

Acoustic neuroma: causes, diagnosis and treatment



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Acoustic neuroma, otherwise known as Vestibular schwannoma, is a slow growing tumor that develops due to the overproduction of Schwann cells (John Hopkins Medicine, 2019). The growth is on a nerve in the inner ear which leads up to the brain. This eighth nerve from the inner ear to the brain, which is known as the vestibulocochlear nerve, controls hearing and balance. The symptoms of acoustic neuroma begin in a very subtle way, sometimes causing a doctor to misdiagnose a patient as simply having a harmless medical condition, rather than a tumor. Larger tumors of this sort however, which can be life threatening, can press strongly onto the nerves and the brainstem, causing numbness and tingling of the face and tongue (Acoustic Neuroma Association, 2018). This type of tumor can be identified by an audiologist and a physician through hearing and imaging tests. After being diagnosed, someone with an acoustic neuroma can be treated with three options: observation, surgery, or radiation (John Hopkins Medicine, 2019).

The inner ear is innervated by the nerve of hearing and balance. The nerves are encased in a layer of Schwann cells which protect the nerve fibers; however, in the case of an acoustic neuroma, there is an overproduction of the Schwann cells (National Institution of Deafness and other Communication Disorders, 2017). The eighth cranial nerve, the nerve of hearing and balance, divides into three sections: two of the parts send the balance information to the brain, and one part sends the information of hearing to the brain. An acoustic neuroma grows on one of the branches that controls balance (University of Iowa Hospitals and Clinics, 2019).

The eighth cranial nerve- the vestibulocochlear nerve- and the seventh cranial nerve- the facial nerve- lie near each other and pass through the internal auditory canal. The canal, only about two centimeters long, is the area in which the acoustic neuroma develops. The neuroma does not reach the brain, but it pushes onto the nerves and the brainstem. As the tumor enlarges, it expands from the internal auditory canal into the cerebellopontine angle, an area behind the temporal bone, which is where it pushes against the brain (Acoustic Neuroma Association, 2018). If the tumor gets abnormally large, it can begin to push on the fifth cranial nerve, the trigeminal nerve, which connects the brainstem to some muscles in the face (NYU Langone Hospitals, 2019). An acoustic neuroma, shaped like a pear or an ice cream cone lying on its side, resides with the smaller end in the internal auditory canal. A tumor of this sort can be described as either small, medium, or large, depending on its size. Less than two centimeters is considered small, whereas four centimeters or larger is considered large (Acoustic Neuroma Association, 2018).

There are two types of acoustic neuromas. The more common one is a unilateral acoustic neuroma, meaning it affects only one ear. It most commonly develops between the ages of thirty and sixty. The cause of a unilateral acoustic neuroma is unknown, but it may be an environmental factor. The second type is a bilateral acoustic neuroma. This inherited acoustic neuroma affects both ears, likely because of a disorder known as neurofibromatosis type 2 (John Hopkins Medicine, 2019). Very rare, an acoustic neuroma affects about one in one hundred thousand people per year, with around 2, 500 new cases a year (NORD, 2019). An acoustic

neuroma can affect children, though it happens very rarely. They occur most frequently in women between the ages of forty to fifty (MD Anderson Center, 2019).

According to the National Organization of Rare Diseases (NORD), there may be some people who experience a very small acoustic neuroma without realizing any signs or symptoms. However, because an acoustic neuroma grows on the nerve of hearing and balance, someone suffering from an acoustic neuroma will usually experience imbalance, dizziness, headaches, hearing loss, and tinnitus, ringing in one's ear (Mayo Clinic, 2018). Persisting or severe acoustic neuromas may cause facial and tongue weakness or numbness if they grow rapidly or go undiagnosed (MedLine Plus, 2017). If an acoustic neuroma grows large enough to push on the brainstem, the cerebrospinal fluid from the brain to the spinal cord can be cut off, causing hydrocephalus, which can lead to headaches, inability to control voluntary movements, or neurological dysfunction. Ninety percent of acoustic neuroma cases notice hearing loss in one ear as the first symptom (NORD, 2019).

Many times, the symptoms of acoustic neuromas are misdiagnosed as old age symptoms since they are typical of aging (MD Anderson Center, 2019).

The causes of acoustic neuroma are not spelled out clearly; however, there are a few things that seem to be connected to this disease. Typical causes of acoustic neuroma include being constantly exposed to loud noise, excessive radiation to the face or neck area, and neurofibromatosis type 2 (NF2), a genetic disorder characterized with noncancerous tumors of the nervous system (John Hopkins Medicine, 2019). One who experiences an acoustic neuroma because of neurofibromatosis may experience deafness if the

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tumor is left untreated, since this disorder can cause a bilateral neuroma. Patients with deafness from NF2 can be treated by an auditory brainstem implant or a cochlear implant, if the nerve of hearing was left unharmed (Acoustic Neuroma Association, 2018).

