

# Differential diagnosis between inner ear disorders which cause conductive or mixed hearing loss from middle ear disorders

## Abstract

There are some inner ear disorders which cause conductive or mixed hearing loss including Third window and non-Third window disorders. In Third window hypothesis, conductive hearing loss may occur because of the Third window which is created except for the Round and Oval windows. The air bone gap mechanism in non-Third window disorders is unknown. We deal with this subject in this paper by mentioning some tests which are useful for differential diagnosis.

**Keywords:** conductive hearing loss, mixed hearing loss, SDS, VEMP

Volume 2 Issue 4 - 2015

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**Received:** January 27, 2015 | **Published:** April 13, 2015

**Abbreviations:** LVAS, large vestibular aqueduct syndrome; DFN3, deafness type 3; AR, acoustic reflex; PTA, pure tone audiometry; SDS, speech discrimination score test; OAE, otoacoustic emissions; VEMP, vestibular evoked myogenic potential; SSCD, superior semicircular canal dehiscence

## Discussion

**Third window disorders:** Dehiscence of Superior Semicircular Canal, Posterior Semicircular Canal and Lateral semicircular canal.<sup>1</sup> Large Vestibular Aqueduct Syndrome (LVAS).<sup>2</sup> Dehiscence between Cochlea and Carotid canal (dehiscence of Scala Vestibuli). Paget's disease. The molecular basis of X-linked deafness type 3 (DFN3). Some inner ear malformations such as Mondini-like malformation of the Cochlea, Apert Syndrome.

**Non Third window disorders:** Meniere's syndrome.

Intra labyrinthine Schwannomas (a rare tumors which arise from distal part of the Cochlea or, and distal portion of the Vestibular Nerve).

## Differential diagnosis

Inconsistency between Acoustic Reflex (AR) and Pure Tone Audiometry (PTA) test should be considered as inner ear disorders (present AR along with conductive hearing loss). Because AR should be absent in middle ear disorders. Negative bone conduction thresholds typically in low frequencies compare to high frequencies is a sign of inner ear disorders, but we see air bone gap in all frequencies and negative bone conduction thresholds is rare in middle ear disorders.

Speech Discrimination Score (SDS) test and Carhart notch is variable. Good SDS and poor SDS has been reported in Third window disorders, but conductive hearing loss accompanied with poor SDS should be considered as an inner ear disorders because SDS is usually good in middle ear disorders. Carhart's notch is not usually seen in inner ear disorders but in some cases it has been reported. So absence of Carhart's notch is one of the sign of inner ear disorders.

Rinne test is negative and Weber is lateralized to the affected ear either in some Third window disorders or middle ear disorders. Therefore Diagonotic tests are not useful for differential diagnosis.

Otoacoustic Emissions (OAE) and Vestibular Evoked Myogenic Potential (VEMP) tests are absent in middle ear disorders but they may be present in inner ear disorders. For example we see augmented VEMP (high normal VEMP) in Superior Semicircular Canal Dehiscence (SSCD).

Laser Doppler Vibrometry indicates fixation or discontinuity in middle ear disorders but it is high normal in inner ear disorders. Sound and pressure induced Vertigo is absent in middle ear disorders but it may be present in inner ear disorders. Radiology tests (CT and MRI) along with Audiology tests are necessary for differential diagnosis.

## Conclusion

Differential diagnosis between inner ear disorders, which cause Conductive or mixed hearing loss, from Middle ear disorders (look like Otosclerosis) is very vital. Misdiagnosis may cause unnecessary Stapedectomy and exacerbate patient's condition. Before proceeding with surgery, all these tests which mentioned earlier should be done for proper diagnosis.

## Acknowledgments

None.

## Conflicts of interest

The authors declare that there are no conflicts of interest.

## Funding

None.

## References

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