

Sudden Hearing Loss

by Richard Regent

Sudden sensorineural hearing loss (SSHL) or **nerve deafness** is hearing loss caused by damage to the cochlea (the spiral cavity of the inner ear) or auditory nerve. Exposure to excessive noise, a virus, an autoimmune disorder or the aging process can cause a sensorineural hearing loss. Sometimes SSHL is temporary. If normal hearing returns at all, it tends to recover within the first few weeks.

Another type of deafness is **conductive hearing loss** in which sound is impeded in its ability to stimulate the inner ear. This can be caused by earwax (cerumen), a perforated ear drum, fluid in the middle ear, or damaged middle ear bones. In general, conductive hearing loss is correctable.

One day I am practicing my clarinet along with accompaniment music playing on my computer. The speakers are at ear height on the computer hutch shelf. Suddenly, a loud tune plays which startles me. Before I can get to the volume control or think about moving away I am exposed to several seconds of loud noise. Not realizing something happened to my hearing I cautiously continue to listen to music after the incident. Perhaps I should have rested my ears.

Later I discover hearing loss symptoms with my left ear. It begins with tinnitus -- a whooshing noise and ringing tones produced inside the ear. My wife puts her ear by my ear, but can not hear these tones. There is also ear fullness -- the ear never pops or opens to normal. Many sounds are meaningless. The beautiful piano now sounds like hard-to-hear distorted chimes and the middle portion of the keyboard cannot be heard. Massaging or touching this ear, which now feels like a limp flap of skin, makes very few sounds. Sleeping is difficult because placing a pillow over the ear or sticking a finger in the ear does not stop this noise. The hearing world of stereo is now monaural.

I continue home tests. The telephone dial tone and a caller's voice cannot be heard. Chewing or biting crunchy food and swallowing can be heard only on the good ear side. Confirming tests made by clicking my fingers near each ear proves that the frustration of hearing loss in one ear continues. My basement portable dehumidifier has an electric fan with motor and a compressor. While operating it produces a wide frequency spectrum of gentle sound, which I find useful for comparing the hearing of my ears. It sounds very raspy and limited with my left ear.

A few days later I play my clarinet at a musical program. The hearing loss makes playing music uncomfortable. "Just go to the other side of the ensemble and you'll be OK." suggest the other musicians. It is not that simple. The bad ear is producing secondary tones that are similar but slightly flat, along with partially hearing of the actual music. With great concentration I play this program from sheet music. Improvising, making up harmony by playing and embellishing music based on hearing the other musician's instruments is frustrating.

I make an appointment with my Family Doctor to check my hearing problem. During the several days between the loud noise incident and the appointment my hearing slowly and miraculously returns to normal! Nonetheless, I keep my appointment. The Doctor takes a general approach to find a possible cause of sudden unilateral (one ear) hearing loss with examinations for a stroke, earwax, a damaged ear drum and head injuries, and a hearing test.

- The **stroke** is checked by taking my blood pressure and having me give a complete teeth-showing smile followed by big eyebrow movements. My uniform and symmetrical facial patterns eliminate a stroke as a cause.
- It helps to check for **earwax** blockage, the most common cause of hearing loss. The physician uses an otoscope, a hand-held instrument with a tiny light and a funnel-shaped attachment (an ear

speculum), to examine my ear canals and eardrums. The good ear is examined first to prevent contamination should it have an infection, next the problem ear is examined. There is no wax and the drums appear normal.

- I am asked questions about dizziness, nausea and **head trauma** (a head wound or injury). While standing, my balance is checked as the doctor nudges me from side to side and then I am observed while walking. Unilateral hearing loss, balance problems and nausea are symptoms of Meniere's disease. I pass these tests.
- Finally, a basic **hearing test** is performed with a tuning fork -- a hand-held device that vibrates at a fixed pitch. It is moved around my ears, placed on my forehead and then behind each ear to check for external and internal hearing loss problems.

With a cause undetermined, my physician refers me to an ear specialist. A few days later I meet the doctor and explain that my hearing has returned to normal. He reassures me that "Recovery by itself is what we like to see." Similar to the family doctor, this physician again checks my blood pressure, asks about dizziness, balance, then examines my ears for earwax, ear drum damage or obvious infections. These results are again normal so a thorough hearing test by his audiologist is recommended.

An audiologist can skillfully administer hearing tests that are designed to find out what a person can and cannot hear. **Pure tone audiometry** is a hearing test where a person listens to tones of 250, 500, 1000, 2000, 4000 and 8000 Hertz (cycles per second) and indicates when they are heard by pressing a button. Typically, the speech audio spectrum of a telephone is from 300 to 3000 Hertz. Loudness of the tones range from 0 to 60 decibels but are computerized to determine the hearing thresholds (the quietest sounds that can be heard) for each ear. The resulting audiogram are graphs of tone frequencies versus loudness for both ears. A comparison of the hearing thresholds of bone conduction and air conduction tests helps to diagnose the degree and type of hearing loss.

