Recognizing and Evaluating Head Injury Associated Hearing Loss

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A 23-year-old woman entered the clinic recently, referred by her primary care physician for tinnitus and possible hyperacusis. During the case history, it was revealed that she had experienced whiplash and a ‘head bump’ in a car accident six months ago. She had visited a chiropractor for her neck and back pain, had experienced some headaches for a week or so, and felt a little dizzy at times, but other than that, felt pretty well. However, she had noticed a persistent ringing in her right ear at night, which seemed to be getting louder as time passed. In addition, she was noticing that her hearing seemed to have changed a bit and sounds like silverware on plates really bothered her ears. Sometimes she would almost feel ear pain when her dogs barked, and she was using earplugs to sleep at night. Could we help?

Most hearing specialists will encounter patients who complain about hearing problems related to head injuries. Often these patients will begin asking for auditory evaluations some weeks or months after the accident, as they notice the effects that have persisted or increased over time.

The statistics for head injury are staggering: the Center for Disease Control in the US estimates that 5.3 millions Americans are now living with brain injuries, 1.5 million people or 2% of the total population will suffer a brain injury in 2004, and a significant injury occurs every 21 seconds. The primary causal factor of these traumatic brain injuries are directly related to motor vehicle accidents. Few, however, receive much in the way of direction to hearing evaluations unless they are particularly persistent. Even the awareness of changes in auditory functioning can depend on the degree of cognitive damage incurred during the accident. It is difficult to analyze changes if the part of the brain that does the analyzing is not working properly!

Of course, more immediate concerns related to life functions are addressed first: skeletal injuries, lacerations, loss of consciousness, mobility, speech, and basic skill areas. Tagging along, then, are hearing and visual problems, and an average patient may not see a specialist in those areas until long after the one-year personal injury protection coverage has expired.

Primary complaints about head injury and the auditory system, then, can be the onset of tinnitus in one or both ears, hyperacusis or collapse of sound tolerance ranges, and loss of hearing acuity, including loss of ability to pick out speech in background noise, or a deterioration in hearing thresholds. Referrals for these cases may come from primary care physicians, ear specialists, or even legal representatives. It is not uncommon for the person to seek care without a referral.

A thorough case history should be completed, and a careful evaluation should include air and bone conduction using masking when needed, speech testing including 0, +5, and +10 signal to noise ratios, and testing by tones, speech, and noise for loudness discomfort levels. Care should be taken to avoid sudden loud presentations of either speech or tones in these cases, and an ascending approach to testing thresholds is best, particularly if the patient tells you up front that sounds are ‘bothersome’ or ‘painful’.
Common outcomes from such evaluations often show unusual but predictable results. There is often a slight loss in unusual places on the audiograms, say, a 15-20 dB asymmetrical dip at 1000 or 1500 Hz. These mid-range ‘dips’ are suspected to be related to the trauma of the impact on the cochlea, the nerves that connect to the brainstem area, and the sensitive auditory neural tissue in the brainstem itself. These unusual affects appear in more than 2/3rds of the cases evaluated here over a 7 year period. Essentially healthy younger people do not demonstrate this mild mid-frequency ‘dips’, compared to the head-injured patient.

There can also be a clear loss of hearing, sensori-neural in nature, on one side of the head, or both. Conductive losses often occur as the delicate chain of bones can break or become loosened in an impact. Inflammation from an injury in the chain of bones can also result in ossification or arthritis type response which compromises the passage of sound into the cochlea. Head injuries can also result in temporal bone fractures, and direct damage to the central auditory cortex areas located on both sides of the brain. Serious head trauma can also cause ruptures of the thin membranes of the cochlea or vestibular system, resulting in loss of balance and hearing. These many complex situations require additional testing by neuro-otologists and specialists.

Another common outcome is the presence of chronic intrusive persistent tinnitus. Often perceived as a high pitched tone or ringing sound, the loudness can increase over time and in most cases, the pitch and volume can be matched using a forced choice repeated testing protocol. Repeating this test several times during the testing can help improve the reliability of the results, and patients are remarkably accurate in pinpointing the same tone and volume.

Finally, a less well known symptom of auditory damage is the condition of hyperacusis or sound sensitivity. Often patients with head injury will find pure tones objectionable at levels far below normal ears, i.e., less than 90 dB. In observing the reaction of patients listening to tones which are gradually increased in loudness steps of 5 dB, grimacing, twitching, or bodily movement should be observed to add to the diagnosis. Most patients will show these small gestures 1 or 2 steps before they say, “Stop!” Supporting these findings are tests using monitored live voice to obtain MCL and UCL. The test results should be in good agreement.

Your examination should be thoroughly documented and copies sent to physicians and legal representatives, as the evidence becomes critical in the process of settlements and assessment of life-long disabilities. The hearing specialist plays an important role in identifying and verifying auditory damage related to head injuries. It is truly in the best interest of all concerned if we are prepared to provide state-of-the-art care!

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