Balance Disorders

Surgery for Conductive Hearing Loss

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Dr. Sperling is among the most experienced ear surgeons in New York City. He is actively involved in researching new and improved aspects of caring for patients with otosclerosis and other ear conditions. He is the past Director of Otology (Ear Surgery) at *SUNY-Downstate Medical College* from 1991 -2010. He also serves on the teaching faculty at the *Causse Ear Hospital* in France, one of the most innovative and experienced centers in the world for Ear surgery and Stapedectomy surgery.

Dr. Sperling graduated with honors from the New York Medical College. He completed a residency in Otolaryngology at the New York Eye and Ear Infirmary, followed by a fellowship in Otology (ear surgery) at the Minnesota Ear Clinic. Dr. Sperling is the author of numerous medical publications and has edited several textbooks. He has been elected to the New York Otologic Society a group of New York ear experts. He has served on local and national committees including the committee on applicants for the American College of Surgeons, and the implantable devices sub-committee of the American Academy of Otolaryngology-Head and Neck Surgery.

Voted into 'Best Doctors' in America: 2003 – 2013

Selected to New York's Top Doctors: 1997, 1999, 2001 – 2013

Selected by New York Magazine Best Doctors in NY: 2007, 2008

Selected to New York Super Doctors: 2008 - 2013

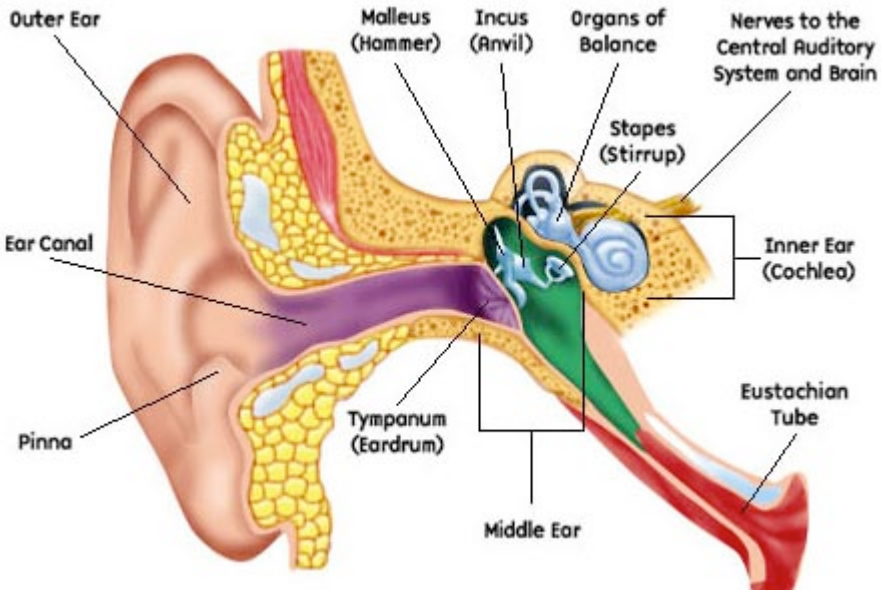
Surgery for Conductive Hearing Loss

What is conductive hearing loss

Conductive hearing loss is a form of hearing loss due to abnormalities in mobile portions of the ear. Theses are the movable parts (including the eardrum) that transmit sound from the outside to the inner ear where our nervous system takes over and transmits signals to the brain. Conductive hearing loss occurs when these movable parts are damaged or when their mobility is impaired. Thankfully, most conductive hearing loss can be helped. Dr. Sperling may discuss options for treatment. Surgery may be an appropriate method to restore hearing.

How the Ear Works

Sound travels through the air around us as sound energy, also called sound waves. The ear's job is to convert sound waves into a form that can be interpreted by the brain, which receives only electrical impulses. The three parts of the ear - the outer, middle and inner ear - each play a critical role in this process.



The outer ear consists of the pinna, or the visible flap of skin and cartilage on both sides of our heads, and the auditory canal. The pinna is shaped to collect sound waves and direct them down the auditory canal to vibrate the tympanic membrane, or eardrum.

The eardrum separates the outer ear from the middle ear. In the middle ear, the eardrum's vibrations move the **Malleus** (hammer), the **Incus** (anvil) and the **Stapes** (stirrup) bones of the middle ear, collectively known as the **ossicles** or **ossicular chain**. With motion of the ossicles, the sound waves that first entered the auditory canal have been converted to mechanical energy, and this energy is conducted toward the inner ear.

