OPEN ACCESS GUIDE TO AUDIOLOGY AND HEARING AIDS FOR OTOLARYNGOLOGISTS

Classification of hearing loss is an essential component of audiological assessment. Classifying hearing loss according to the type, degree and configuration of hearing loss is the primary information required to determine further test procedures and to direct medical and/or audiological interventions.

Hearing Loss – Classification

Hearing status is typically quantified according to the hearing threshold (lowest intensity at which a signal is just audible to a person (measured in decibel or dB) across several frequencies (measured in Hertz or Hz). The gold standard to determine hearing thresholds is pure tone audiometry (PTA) (see Pure Tone Audiometry chapter); it is recorded on a chart called an audiogram *(Figure 1)*.

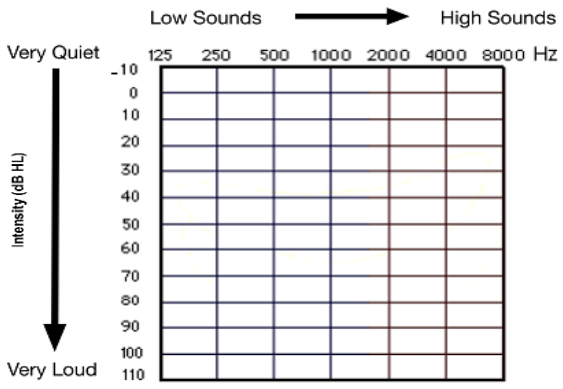

Figure 1: Pure tone audiogram (x-axis = frequency; y-axis = intensity in decibel)

Hearing thresholds are recorded across frequencies using air conduction pure tone signals that are presented using transducers (e.g. insert earphones, supra-aural, circumaural, or free field speakers). In addition to air conduction signals, bone conduction pure tone thresholds, presented with a bone oscillator (see Pure Tone Audiometry chapter), represent hearing thresholds when directly stimulating the cochlea. ***Air conduction stimuli*** represent hearing thresholds of sound conducted through the entire auditory system (external, middle, inner ear and auditory nervous system) whilst ***bone conduction audiometry*** represents thresholds of sound conducted through the inner ear and auditory nervous system.

Using these tests in both ears one can ascertain the type, degree, configuration and symmetry of hearing loss. The combination of bone and air conduction tests allows one to differentiate between pathology located in the external and middle ear as opposed to the cochlea and central auditory pathway.

It is important however to note that these tests ***must be done as part of an audiological test battery*** to confirm and crosscheck the audiometric results. Some types of hearing loss also require other tests to determine the exact type of hearing loss. Auditory neuropathy is one such condition and requires advanced tests including auditory brainstem responses (see chapter on auditory brainstem response) and otoacoustic emissions (see chapter on otoacoustic emissions).

Conductive hearing loss

Conductive hearing loss indicates an obstruction to the flow of sound energy from the atmosphere to the inner ear. Pathology causing conductive hearing loss blocks the natural transduction of energy through the external ear canal and middle ear *(Figure 2)*.

Flow of sound energy may be blocked in the outer ear canal e.g. by wax impaction; flow may be blocked in the middle ear in the cases of otitis media with effusion or any other condition which changes the sound conduction properties of the middle ear structures (*Table 1*).

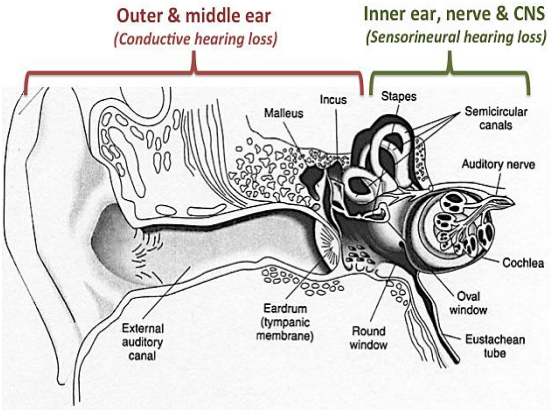

Figure 2: Hearing loss related to the structure of the ear

Conductive hearing loss
Wax impaction in ear canal Atresia of ear canal Perforation of tympanic membrane Otosclerosis Dislocation of ossicular chain Cholesteatoma Otitis media with effusion

Sensorineural hearing loss
Genetic hearing loss (syndromic & non-syndromic) Congenital infections (e.g. Rubella, CMV) Acquired infections (measles, mumps, toxoplasmosis, meningitis, syphilis) Ototoxicity (aminoglycosides, loop diuretics, cytotoxic drugs, antimalarials) Noise induced hearing loss Presbyacusis

Table 1: Examples of causes of conductive and sensorineural hearing loss

Many types of conductive hearing loss are reversible e.g. with removal of wax plugs or drainage of middle ear effusions. Audiograms show normal bone conduction but abnormal air conduction thresholds (*Figure 3)*.

