Hearing examinations and disorders

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The Ear.

Hearing can be impaired due to lesions in 3 parts of the ear: the outer ear, the middle ear, or the inner ear. Hearing examinations evaluate hearing function and attempt to localize the site of lesion in each of the three parts (Hair, 2012). This essay will discuss the various hearing examinations and their effectiveness. In addition, the essay will also discuss the hearing defects and disorders. Hearing testing This is to decide if more expensive tests like magnetic resonance imaging (MRI) are needed. Hearing tests can be used to decide if a hearing aid might be helpful. These procedures must be taken to insure an accurate and minimal risk health assessment: A detailed history of both environmental and genetic conditions that may unfavorably affect the health of ears and hearing sharpness. A physical examination of the ear canals using a light-source with magnification called an auroscope. Removal of excessive earwax prior to testing.

According to American Hearing Research Foundation, these tests are used to determine overall hearing function:

- Bedside testing
- Audiometry
- Tympanometry
- Brainstem auditory evoked response
- Oto-acoustic emissions

Bedside testing

Usually used as a quick screening procedure. While audiometry testing is preferable, it may not always be possible. In bedside testing, tuning forks are often used to test at chosen frequencies. Other methods (whisper, rubbed fingers, ticking watch) can be used to quantify hearing using sources of noise.

Rinne test

It compares perception of sounds, as transmitted by air or by bone conduction through the mastoid. Conductive hearing loss is quickly suspected since a positive Rinne Test indicates an air bone gap. A vibrating tuning fork (512 or 256 Hz) is placed on the mastoid process until sound is no longer heard, the fork is then immediately placed just outside the ear. When the air-bone gap is less than 17.5 dB or greater than 30 dB, Rinne test is usually negative (Jacob et al, 1993).Therefore, the Rinne test has limited utility.

Weber test

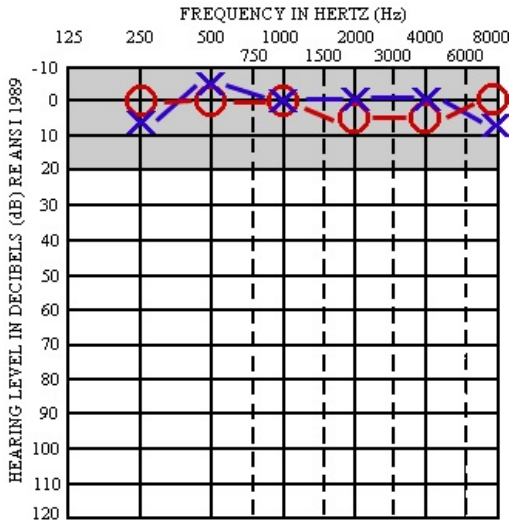
It detects one-sided conductive hearing loss and unilateral sensorineural hearing loss. The vibrating tuning fork is placed in the middle of the forehead. Normally, the sound is heard equally loud in both ears (no lateralization). However; a patient with symmetrical hearing loss will have the same findings. There is diagnostic utility only in asymmetric hearing losses.

Audiometry

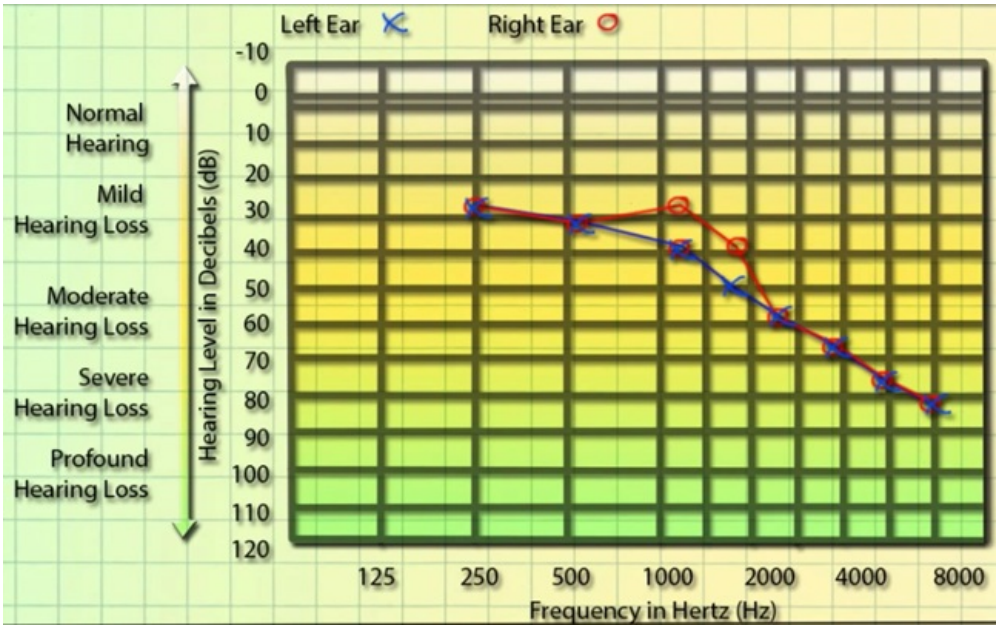
An audiometer hearing test is administered to a person wearing headphones which is connected to an audiometer. The audiometer produces tones at specific frequencies and volume levels to each ear independently. The audiologist plots the MINIMUM loudness in decibels REQUIRED TO HEAR A PARTICULAR FREQUENCY. People