Movement of the ossicles causes vibrations in the fluid of the cochlea, the hearing portion of the inner ear. As the cochlear fluid vibrates, it moves thousands of tiny hair-like nerve cells that line the cochlear walls.

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This movement converts the mechanical energy of the ossicles into electrical nerve impulses. These impulses travel from the cochlea up the auditory nerve, where they are received and given meaning and relevance by the brain.

The structures described here are located deep in the mastoid process, the bony protuberance that forms the part of the skull immediately behind each ear.

Common Causes of Conductive Hearing Loss

Otosclerosis

Otosclerosis (also termed otospongiosis) is a condition of the inner ear bone. Abnormal changes ('remodeling') of the inner ear bone results in stiffening or fixation of the stapes bone hinder its vibrations. This results in a conductive hearing loss. Otosclerosis will usually affect both ears but is generally worse on one side. It is hereditary in some cases.

Treatment options

- The hearing loss associated with otosclerosis is likely to slowly progress over time. If it interferes with one's daily life it may be appropriate to consider treatment options. There is currently no cure for otosclerosis, but treatment that overcomes the hearing loss is available.
- Generally the options are
    1. observation
    2. hearing aid
    3. middle ear surgery
- Dr Sperling will discuss management options with you in detail. Be sure to have all you questions answered.

Surgery for Otosclerosis: Laser Stapedotomy / Stapedectomy*

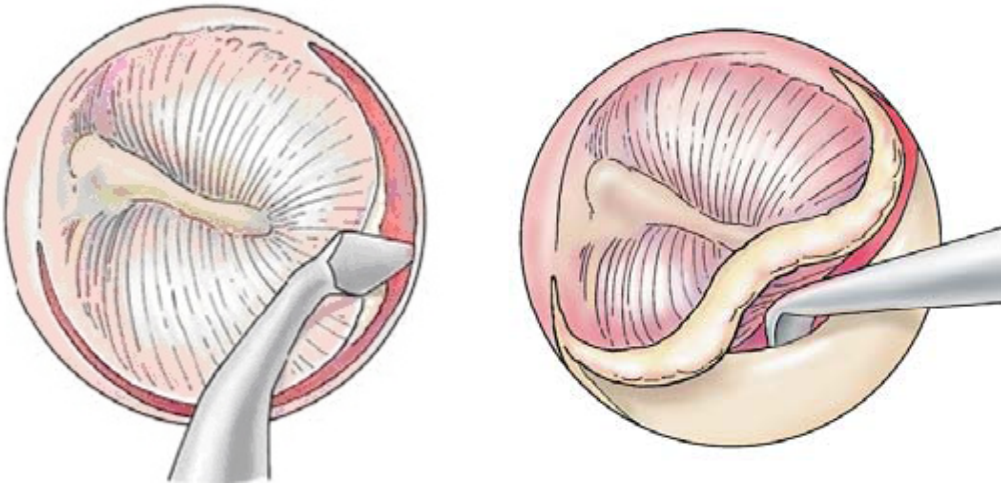
Stapedotomy and Stapedectomy are 2 variations of surgery done for otosclerosis. Although Stapedotomy is more commonly done, the term Stapedectomy has traditionally been used to refer to either procedure.

- Stapedotomy/Stapedectomy surgery can improve the conductive hearing loss associated with otosclerosis in the great majority of cases. It is done in an operating room under general anesthesia, and lasts form 1 – 2 hours. 1 – 3 hours of recovery time is usually needed before you will be sent home.
- Stapes surgery is entirely done through the ear canal, and therefore you can expect no incisions or scars about the ear. Typically a vein graft is taken from the hand. This is a specialized technique which is felt to improve the success of the surgery. You will have a few absorbable stitches in your hand.
- The surgery is done by lifting the ear drum ("like the hood of a car"). This does not damage the ear drum as it is put back in place upon completing the surgery. Using a laser the immobilized stapes bone is partially

