

Occupational Airways

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On a different note...

In this issue we are diverging from our usual focus on occupational respiratory disease to discuss another important occupational health issue, noise-induced hearing loss (NIHL). NIHL is preventable with consistent and proper usage of hearing protection. Workers tend not to seek medical treatment until permanent damage has already occurred, and occupational hearing disorders are rarely reported by physicians and other health care providers. Health care providers can play an important role in increasing patient awareness of NIHL. Also, physician reporting of occupational hearing disorders could lead to prevention activities in the workplace. We hope you find the following article both useful and interesting.



Noise-Induced Hearing Loss

By Peter Rabinowitz, MD, MPH and Judy Sparer, CIH
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Case History

A forty-five year old longshoreman came to Yale for evaluation with a complaint of tinnitus. He has a 20 year work history of loading and unloading ships, being around loud engines, trucks and forklifts, 'impulse' noise from the clanking of steel loads against the steel holds, and loud fans in the refrigerated warehouses. He admits to wearing hearing protection very intermittently.

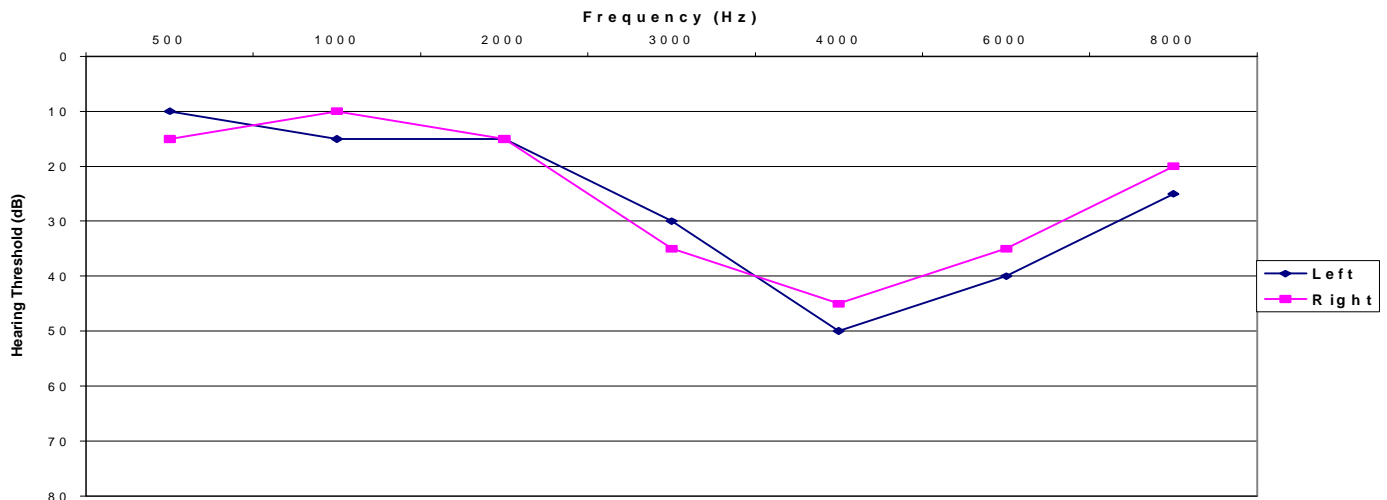
His problems began with sensations of ringing in his ears and decreased hearing at the end of a workshift. He would turn the

radio up on his way home after work and the next morning he would find that it was much too loud. Now, he reports constant ringing in his ears. He has difficulty understanding conversations in crowded rooms and has been arguing with his wife about turning up the volume of the TV. His audiogram (Figure 1) reveals a "notch" of decreased hearing in the higher frequencies.

This case is typical for noise-induced hearing loss with a history of chronic exposure to loud noise, initial temporary losses of hearing acuity

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Figure 1: Audiogram of Patient with Noise-Induced Hearing Loss



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(“temporary threshold shifts (TTS)”), and more gradual onset of permanent loss. The hearing deficit typically begins with a “notch” around 4000 Hz, and with time increases to involve other frequencies.

What is noise-induced hearing loss?

Noise-induced hearing loss (NIHL) is a sensorineural hearing loss, usually bilateral, with gradual onset, beginning at high frequencies, caused by chronic exposure to excessive sound levels which damage the hair cells of the inner ear.¹ It is estimated that 10 million Americans suffer from hearing loss due to occupational noise, making it the second most common type of acquired hearing loss, second only to age-related loss (presbycusis).

We hear sound waves because the bones of the middle ear conduct the waves to the fluid-filled inner ear. There the hair cells lining the inside of the cochlea are stimulated and transfer sound energy to nerve impulses interpreted by the brain as sound. If sound pressures are excessive, the hair cells are damaged. While they are able to recover from minor damage, repeated injury leads to cell death. Once lost, hair cells do not regenerate. Some ototoxic medications such as aminoglycosides, and some chemical exposures such as solvents and heavy metals can also damage hair cells, thus increasing risk to workers.

How is Noise measured?

Sound is described in terms of intensity (perceived as loudness), and frequency (perceived as pitch). Sound intensity is measured on a logarithmic scale using the unit of decibels (dB). An adjustment to that scale known as “A-weighting”, or “dBA” emphasizes sounds at higher frequencies where the ear is more sensitive. An increase of 3 decibels in sound level represents a doubling of sound intensity. Table 1 lists and compares the intensities of some common sounds.

