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Hearing Loss from Traumatic Brain Injury

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There are many forms of hearing loss, and many ways in which hearing loss can occur. Until recently the only commonly recognized forms of hearing loss were issues with the middle ear not functioning properly, or damage to the cilia in the inner ear. The former can be treated with the use of a hearing aid, but the latter cannot be treated. In most cases, if a person has trouble hearing, and the issue is not in the middle ear, then it is considered untreatable. However recent studies have shown that there are many more places that can be damaged and result in hearing loss. Some of those can be treated, and some still have no verified treatment yet.

As sound waves hit the eardrum at the end of the outer ear, they are transferred through the middle ear to the cochlea of the inner ear. The signal is picked up by the cilia in the cochlea, which translate it into electrical signals that then travel up the vestibulocochlear nerve to the thalamus. The signal is assessed for importance in the thalamus, and then sent along to the auditory cortex, to understand the sound. The previously common hearing issues are in the middle ear, and the start of the inner ear. However, after leaving the inner ear, the sound travels via several neural pathways to two distinct parts of the brain, each of which can be damaged in different ways, and each would present loss of hearing along with a few other symptoms.

A traumatic brain injury is the most common cause for damage to these areas of

the brain. That means the person gets hit in the head, or is in close proximity to a concussive blast that causes damage in the head. These kinds of injuries are difficult to see, and difficult to assess other than the secondary symptoms from them. Immediate symptoms match common symptoms of a concussion. Delayed symptoms include cognitive deficits such as difficult assessing ones surroundings, inability to focus on things, and an increased level of stress.

Treatment of traumatic brain injury varies on a case by case basis, but after any necessary surgeries, there are not any medical treatments to reverse the damage done by the brain. Most of the care is done by psychologists, and focuses around rehabilitation and coping mechanisms. These cases show some of the different ways that the auditory tract can be damaged. For those with damage to the thalamus, issues include inability to filter background noises out, issues focusing on a single sound source which presents as self-described hearing loss. These issues require a different kind of hearing test. Currently, hearing tests consist of a quiet background with quiet noises playing, in various frequency ranges to see if they can be heard. However, these issues require a form of testing with target noises in background noise. They also require tests that have rapid changes in frequency ranges, or multiple frequencies at the same time.

Unfortunately there is currently no direct form of treatment as there is with some other forms of hearing loss, such as a hearing aid. There may come a time when a neurosurgery is developed that can actively repair the damaged neurons in the brain, but currently we rely on the brains neuroplasticity to repair itself. The best way to facilitate this self repair is for the patients to continue trying to train themselves to hear and understand

better. This treatment is the same as is used of post traumatic stress disorder, and several other similar issues. In recent years, it has proven to be very effective with PTSD, and will hopefully prove as effective with traumatic brain injury related hearing loss.

Bibliography

"Traumatic Brain Injury (TBI)." *Traumatic Brain Injury (TBI).* N.p., n.d. Web. 14April 2015.

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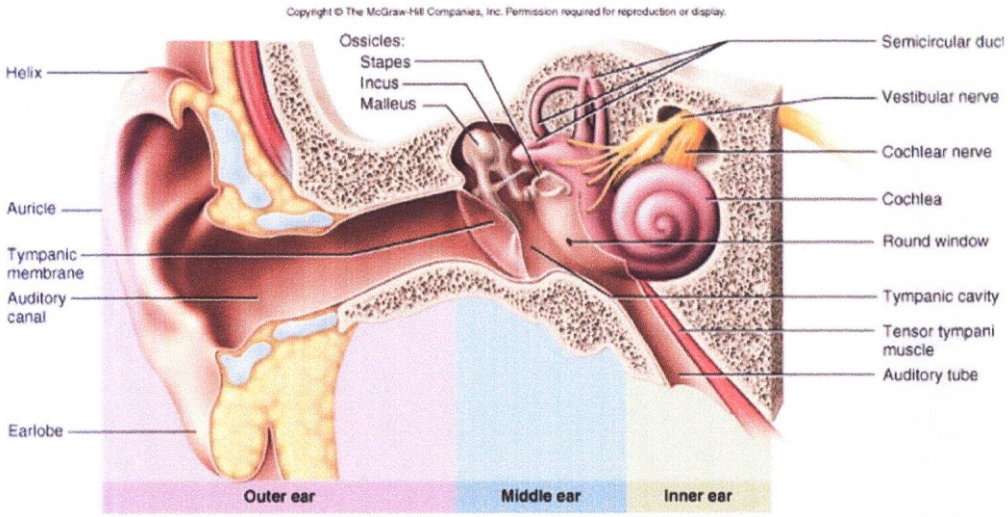
Weber, Darren L. "Information Processing Bias in Post-traumatic Stress Disorder." *The Open Neuroimaging Journal.* Bentham Open, n.d. Web. 14 April 2015.

Auditory Trauma Outside The Ear

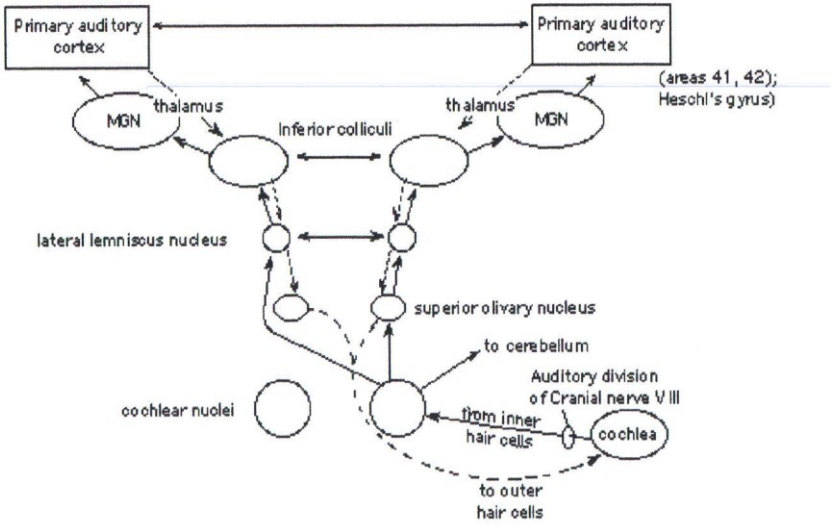
By
Nathan Young

Converting sound waves to nerve signals

External Auditory Canal (meatus) - Tympanic Membrane - Oval WindowCochlea - Vestibulocochlear Nerve (VIII) - Brain



Auditory Tract



Auditory Trauma To

- Ossification
- Inner Ear
- Vestibulocochlear Nerve (VIII)
- Thalamus
- Auditory Cortex

Symptoms

- Difficulty Filtering
- Difficulty Hearing
- Confusion
- Disorientation/nausea

Treatment

- PTSD
- Hearing Aids
- Surgery
- "Physical Therapy"

Sources

- Module B1 Senses
- http://www.kumc.edu/SAH/OTEd/OTPT_Neuro/Lecture Notes/auditory.html
- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2714576/