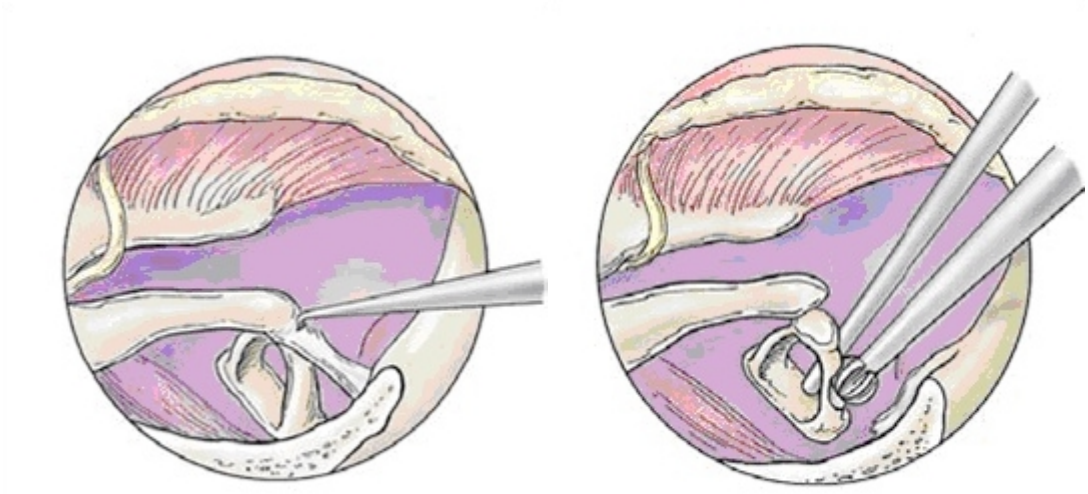
removed. A small opening into the inner ear is made using the laser and other instruments. The vein graft is then used to protect the inner ear contents, including the fluid that fills it. An artificial bone (prosthesis) made of a variety of materials is then used to 'reconnect' the vibrating bones with the inner ear.

- A packing material is used in the ear upon completing the surgery. This will produce a blocked feeling in the ear for the first few days following your surgery.

Steps of Stapedotomy Surgery

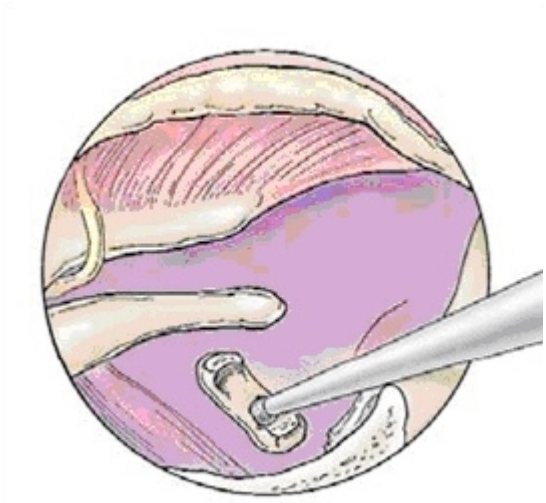


Elevating the tympanic membrane (ear drum)



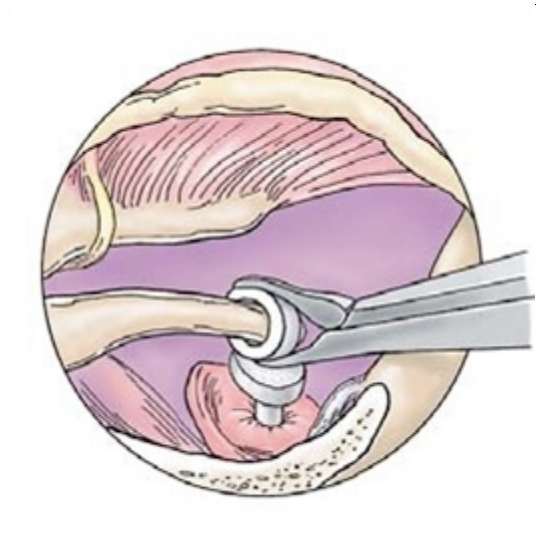
The ossicular chain is tested for motion