The earlier an acoustic neuroma is diagnosed, the better chance for recuperation and returning to a full recovery. Most doctors will perform a physical exam and do a thorough case history of the patient. The tumor is diagnosed through a series of hearing and balance tests, such as an audiogram, auditory brainstem responses, electronystagmography, and magnetic resonance imaging (National Institution of Deafness and other Communication Disorders, 2017).

ASHA, the American Speech and Hearing Association, defines an audiogram as “ a graph showing the results of a pure-tone hearing test. It will show how loud sounds need to be at different frequencies for you to hear them.” Type, degree, and configuration of the hearing loss are shown through an audiogram. Aside from showing how severe one’s hearing loss is, it also tells the pattern of the hearing loss. The test yields result for both the right ear and the left ear. This test is administered by an audiologist. (American Speech-Language-Hearing Association (ASHA), n. d.). When using an audiogram with pure tone audiometry, the most common form of hearing loss found in acoustic neuroma patients is high frequency hearing loss.

ABR, auditory brainstem response, provides detail of the inner ear function. The ABR tests the function of the auditory neural pathways to search for the cause of the hearing loss experienced due to certain symptoms (John

Hopkins Medicine, 2019). This test is used for suspected hearing loss in the cochlea, a part of the inner ear. Electrodes placed on the patient's forehead and around the ears record the brain wave activity in response to sounds emitted through earphones. The ABR test does not require the patient's interaction; in fact, they can be completely asleep during the test. It only requires brain function (American Speech-Language-Hearing Association, n. d.). This test provides doctors with information about the inner ear, allowing them to notice if there is any inner ear dysfunction, which can be a result of an acoustic neuroma.

The electronystagmography, also known as ENG, is designed to test for vertigo, dizziness, and other disorders associated with hearing and vision. An ENG will detect nystagmus, rapid eye movement, through electrodes which are placed around the eyes to record the changes in electrical activity taking place in response to stimuli. If there is no nystagmus present during the test, it means that a problem aroused either within the inner ear, within the nerve supply to the inner ear, or within some areas of the brain. The ENG consists of one or a few series of measurements (John Hopkins Medicine, 2019). The results of the measurements detect if an acoustic neuroma is present in the brain of the patient being tested. If no nystagmus is present, meaning the problem is within the inner ear, there is room for assumption of an acoustic neuroma.

Magnetic resonance imaging, more commonly known as an MRI, uses magnetic fields, along with radio waves to produce images of the patient's brain. An MRI scan shows visual sliced sections of the brain, which when piled up together, create a three-dimensional image, allowing the doctors to

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see a clear model of the tumor. Before the scan, a contrast dye is injected into the brain. If there is a tumor in the brain, it will suck up more dye than healthy brain tissue. In the case of an acoustic neuroma, the tumor will suck up more dye, creating a darker area in the internal auditory canal (John Hopkins Medicine, 2019). An MRI is the preferred method of imaging for an acoustic neuroma because it can detect a tumor as small as one millimeter (Mayo Clinic, 2018).

There are three possible options for treating an acoustic neuroma: surgery, radiation therapy, or simply, watching and waiting. If possible, the option of waiting and watching the growth of the tumor is the most ideal, so as not to expose someone to the dangers of surgery or radiation, which can be more harmful for some. For an older patient who is not experiencing the symptoms of the tumor, he may choose to live with the acoustic neuroma and have the doctors keep watch on it. Even if a patient is still young, but has lost hearing in an ear, he may decide to opt out of therapy to avoid further harm, if he is not living with life-threatening symptoms. Someone who has doctors watching the growth will be guided as time goes on. If symptoms worsen or become harmful to the individual, his doctor may then suggest surgery or radiation (John Hopkins Medicine, 2019). Some individuals are watched for a very short time before having something done, whereas for some people, the watchful waiting continues their whole life without needing treatment. Very rarely does it happen that the acoustic neuroma will shrink on its own (NYU Langone Health, 2019).

A few approaches of surgery can possibly be used to remove small tumors. Sometimes surgery will be performed to remove part of the tumor, rather

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than the whole thing, and later on the rest might be removed. Removing a part rather than a whole is usually to keep the facial nerves intact and prevent the patient from facial paralysis, or to preserve one's hearing (NORD, 2019). The three surgical options are: Translabyrinthine Approach, Retrosigmoid Approach, and Middle Fossa Approach.

The Translabyrinthine Approach is used when a hearing loss is already present or if there is no hope to preserve hearing. In this surgery, the surgeon will reach into the internal auditory canal to remove the tumor. Sometimes in order to reach the acoustic neuroma, a surgeon will have to remove the cochlea, as the patient anyways no longer has the ability to hear. Although part of the inner ear is lost during this surgery and the individual can not hear, usually his balance is not affected, for he has the other ear to compensate for it. Retrosigmoid Approach, the second type of surgical removal for an acoustic neuroma, is used more often for smaller tumors, in the case when it may be possible to preserve the patient's hearing. This surgery is used when the tumor is growing towards the brainstem, coming out of the internal auditory canal. Middle Fossa Approach is the last type of surgery for removing an acoustic neuroma. This is meant for smaller sized tumors that have not yet grown past the internal auditory canal. The internal auditory canal is uncovered, and the acoustic neuroma is removed by the surgeon. This approach has the highest rate for preserving hearing (NYU Langone Health, 2019).

