

Comparative Study of Vestibular Evoked Myogenic Potentials, Otoacoustic Emissions and Electrocochleography In Meniere's Disease

Thesis

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By

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List of abbreviations

3DFT-CISS	Three dimensional Fourier transformation constructive interference in steady state
ABR	Auditory brainstem response
AP	Action potential
BPPV	Benign paroxysmal positional vertigo
CM	Cochlear microphonics
DEH	Delayed endolymphatic hydrops
DNA	Deoxyribonucleic acid
DPOAEs	Distortion product otoacoustic emissions
ECochG	Electrocochleography
EMGs	Electromyograms
ENG	Electronystagmography
GM	Geometric mean
H ₃	Histamine receptor 3
HL	Hearing loss
HSV	Herpes simplex virus
IAD	Interaural amplitude difference
MRI	Magnetic resonance imaging
OAEs	Otoacoustic emissions
OHC	Outer hair cell
PB	Phonatically balanced
SCM	Sternocleidomastoid
SFOAEs	Stimulus frequency otoacoustic emissions
SM	Scala media
SP	Summating potential
SRT	Speech reception threshold
TCD	Transcranial doppler sonography
TEOAEs	Transient evoked otoacoustic emissions
VEMPs	Vestibular evoked myogenic potentials
VNL	Vestibular neurolabyrinthitis
WDS	Word discrimination score

INTRODUCTION AND RATIONALE

Meniere's disease is a pathology affecting the inner ear, which manifests as a triad of symptoms: vertigo, hearing loss, tinnitus and aural fullness (**Gibson and Prasher, 1983**). These symptoms, which were first described by French physician Prosper Meniere in 1861, are generally episodic in nature, and the degree of their severity fluctuates over the course of months or even years.

Meniere's disease is commonly referred to as endolymphatic hydrops because a typical component of this disorder is excessive pressure within the cochlear fluid of the scala media, or endolymph, subsequently resulting in a distention of Reissner's membrane, one of the scala media's boundaries (**Yoon et al., 1991**). The endolymphatic sac becomes fibrosed and there is loss of the surrounding pneumatization as if some inflammatory process is occurring. Eventually the endolymphatic duct becomes blocked by an eosinophilic exudate (**Gibson and Prasher, 1983**). However, this hydrops, or increased pressure, is not limited to the cochlea alone; it can also be present in portions of the vestibular labyrinth such as the utricle, saccule, and semi-circular canal ampulla (**Hall, 1992**).

Most routine clinical vestibular tests evaluate the horizontal semicircular canal and fail to evaluate the remaining four vestibular organs. Recent research is focusing on developing clinical tests to assess otolith function. Vestibular evoked myogenic potentials (VEMPs) are short-latency electromyograms (EMGs) evoked by high-level acoustic stimuli recorded from surface electrodes over the tonically contracted sternocleidomastoid (SCM) muscle. These responses are presumed to originate in the saccule (**Colebatch and Halmagyi, 1992**). VEMPs have

been proposed as a clinical test of saccular and/or inferior vestibular nerve function (**Colebatch, 2001**).

One of other tests that can be used in diagnosis of Meniere's disease is electrocochleography (ECoChG) which is a method of recording the stimulus related potentials of the cochlea and auditory nerve (**Ferraro et al., 1983**). The response that is measured in ECoChG occurs within the first two or three milliseconds after an abrupt stimulus, and it includes the following components: the cochlear microphonic (CM), the summing potential (SP), and the whole nerve or compound action potential (AP) (**Ferraro, et al., 1983**). Analysis of the components of and variations within an electrocochleographic waveform have been used extensively in the diagnosis of Meniere's disease.

Distortion product otoacoustic emission reflects the biomechanical processing that underlies the nonlinear operations responsible for the cochlea's high sensitivity, sharp tuning, and wide dynamic range. Consequently it is useful in identifying initial disturbance in cochlear function so it is very useful in diagnosis of Meniere's disease.

The presence of in vivo hydrops has never been confirmed, but it has been suggested by the results of glycerol or furosemide tests and by electrocochleography and otoacoustic emissions. However, these tests are not appropriate to assess otolithic organs or descending neural pathways (lateral vestibular-spinal tract). New clinical tests are necessary to identify saccular hydrops.

This study was designed to compare the sensitivity of vestibular evoked myogenic potentials (VEMPs), distortion product otoacoustic

emission (DPOAEs) and electrocochleography (EcochG) in diagnosis of Meniere's disease.

AIM OF THE WORK

- To compare the diagnostic value of vestibular evoked myogenic potentials, electrocochleography and distortion product otoacoustic emissions in Meniere's disease.

REVIEW OF LITERATURE

MENIERE'S DISEASE

Definition:

Meniere's disease is an idiopathic inner ear disorder characterized by recurrent spontaneous episodic vertigo, fluctuating hearing loss, tinnitus and aural fullness (**Woodworth et al., 2000**).

Historical background:

In 1861 Prosper Meniere was the first one who described a series of patients with the classical triadic symptomatology of hearing loss, vertigo and tinnitus. The essence of his hypothesis was that the symptoms were caused by a disorder of the labyrinth instead of a vascular cerebral dysfunction, as had been previously thought (**Meniere, 1861**). He concluded that sudden dysfunction of the inner ear is not only responsible for the symptoms of tinnitus and diminution of hearing, but also leads to attacks of vertigo, dizziness, uncertain gait, staggering and falling. Nausea, vomiting and syncope may accompany the attacks. He described that the attacks as intermittent attacks followed by hearing loss of increasing severity.

In 1902 Politzer described and quantified results of treatment for patients with Meniere's disease and measured an improvement of hearing and reduction of the number and the severity of the attacks.

Crowe in 1938 first described a fluctuating hearing loss. He also stated that the attacks occurred at irregular intervals at any time and patients were feeling well between the attacks. Aural fullness and a