The stapes bone is removed

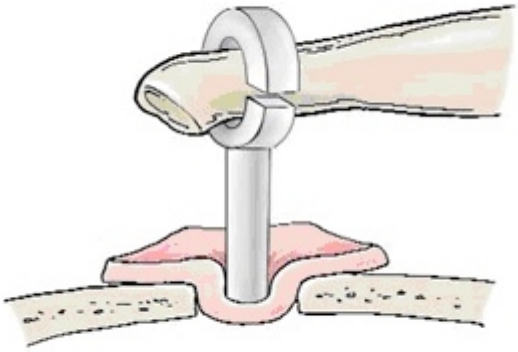


The stapes footplate is opened

Vein graft covers the opening of the footplate



The prosthesis is placed onto the Incus



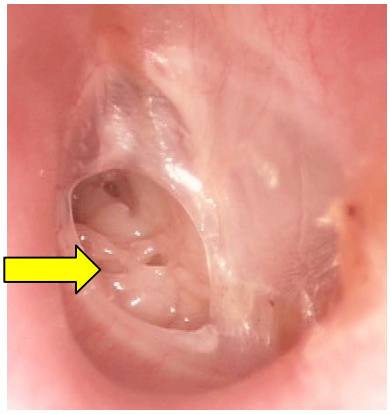
The prosthesis resting on the vein graft

Ear Drum Perforation and other causes of Conductive Hearing Loss

- The ear drum (also known as the **tympanic membrane)** is the thin layer of skin that covers the deeper air-containing space called the middle ear. It is a barrier to external objects entering the ear. It serves to 'focus' the sound energy to the **Ossicular chain**. This is a chain of 3 bones that conduct the sound energy through the middle ear to the inner ear where the nerve endings are located. The 3 bones are (in order from external to internal): **Malleus, Incus and Stapes.**

Perforation:

Normal Left Ear Drum



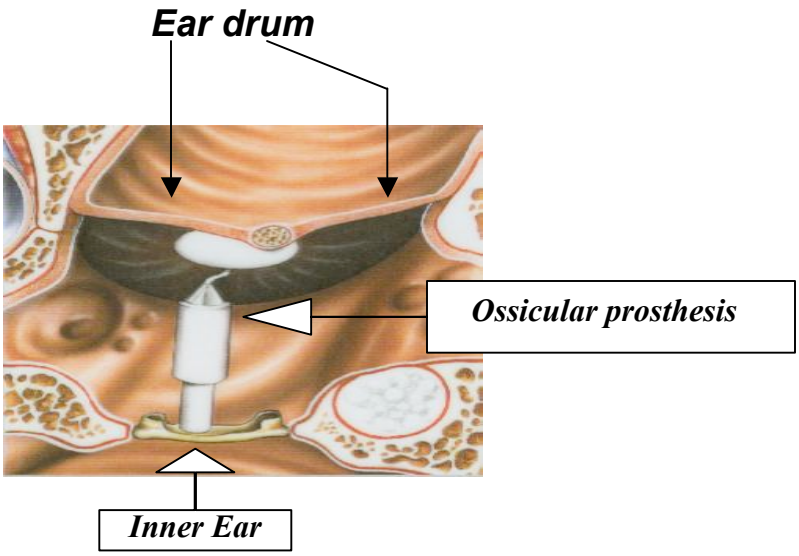
Perforated Left Eardrum

- An opening or perforation in the tympanic membrane can result in hearing loss by interfering with the normal transfer of sound to the ossicular chain. Perforations typically occur from injury or repeated infections. At times the ossicular bones may be damaged or dislocated causing a disruption of sound energy transmission and thus a conductive hearing loss.
- By repairing the tympanic membrane and/or the ossicular bones, the normal conductive mechanism can be re-established and hearing loss improved.

Surgery for Perforation: Tympanoplasty

Surgery to repair the ear drum is termed Tympanoplasty and may or may not include repair of the ossicles (ossicular chain reconstruction). This surgery typically requires a graft of your own tissues. This 'patch' is usually taken from behind the ear leaving a small scar. The drum is patched by freshening the edges of the perforation. The ear-drum is lifted and patched on it's under surface. Patched is held in place by absorbable packing material.

- **Ossicular Reconstruction**
  If the ossicular chain is damaged or malformed, reconstruction can be performed to improve hearing. This generally consists of replacing or repairing 1, 2 or all 3 ossicular bones, depending on the extent of the ear condition. Reconstruction is done by re-shaping your own ossicular bone, or with a prosthesis (artificial replacement) as needed. Prostheses are usually made of a combination of Teflon plastics and/or titanium or other metals. They are extremely safe and reliable.



Ossicular Prosthesis placed between the tympanic membrane (ear drum) and the footplate of the stapes bone.