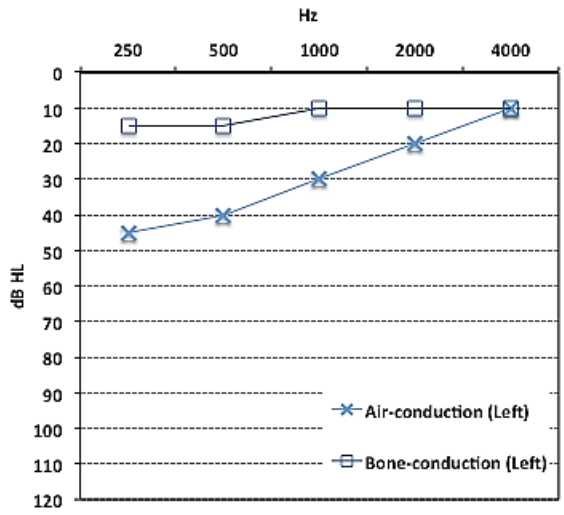

Figure 3: Audiogram of a patient with conductive hearing loss

Sensorineural hearing loss

This is a broad term used to describe reduction of auditory threshold sensitivity. The pathology may be located in the ***cochlea*** and/or in the auditory nerve and central nervous system auditory structures ***(retrocochlear)*** (*Table 1, Figure 2)*. The causes of sensorineural hearing loss are varied *(Table 1)*.

Historically it was difficult to clearly differentiate between sites-of-lesion in the sensory and neural systems because they are so closely linked. There are also deteriorating effects secondary to the primary lesion e.g. noise induced damage to the cochlea may also cause secondary atrophy of the central auditory pathway. Audiological advances such as otoacoustic emissions (see chapter on otoacoustic emissions) and auditory brainstem evoked responses (see chapter on auditory brainstem response) have however increased our diagnostic specificity of the primary site-of-lesion.

Audiograms of sensorineural hearing loss show hearing loss that equally affects air and bone conduction *(Figure 4)*.

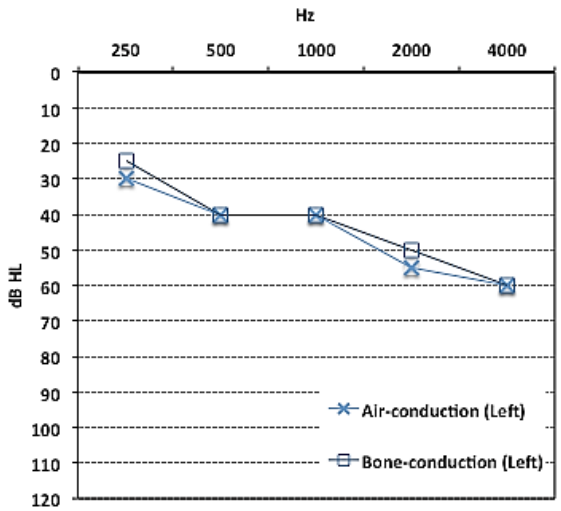

Figure 4: Example of audiogram of a patient with sensorineural hearing loss

Mixed hearing loss

Mixed hearing loss refers to the combined presence of both conductive and sensorineural hearing loss *(Figure 5)*.

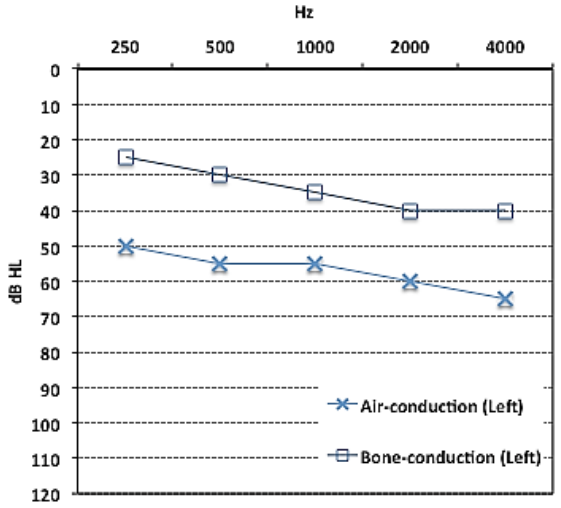

Figure 5: Example of audiogram of a patient with mixed hearing loss

Mixed hearing loss may occur when a sensorineural hearing loss is compounded by conductive hearing loss e.g. due to otitis media with effusion. Mixed hearing loss may also be related to developmental abnormalities affecting both the middle ear and cochlea.