INDICATE THAT THEY HAVE HEARD by pressing a button. The points are joined to see which frequencies are not being heard normally and what degree of hearing loss may be present. Normal hearing at any frequency is a sound pressure of 20dB$_{SPL}$ or quieter; with worsening hearing as the number of dB increases. Tone audiometry – determination of the threshold of hearing usually in the range of 125-8000 Hz in octave steps silent chamber; results – audiogram Speech audiometry- involves testing your ability to hear words without using any visual information. The words may be played through headphones or a speaker, or spoken by the tester. Objective audiometry – complicated measures evoked action potentials in cochlea, neural fibers or cerebral cortex. Detected by electroencephalography ➜ Problem: to distinguish from large amount of signals those corresponding to acoustic stimulation.

Audiogram for person with normal hearing:



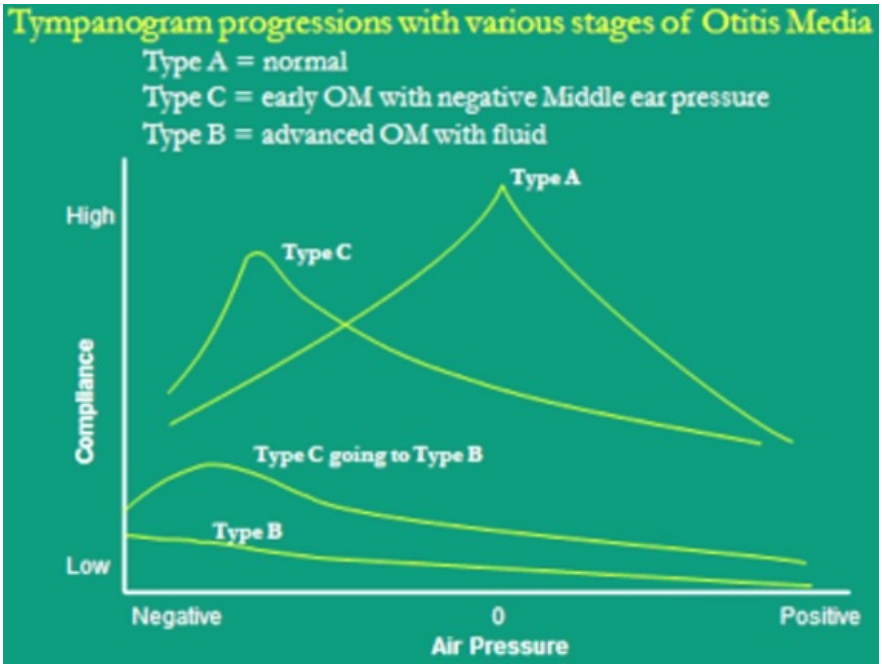
Audiogram for old person with worsening conditions in both ears:



Tympanometry

A fast non-behavioral test of the middle ear. The normal middle ear has air pressure that is even on both sides of the tympanic membrane. This is when the ear is most efficient at passing sounds through it. A probe with 3 holes is placed into the ear canal. Tympanometry tests how much sound bounces back of the tympanic membrane as a function of air pressure changes in the outer ear canal. Least amount of sound is bouncing back of the ear drum at normal air pressure. “This test can be helpful in detecting fluid in the middle ear, negative middle ear pressure, disruption of the ossicles, tympanic membrane perforation, and otosclerosis.” (American Heart Research Foundation, 2012)

The result of the test is recorded in a visual output, called a tympanogram. If there is fluid in the middle ear, the tympanic membrane will not vibrate properly and the line on the tympanogram will be flat.