Sound	Intensity (decibels)
Firearms	140-170 dB
Pneumatic rock drill	130 dB
Rock concert	110 dB
Personal stereos	100 dB
Many factories	80-99 dB
Required of OSHA Hearing Conservation Program	85 dBA 8 hour average
Loud restaurant	80 dB
Ordinary conversation	60 dB
Average office	50 dB

How is NIHL evaluated?

The evaluation of a worker with suspected noise-induced hearing loss involves:

- Taking a history of noise exposures, both occupational and non-occupational
- Taking a medical history to exclude medical causes of hearing loss
- Performing an otoscopic examination to evaluate the outer and middle ear
- Conducting Rinne and Weber tests as well as tympanometry (if available) to detect conductive hearing loss problems
- Performing audiometry

If the audiometry suggests significant hearing loss, patients should be referred to an audiologist for a full hearing evaluation. Since noise-induced hearing loss is typically symmetric (with the exception of single ear exposure as may occur in hunting or the military), patients with asymmetric sensorineural hearing deficits should be referred to an oto-laryngologist to exclude retrocochlear pathology such as an acoustic neuroma.

If occupational noise or chemical exposure is suspected as the cause of hearing loss, the physician is required to report the case to the CT Departments of Labor and Public Health. In Michigan, where there is a special emphasis on NIHL, more than 1300 cases were reported over an 8 year period.² In Connecticut, however, only 69 cases were reported over a similar period.

Why is NIHL Important?

As hearing loss increases, a person experiences difficulty with speech discrimination, especially in background noise. High frequency hearing is important for distinguishing consonant sounds such as “t”, “p”, or “s”. People report that “I can hear you, I just can’t understand you”. High pitched sounds like a telephone ring, and high-pitched voices such as a child’s are lost; music loses its richness, sounds of birds and rain disappear. Tinnitus, another common symptom, further interferes with

hearing acuity, sleep, and concentration. Social isolation and depression have been associated with noise-induced hearing deficits, as have increased risk of accidents and injury.

Treatment

If the loss is sufficiently severe, hearing aids may improve hearing. Hearing aids are not able to correct hearing the way glasses can correct vision. They can amplify sounds but not fully correct the distortion and background noise.

Noise-induced hearing loss is preventable!

Reducing sources of noise exposure at work and at home is the best way to prevent NIHL. If the noise level can not be reduced, hearing protection can help. A wide variety of hearing protectors is available and should be used at work and at home for noisy jobs. Evidence is growing that proper training can increase use of hearing protectors.³

OSHA and Hearing Conservation

OSHA requires that noise levels in the workplace, averaging more than 90 dBA over an 8 hour period, be reduced. Employees exposed to noise levels averaging more than 85 dBA must be enrolled in a Hearing Conservation Program. Despite such programs, noise-induced hearing loss continues to be one of the most common occupational disorders.

A Hearing Conservation Program requires engineering and administrative controls to reduce noise exposures, training of employees in the use of hearing protection, and annual audiometry for noise-exposed workers. The annual audiogram is compared to baseline for detection of “standard threshold shifts”, defined as a change for the worse of 10 dB average at the frequencies of 2000, 3000, and 4000 Hz. Workers who have a 10 dB shift must be counseled and rechecked. OSHA allows “age correction” of the audiogram using a standard table.

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Keeping Connecticut Healthy

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While OSHA refers to a “10 dB shift”, other more sensitive ways of measuring shifts have been proposed. NIOSH recommends using a 15 dB change from baseline in any frequency on two successive audiograms.⁴ NIOSH also recommends against age correction of an individual’s audiogram, on the basis that it is unreasonable to apply population averages for age effects to an individual.

For questions regarding noise-induced hearing loss, contact:

- OSHA (www.OSHA.gov)
- NIOSH (<http://www.cdc.gov/niosh>)
- The National Hearing Conservation Association (<http://www.hearingconservation.org>)
- Peter Rabinowitz MD, MPH at Yale, 203/785-4197.

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Occupational Disease in Connecticut: Data for Action

This past June, the Connecticut Department of Public Health released a comprehensive report entitled **Occupational Disease in Connecticut: Data for Action**. The report provides a history of occupational disease in CT, an overview of national initiatives, presents CT occupational disease data compiled from physician reports of occupational disease, describes social and economic impacts of occupational disease, describes the uses of occupational disease data, and discusses recommendations for future directions.

To receive a copy of this report, please call the Occupational Health Program at 860/509-7744.

Summary of Number of Reported Cases of Selected Respiratory Diseases in CT*
 CT DPH Occupational Disease Surveillance Data

	1997	1998	1999	2000	ODSS Total**
Asthma	27	19	24	5	201
RADS***	4	7	5	2	34
Silicosis	1	3	1	0	13
Asbestosis	3	7	6	0	110
Asbestos-related pleural diseases	2	10	9	0	118
TOTAL	37	46	45	7	476

* As of June 5, 2000. Data subject to change.
 ** Occupational Disease Surveillance System (ODSS) total since 1/1990
 *** Reactive Airways Dysfunction Syndrome