The **bone conduction** hearing test is made by placing a small vibrator on the mastoid bone behind the ear. Sounds travel through the bones of the skull to the cochlea and hearing nerves, bypassing the middle ear. The test indicates the sensitivity of the **cochlea**.

The **air conduction** test measures hearing with pure tones presented through headphones. The sounds travel through the air, down the ear canal, through the middle ear, and to the very delicate organ of hearing in the inner ear and the cochlea. An air conductive hearing loss is when the bone conduction hearing thresholds are normal, but there is a loss of hearing for air-conducted sounds. This means that the cochlea is normal and healthy, but there is some blockage to sound in the middle or outer ear. Middle ear infection is a common cause of air conductive hearing loss in young children. Outer and middle ear blockages can often be corrected by medical or surgical treatment. The audiogram in **Figure 1** shows my recovered hearing. The doctor reports "You have the hearing of a 21-year old." which is one third my age!

Speech discrimination is how well a person is able to clearly understand talking. It can be measured with words like *eyebrow* or *baseball*, presented at different levels of loudness, which the hearing impaired person has to repeat. A person who has a problem understanding the words, even when they are loud enough, may find the benefit provided by a hearing aid will be limited. People who have a sensorineural hearing loss often fall into this category. Generally, the greater the hearing loss the poorer the speech discrimination. There are no problems here.

Although **typanometry** is not a hearing test, it checks how well the middle ear system functions and the eardrum moves. A small rubber tip is placed in the ear and a little air is pumped into the outer ear canal. Very little movement of the eardrum could indicate fluid behind the drum as a result of an infection. Often the results of typanometry indicate the location of blockage that is causing the hearing loss and if medical treatment may help. The pneumatic resistance to a puff of air for each eardrum can be graphed as shown in the tympanogram of **Figure 2**. My typanometry tests are normal.

Four months later I am working on a smoke and carbon dioxide detector up on a ladder in the hallway of my home when its loud piercing alarm sounds. Unfortunately, the same hearing loss sequence occurs again with my left ear. This time I make an appointment directly with the ear specialist. At his office I am given another hearing test and this time the audiogram captures the hearing loss as shown in **Figure 3**. The Doctor predicts my hearing will again return to normal, but in the meantime he recommends a treatment and a test.

The doctor reviews my health history with me and suggests taking steroids as a treatment for this SSHL of unknown etiology. Jokingly he says “The steroids will not pump you up!” and prescribes Prednisone (10 mg dose of 58 tablets, taken four per day down to one per day over two weeks). If a strong immune system attacks a minor infection in the ear, it might cause such hearing loss. Without any medication the chances of SSHL recurring are 33%; but with this steroid treatment it is lowered to 20%. Reducing the auto immune system with corticosteroid therapy is supported by solid medical evidence. This treatment should be started as early as possible after the onset of the hearing loss. Side effects may be tiredness, a sore hip, or irritability.

The doctor recommends a test called **Magnetic Resonance Imaging (MRI)** to check for a possible tumor in my brain. One concern is finding a tumor on the auditory nerve (acoustic neuroma), although other brain tumors may lead to hearing loss. The 1 in 50 chance of finding such tumor sounds improbable, but if an MRI is not obtained, there would be no other way of eliminating this possibility. If a growing tumor is seen, knowing its exact size and location are important in treatment planning and follow up. There are 12 MRI scans taken of my head. Not expected is that for the last four images there is an intravenous solution called Gadolinium injected into a vein in my arm to enhance the image contrast. Malignant tumors begin to grow their own blood supply network once they reach a certain size. The pre-contrast and post-contrast images are compared and areas of differences are highlighted. The MRI procedure lasts about 45 minutes. A few weeks later my hearing returns to normal as the doctor predicted. At another appointment the doctor reviews the MRI images and happily reports that there are no tumors. Another hearing test is given with normal results similar to **Figure 1**.

Regrettably, most cases of SSHL remain specifically unexplained. They may be due to: unidentified viral infection, immunologic diseases (such as systemic lupus erythematosus), and vascular occlusion (essentially, an inner ear stroke). Syphilis, meningitis, a reactivated chicken pox infection (herpes zoster oticus), congenital cytomegalovirus infection, measles, rubella, sarcoidosis and multiple sclerosis are occasionally associated with SSHL. Certain medications like antibiotics, chemotherapeutic agents and other drugs which may lead to hearing loss should be avoided, unless they are necessary to save life or limb. Use caution when skydiving or deep sea diving that may involve sudden pressure changes. Show great care when cleaning an ear. Swabs can cause serious injuries! I plan to avoid loud noises, have relocated speakers away from my ears, and wear ear plugs as hearing protection when working on devices that could unexpectedly produce loud noises.

Losing hearing in a similar way in the other ear is unlikely and SSHL is hardly ever a sign of a more serious disease. However, if hearing doesn't return on its own or with medical treatment the impairment may be irreversible. Two good ears are many times better than one ear to find the range and direction of sounds; from the sirens of emergency vehicles to the breezes through trees and the distinct songs of birds in those trees.