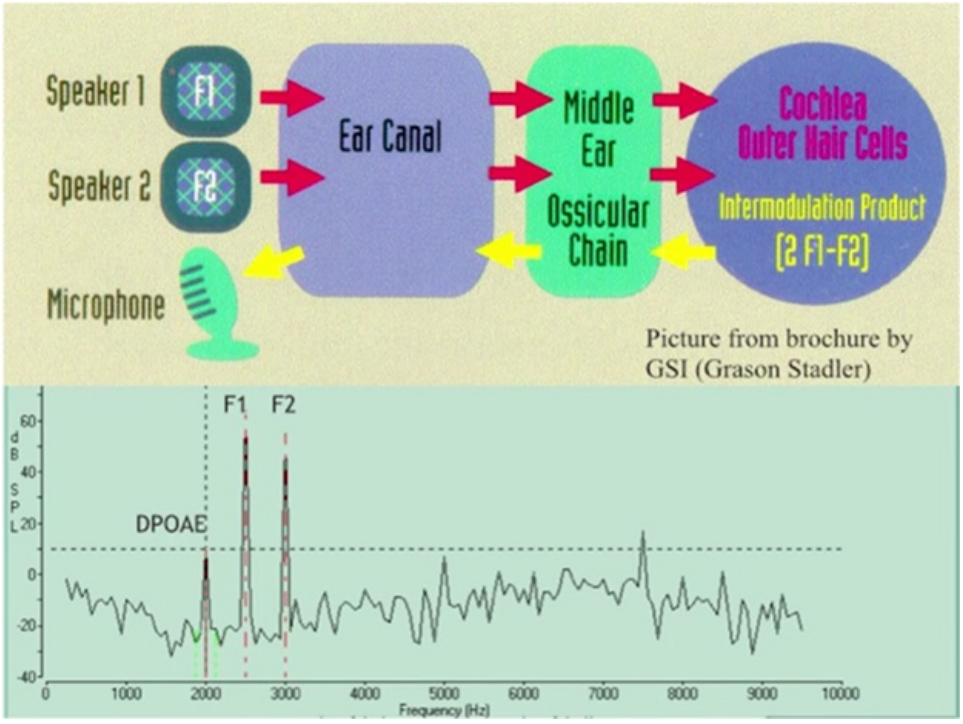


Brainstem auditory evoked responses

Measures the difference in time when electrical waves are transmitted from the brainstem and the response heard by clicks in the ear. Three waves are plotted for each ear. Delays of one side relative to the other suggests a lesion in the 8th cranial nerve between the ear and brainstem.

Oto-acoustic emissions

Test of outer hair cell function. Quiet tones are sent from the speaker, which travel through the middle ear and stimulate the hairs in the cochlea. The hairs respond by generating their own sounds, which are detected by the microphone. If there is a hearing loss, the hairs in the cochlea do not generate these minute sounds.



Hearing disorders

These hearing exams detect hearing loss and disorders which are caused and affected by many elements, such as, family history of diseases, trauma, certain medicines, aging, and long term exposure to loud noises. There are three major types of hearing loss: conductive hearing loss, sensorineural hearing loss (SNHL) and mixed hearing loss.

Conductive hearing loss

Categorized by the inefficient transfer of sound through the outer ear canal to the eardrum and Ossicles (the tiny bones of the middle ear). It can be caused by blockage in the external ear canal or deficiency in the mechanical pathway of the middle ear. The main causers of this type are: allergies, perforated eardrum, infection in the ear canal, impacted earwax, Benign tumors and otosclerosis, which can also cause sensorineural hearing loss. This type of hearing loss can often be treated medically or surgically.

Sensorineural hearing loss

Results from either the inner ear (cochlea) or damage in the auditory nerve. Dysfunction in the inner ear may be caused by damage of the organ of Corti or the inability of the hair cells to generate an action potential in the auditory nerve. Also, the auditory nerve can degenerate and fails to transfers a neurochemical signal to the brain through the central auditory canal. The major causers of SNHL are: exposure to loud noises, head trauma, viruses, autoimmune inner ear disease, aging, hereditary and malformation of the inner ear. SNHL usually cannot be treated or reversed; it is the most common type of permanent hearing loss. SNHL can cause reduction of sound intensity and also can cause the sound to be unclear and blur.

Mixed hearing loss

Caused by a combination of SNHL and conductive hear loss factors. It occurs when the inner ear is simultaneously damaged with either the outer or middle ear. In the treatment of mixed hearing loss it is recommended to take care of the conductive component first to minimize the damage as much as possible.

Future developments

Researchers are currently looking for ways of reversing this hearing loss by using stem cells or gene therapy and this consequently provides potential for a whole new range of treatments.

References

Template:American Hearing Research Foundation, Hain, Timothy

Template:NHS choices

Template:Amplex Hearing Centres

Template:American Speech-Language-Hearing Association

Template:Better Hearing Institute

Template:Hearing Loss Association of America