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The Buzz That Veterans Hear

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Capt. Nathan Green remembers the alarm sounding that day last April in Baghdad's Green Zone. He remembers running, and then the loud explosion of the rocket hitting 30 feet behind him. He was knocked unconscious, suffered a traumatic brain injury and now hears the high-pitched whine and static buzz of an AM radio. All the time.

Except there is no AM radio. Green, 32, an Air Force weather officer for nine years, has tinnitus, or ringing in the ears.

There is no cure, though there is ongoing research to find one. Relief most often comes through various methods of "managing" the condition.

Nobody knows quite how big a group Green has joined. Based on a 2007 survey, the Centers for Disease Control and Prevention estimates that some 23 million people in the country hear something when there is no external sound present. The American Tinnitus Association (ATA), figures the number may be 50 million, based on a survey done for Gallaudet University in the 1990s.

That survey suggests that about 12 million people have the kind of chronic condition that prompts them to seek medical attention; about 2 million have such a severe case that it is disabling, interfering with sleep, concentration, social interaction and work.

Aging plays a role in the occurrence of tinnitus, as do some physical ailments. But loud noise and subsequent damage to the ear -- the inner ear in particular -- is the principal culprit. The sources of such noise are all around us: sirens, rock concerts, blow dryers, jackhammers, chain saws, power mowers, farm and lawn tractors. Adding to the din is a whole bunch of military things, which explains why tinnitus is the No. 1 service-connected disability for Iraq veterans.

Anything above 85 decibels, about the sound of normal traffic that you can hear with the car windows up, can be damaging. And there is also a growing concern that members of the younger generation are at risk, as they crank up their MP3 players and iPods.

Tinnitus has drawn increased attention lately because the Department of Veterans Affairs counted about 400,000 veterans affected by the condition through 2006 and reported in 2008 that just over 93,000 returning Iraq veterans were affected. (The Army issues earplugs, but whether they're used is another question.)

The math is unforgiving, given that many of these military people are young. Tinnitus commonly gets a 10 percent disability rating, which translates to \$1,320 a year per individual. Fifty years of such payments for that 2008 group of 93,000 runs a little over \$6 billion. And the number of those affected is going up: Tinnitus disability payments increased 16 percent between 2005 and 2006.

Research on the disease has been limited. The ATA says that the combined public-private research money came to a little over \$3 million in 2007. The organization is pushing for larger government -- particularly Defense Department -- biomedical research grants.

Beethoven and Letterman

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Tinnitus is not a new phenomenon. Hippocrates spoke of it. Beethoven had it. Pete Townsend, lead guitarist for the Who, describes a serious case. William Shatner and David Letterman, who both have it, discussed it on a Letterman show.

They all describe the same thing: ringing, roaring, hissing, chirping, buzzing or clicking when there is no external sound generator.

Scientists generally think the starting point for the condition is the inner ear, the cochlea. There are tens of thousands of cells in the cochlea, each tipped with hair bundles called stereocilia. They are instrumental in converting incoming sound vibrations to neural activity that is distributed, via the auditory nerve, to various parts of the brain for processing.

"The cells in the inner ear are laid out like a piano keyboard," Craig Kasper, a doctor of audiology in private practice in New York, said in a telephone interview. "Each of those picks up a specific frequency, and when specific hair cells die, it's like those particular piano keys don't work, they don't hit the strings." The high frequencies seem to go first.

The cruel fact is that, in humans, when those hairs are damaged, they don't regenerate. In birds and chickens, yes; in humans, no.

So why the ringing?

The initial suggestion was that the perceived sound was generated by the ear. But Pawel Jastreboff and other pioneers in the field postulated that the real generation lay in certain parts of the brain. Research with brain imaging techniques, particularly by Richard Salvi, who directs the Center for Hearing and Deafness at the State University of New York at Buffalo, confirmed that.

He and others are continuing with that research, which suggests that the brain reacts to the auditory lapse from hair cell damage in a couple of interrelated ways.

The disappearance of sound, it is suggested, can awaken in the brain the memory of sound. And the auditory lapse produces spontaneous activity in the brain. The combination of those factors can result in the phantom sound. It is as if, when the inner ear's hair cells die, the brain says, "Wait a minute, I'm meant to be hearing something and I'm not. Here's something to fill that void."