Auditory Neuropathy

Auditory neuropathy is a type of hearing loss which technically can be considered a subgroup of sensorineural hearing loss but has a very characteristic presentation with a specific subset of symptoms and diagnostic test results. The clinical presentation is varied and consequently has been referred to as ***auditory neuropathy spectrum disorder (ANSD)***. These patients have significant sensorineural hearing loss despite evidence of normal outer hair cell function, and the neural response is absent or abnormal as measured by the auditory brainstem response.

They may present with any degree and configuration of hearing thresholds despite absent or very abnormal auditory nerve functioning as measured by the auditory brainstem response. Furthermore, speech perception is disproportionately poor with respect to the hearing loss.

The signature diagnostic finding is the presence of normal or near-normal outer hair cell functioning as measured by the cochlear microphonic response; this can be visualised on the auditory brainstem response. Otoacoustic emissions are also generally present despite significant loss of hearing sensitivity.

Degree and configuration of hearing loss

The ***degree of hearing loss*** is classified based on the pure tone average (PTA) of air conduction thresholds at ***500, 1000, 2000, and 4000 Hz*** in the ***better ear***, as recommended by the ***World Health Organization (WHO, 2021)***. This classification system provides a standardised framework for estimating the severity of hearing loss and its likely impact on communication and daily functioning.

Table 2 provides the WHO-recommended grades of hearing loss in adults, along with associated hearing experiences in quiet and noisy environments. Normal adult hearing thresholds are considered to be < 20 dB HL based on the four-frequency PTA.

PTA dB HL (Better Ear)	Hearing Loss Grade	Hearing Experience in Quiet	Hearing Experience in Noise
< 20	Normal hearing	No problem hearing sounds	No or minimal problem hearing sounds
20 to <35	Mild	No difficulty with conversational speech	May have difficulty hearing conversational speech
35 to <50	Moderate	May have difficulty with conversational speech	Difficulty hearing and participating in conversation
50 to <65	Moderately severe	Difficulty hearing conversational speech	Difficulty hearing most speech and participating in conversation
65 to <80	Severe	Does not hear most conversational speech	Extreme difficulty hearing and participating in conversation
80 to <95	Profound	Cannot hear conversational speech; may hear loud sounds	Conversational speech cannot be heard
≥ 95	Complete	Cannot hear speech or most environmental sounds	Cannot hear speech or most environmental sounds

Table 2: WHO Grades of Hearing Loss (HL) and Related Hearing Experience (WHO, 2021). Pure Tone Average of 500, 1000, 2000 and 4000 Hz

The *World Health Organization's* revised classification (2021) is intended to enable consistent estimation of an individual's functional hearing ability and supports global comparability in prevalence estimates, epidemiological tracking, and planning for hearing health services. While individual ear thresholds remain important for clinical decision-making, public health grading is standardized on the better ear to reflect the impact on overall communication function.

Hearing loss configuration is classified in accordance with the shape of the air conduction audiogram across the frequency spectrum. Different configurations may be associated with certain aetiologies of hearing loss. A commonly used classification system is presented in *Table 3*.

Term	Descriptions
Flat	≤5dB average difference per octave
Gradually sloping	6-10dB rise or fall per octave
Sharply sloping	11-15dB rise or fall per octave
Precipitously sloping	≥16dB rise or fall per octave
Rising	Better hearing at the higher frequencies
Trough or saucer	≥20dB more loss at mid-dle frequencies than at 250 and 8000Hz
Notch	Sharply poorer at one frequency, with recovery at adjacent frequencies

Table 3: Configurations of hearing loss based on air conduction PTA

References

World Health Organization (2021). *World report on hearing*. World Health Organization. https://www.who.int/publications/i/item/9789240020481

How to cite this chapter

Swanepoel DW, Laurent C. (2025) Classification of Hearing Loss. In *Open Access Guide to Audiology & Hearing Aids for Otolaryngologists*. Retrieved from https://vula.uct.ac.za/access/content/group/

27b5cb1b-1b65-4280-9437-a9898ddd4c40/Classification%20of%20hearing%20loss.pdf

Author & Editor

De Wet Swanepoel PhD
Professor
Department of Speech-Language Pathology and Audiology, University of Pretoria
Pretoria, South Africa
dewet.swanepoel@up.ac.za

Author & Editor

Claude Laurent, MD, PhD
Professor in ENT
ENT Unit
Department of Clinical Science
University of Umeå
Umeå, Sweden
claude.laurent@ent.umu.se

Editor

Johan Fagan MBChB, FCS (ORL), MMed
Emeritus Professor and Past Chair
Division of Otolaryngology
University of Cape Town
Cape Town, South Africa
johannes.fagan@uct.ac.za

OPEN ACCESS GUIDE TO AUDIOLOGY & HEARING AIDS FOR OTOLARYNGOLOGISTS
http://www.entdev.uct.ac.za