Radiation therapy is another treatment for acoustic neuroma. Radiation does not get rid of the tumor, rather it shrinks the tumor over time. A form of radiation known as the Gamma Knife is used for treating smaller tumors.

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Gamma Knife allows a surgeon to send radiation waves to an acoustic neuroma in the internal auditory canal while not affecting important surrounding nerves, such as the nerve for hearing and balance, and the facial nerve. Unlike a surgery, this method of radiation does not involve opening any areas of the body. The Gamma Knife option sends beams of radiation directly to the tumor, and it is done all in one session. The patient wears a head frame to prevent movement of the head since the radiation is directed to an exact target (NYU Langone Health, 2019). The precision of the Gamma Knife is its sharp aim of cobalt-60 photon radiation directed at various shapes of the smallest sized tumors (Neurosurgery: University of Pittsburgh, 2019).

For those who are unable to be treated with the Gamma Knife radiation for various reasons can instead be treated with fractionated stereotactic radiotherapy. This is done for one who either has poor health or has a tumor that is too large to be removed with the Gamma Knife option. This method delivers small amounts of fractionated stereotactic radiation over a period of several weeks (NYU Langone Health, 2019).

An acoustic neuroma, a slow growing benign tumor that forms in the internal auditory canal affects hearing, balance, and some facial nerves if left untreated. It erupts due to the overproduction of Schwann cells. The symptoms of one suffering from an acoustic neuroma vary from hearing loss, to tinnitus, to facial and tongue muscle weakness for much larger tumors. The tumor can be diagnosed by an audiologist or a brain doctor through magnetic resonance imaging, audiogram, electronystagmography, and auditory brainstem responses. After being diagnosed, the acoustic neuroma

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can be treated through surgery, radiation, or it can just be watched by a doctor. One with an acoustic neuroma will be living through difficult moments and will have to work on overcoming hardship. If he loses hearing or is affected with facial muscle weakness, he will have to learn to compensate for that. But we can be hopeful that one with an acoustic neuroma can survive with health from the disease.

Works Cited

- *Acoustic Neuroma Association* . (2018). Retrieved from Acoustic Neuroma: <https://www.anausa.org/learn-about-acoustic-neuroma/symptoms-from-an-acoustic-neuroma#early-symptoms>
- *American Speech-Language-Hearing Association* . (n. d.). Retrieved from Auditory Brainstem Response (ABR): <https://www.asha.org/public/hearing/Auditory-Brainstem-Response/>
- *American Speech-Language-Hearing Association (ASHA)* . (n. d.). Retrieved from The Audiogram: <https://www.asha.org/public/hearing/audiogram/>
- *John Hopkins Medicine* . (2019). Retrieved from Vestibular Schwannoma: <https://www.hopkinsmedicine.org/health/conditions-and-diseases/brain-tumor/vestibular-schwannoma>
- *John Hopkins Medicine* . (2019). Retrieved from Health: <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/electronystagmography-eng>
- *Mayo Clinic* . (2018, August 10). Retrieved from Acoustic Neuroma: <https://www.mayoclinic.org/health/treatment-tests-and-therapies/electronystagmography-eng>

org/diseases-conditions/acoustic-neuroma/symptoms-causes/syc-20356127

- *MD Anderson Center* . (2019). Retrieved from Acoustic Neuroma: <https://www.mdanderson.org/cancer-types/acoustic-neuroma.html>
- *MedLine Plus* . (2017, October 4). Retrieved from Acoustic Neuroma: https://medlineplus.gov/acousticneuroma.html#cat_95
- *National Institution of Deafness and other Communication Disorders* . (2017, March 6). Retrieved from Vestibular Schwannoma and Neurofibromatosis: <https://www.nidcd.nih.gov/health/vestibular-schwannoma-acoustic-neuroma-and-neurofibromatosis>
- *Neurosurgery: University of Pittsburgh* . (2019). Retrieved from Why Gamma Knife Treatment is Superior : <http://www.neurosurgery.pitt.edu/centers-excellence/image-guided-neurosurgery/gamma-knife/why-it-superior>
- *NORD* . (2019). Retrieved from Rare Diseases: <https://rarediseases.org/rare-diseases/acoustic-neuroma/>
- *NYU Langone Health* . (2019). Retrieved from Watchful Waiting for Acoustic Neuroma: <https://nyulangone.org/conditions/acoustic-neuroma/treatments/watchful-waiting-for-acoustic-neuroma>
- *NYU Langone Hospitals* . (2019). Retrieved from Diagnosing Acoustic Neuroma: <https://nyulangone.org/conditions/acoustic-neuroma/diagnosis>
- *University of Iowa Hospitals and Clinics* . (2019). Retrieved from Health Topics: Acoustic Neuroma: <https://uihc.org/health-topics/acoustic-neuroma>

- *Victoria State Government* . (2018). Retrieved from Better Health Channel: <https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/acoustic-neuroma>