Salvi likens it to listening to the radio in your car. "As you get farther away from the radio station and don't hear it as well, you have a tendency to turn up the volume," he said in a telephone interview. The brain tries to compensate in a similar fashion. And because of the communication between various parts of the brain, the absence of information from the hair cells gets run through the emotion control station, which is called the limbic system. That can produce anxiety, stress, sometimes depression. All of those, the medical people say, can increase the perceived constancy and intensity of the tinnitus.

Green, for instance, says his tinnitus is "significantly worse in high-stress situations." He also has migraines as a result of his brain injury, and he notes that the tinnitus makes the migraines worse. "It feeds on itself and exacerbates the problem."

Tuning It Out

What to do?

Any possible underlying physical conditions (jaw, neck, cervical spine problems, for example) should be identified and treated. Tinnitus sometimes disappears with such treatment. Check your medicines. The ATA counts more than 200 over-the-counter medicines (even aspirin in large doses) that list tinnitus as a possible side effect. An old treatment for arthritis pain was to take increasing doses of aspirin until you hear ringing in your ears, then reduce it until it stops. That is no longer prescribed.

Hearing aids can sometimes help by picking up enough ambient sound to override the tinnitus. Other alternatives involve "tinnitus management," often combining counseling and sound therapy. The goal is to suppress the perceived sound, "to pull tinnitus into the background," said Kasper, who attributes the sound of the nonexistent tea kettle he hears to the seven teenage years he spent playing bass guitar in a punk band.

"You want to make it like a refrigerator: You hear it starting up, but the brain immediately recognizes that sound as inconsequential and dismisses it," Kasper said. Accomplishing that takes into account what those in the trade call the brain's plasticity: its ability to absorb, learn, memorize, forget, discard and, in general, remap the connections between neurons.

The success rate with these therapies varies with individuals, but the results have been generally encouraging.

The initial phase of counseling provides perspective. The knowledge that tinnitus, while usually accompanied by some hearing loss, doesn't mean total hearing loss, generally relieves stress.

"What it's not is as important to the patients as what it is," said Michele Spencer, a doctor of audiology who, with Margaret Jylkka, administers a clinical tinnitus treatment program at Bethesda's National Naval Medical Center. They are in the beginning stages of the program, and Green is one of the initial participants.

Questionnaires start the process, which tries to put an objective measure on a highly subjective subject, and to pinpoint the situations in which the tinnitus is worse.

Two group sessions follow. The first deals with perspective -- what tinnitus is and isn't -- and opens a forum to talk about it. And the participants work on developing their own individual "sound plans."

Green, like many others, tried something on his own to neutralize tinnitus before getting involved in the Bethesda program. "I couldn't sleep, and I figured I had to have some kind of background noise to get to sleep." So he put a fan in the bedroom, "always turned on high whether it was 40 degrees or 90 degrees."

While it provided some relief, "it drove my wife crazy. You looked at our bed, you saw one thin sheet on my side and five covers on her side" to block out the sound.

The sound plan Green worked on at Bethesda creates a background by choosing or combining three kinds of sound: environmental sounds (rain, waterfall), music (unlikely to be Coldplay or Lil Wayne, "but if it works, put it in," said Green) or speech (such as talk radio).

The second session gauges the success of the individual sound plan. This is the ultimate mix and match. "You try multiple things until you hit it," Spencer said.

If that is unsuccessful, Bethesda will send the patients to other places -- often the hearing and balance center at the University of Maryland Medical Center in Baltimore -- for wearable devices that might help.

There are several programs involving such devices: tinnitus retraining therapy, tinnitus masking therapy, tinnitus activities treatment, and a program from a private concern called Neuromonics. In general, these employ sound generators that fit in the ear and are used in conjunction with the other procedures of each program, some of which last up to 18 months.

Progress in understanding tinnitus is constant, some of it thanks to advances in brain imaging techniques, such as the functional MRI scan, which can pinpoint parts of the brain where activity is occurring. Jaw-clenching, for example, can aggravate or calm tinnitus in some individuals. An fMRI can show what parts of the brain are firing when that happens.

Despite all the advances, for many patients learning to quiet or live with tinnitus remains a matter of constant adjustment and experimentation. Green has now been able to replace his noisy fan at night with a quieter humidifier -- and he and his wife are sleeping more peacefully.