

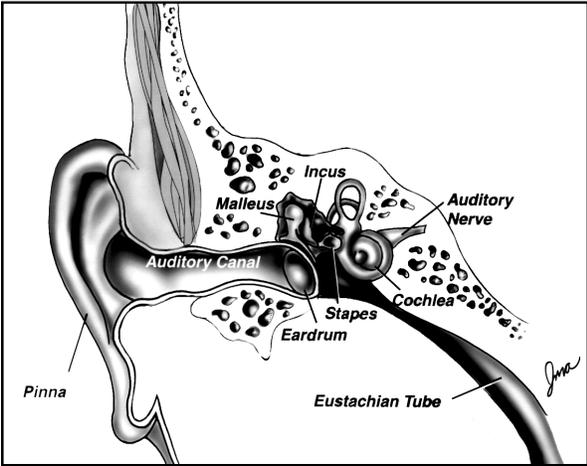
Noise-Induced Hearing Loss

What Is Noise-Induced Hearing Loss?

Every day we experience sound in our environment, such as the television, radio, washing machine, automobiles, buses, and trucks. But when an individual is exposed to harmful sounds—sounds that are too loud or loud sounds over a long time—sensitive structures of the inner ear can be damaged, causing Noise-Induced Hearing Loss (NIHL).

How Do We Hear?

Hearing is a series of events in which the ear converts sound waves into electrical signals and causes nerve impulses to be sent to the brain, where they are interpreted as sound. The ear has three main parts: the outer, middle, and inner ear. Sound waves enter through the outer ear and reach the middle ear, where they cause the eardrum to vibrate. The vibrations are transmitted through three tiny bones in the middle ear called the ossicles. These three bones are named the malleus, incus, and stapes (and are also known as the hammer, anvil, and stirrup). The eardrum and ossicles amplify the vibrations and carry them to the inner ear. The stirrup transmits the amplified vibrations through the oval window and into the fluid that fills the inner ear. The vibrations move through fluid in the snail-shaped hearing part of the inner ear (cochlea) that contains the hair cells. The fluid in the cochlea moves the top portion of the hair cells, called the hair bundle, which initiates the changes that lead to the production of the nerve im-



pulses. These nerve impulses are carried to the brain, where they are interpreted as sound. Different sounds move the population of hair cells in different ways, thus allowing the brain to distinguish among various sounds, for example, different vowel and consonant sounds.

What Sounds Cause NIHL?

NIHL can be caused by a one-time exposure to loud sound as well as by repeated exposure to sounds at various loudness levels over an extended period of time. The loudness of sound is measured in units called decibels. For example, usual conversation is approximately 60 decibels, the humming of a

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refrigerator is 40 decibels, and city traffic noise can be 80 decibels. Examples of sources of loud noises that cause NIHL are motorcycles, firecrackers, and small arms fire, all emitting sounds from 120 to 140 decibels. Sounds of less than 75 decibels, even after long exposure, are unlikely to cause hearing loss.

Exposure to harmful sounds causes damage to the sensitive hair cells of the inner ear and to the nerve of hearing. These structures can be injured by noise in two different ways: from an intense brief impulse, such as an explosion, or from continuous exposure to noise, such as that in a woodworking shop.

What Are the Effects of NIHL?

The effect from impulse sound can be instantaneous and can result in an immediate hearing loss that may be permanent. The structures of the inner ear may be severely damaged. This kind of hearing loss may be accompanied by tinnitus, an experience of sound like ringing, buzzing, or roaring in the ears or head, which may subside over time. Hearing loss and tinnitus may be experienced in one or both ears, and tinnitus may continue constantly or intermittently throughout a lifetime.

The damage that occurs slowly over years of continuous exposure to loud noise is accompanied by various changes in the structure of the hair cells. It also results in hearing loss and tinnitus. Exposure to impulse and continuous noise may cause only a temporary hearing loss. If the hearing recovers, the temporary hearing loss is called a temporary threshold shift. The temporary threshold shift largely disappears within 16 hours after exposure to loud noise.

Both forms of NIHL can be prevented by the regular use of hearing protectors such as earplugs or earmuffs.

What Are the Symptoms of NIHL?

The symptoms of NIHL that occur over a period of continuous exposure increase gradually. Sounds may become distorted or muffled, and it may be difficult for the person to understand speech. The individual may not be aware of the loss, but it can be detected with a hearing test.

Who Is Affected by NIHL?

More than 30 million Americans are exposed to hazardous sound levels on a regular basis. Ten million Americans have suffered irreversible NIHL. Individuals of all ages, including children, adolescents, young adults, and older people, can develop NIHL. Exposure occurs in the workplace, in recreational settings, and at home. There is an increasing awareness of the harmful noises in recreational activities, for example, target shooting or hunting, snowmobiles, go-carts, woodworking and other hobby equipment, power horns, cap guns, and model airplanes. Harmful noises at home may come from vacuum cleaners, garbage disposals, lawn mowers, leaf blowers, and shop tools. People who live in either urban or rural settings may be exposed to noisy devices on a daily basis.

Can NIHL Be Prevented?

NIHL is preventable. All individuals should understand the hazards of noise and how to practice good hearing health in everyday life.

- Know which noises can cause damage (those above 75 decibels).
- Wear earplugs or other hearing protective devices when involved in a loud activity (special earplugs and earmuffs are available at hardware stores and sporting good stores).
- Be alert to hazardous noise in the environment.
- Protect children who are too young to protect themselves.
- Make family, friends, and colleagues aware of the hazards of noise.
- Have a medical examination by an otolaryngologist, a physician who specializes in diseases of the ears, nose, throat, head, and neck, and a hearing test by an audiologist, a health professional trained to identify and measure hearing loss and to rehabilitate persons with hearing impairments.

What Research Is Being Done for NIHL?

Scientists focusing their research on the mechanisms causing NIHL hope to understand more fully the internal workings of the ear, which will result in better prevention and treatment strategies. For example, scientists have discovered that damage to the structure of the hair bundle of the hair cell is related to temporary and permanent loss of hearing. They have found that when the hair bundle is exposed to prolonged periods of damaging sound, the basic structure of the hair bundle is destroyed and the important connections among hair cells are disrupted, which directly lead to hearing loss.

Other studies are investigating potential drug therapies that may provide insight into the mechanisms of NIHL. For example, scientists studying altered blood flow in the cochlea are seeking the effect on the hair cells. They have shown reduced cochlear blood flow following exposure to noise. Further research has shown that a drug that promotes blood flow and is used for treatment of peripheral vascular disease (any abnormal condition in blood vessels outside the heart) maintains circulation in the cochlea during exposure to noise. These findings may lead to the development of treatment strategies to reduce NIHL.

Continuing efforts will provide opportunities that can aid research on NIHL as well as other diseases and disorders that cause hearing loss. Research is the way to develop new, more effective methods to prevent, diagnose, treat, and eventually eliminate these diseases and disorders and improve the health and quality of life for all Americans.