Relation Between Hearing Loss and Otolith Dysfunction in Elderly

Thesis

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ
﴿يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ
وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ
وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ﴾
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List of Abbreviations

Abb.	Full term
AC	Air conduction
AP	Action Potential
ARHL	Age related hearing loss
CAP	Central Auditory Processing
CDP	Computerized dynamic posturography
CEBA	Central effect of biological aging
CEPP	Central effect of peripheral pathology
CVD	Cardiovascular disease
cVEMP	Sound-evoked cervical vestibular-evoked myogenic potential
DPOAEs	Distortion Product Otoacoustic Emission
EMG	Electromyography
EP	Endolymphatic potential
GAB	Gamma-Aminobutyric acid
HTN	Hypertension
IC	Inferior colliculus
IHC	Inner hair cells
LVST	Lateral vestibule-spinal tract
MLF	Medial longitudinal fasciculus
MVST	Medial vestibule-spinal tract
NHANES	National Health and Nutrition Examination Survey
OHC	Outer hair cells
oVEMP	Ocular vestibular-evoked myogenic potential
PTA	Pure Tone Audiometry
RST	Reticulo-spinal tract
SCM	Sternocleidomastoid
SHA	Sinusoidal harmonic acceleration test
SOAEs	Spontaneous Otoacoustic Emission
SP	Summation Potential
SSC	Semicircular canals stimulation:
VCN	Ventral cochlear nucleus
VCR	Vestibulo-collic reflex
VN	Vestibular nucleus

List of Abbreviations **cont...**

Abb.	Full term

VOR ..... Vestibulo- ocular reflex
VSR..... Vestibulo- spinal reflexes
VST ..... velocity step test

INTRODUCTION AND RATIONALE

One of the main features of the Egyptian population over the last few decades is the gradual increase in the absolute and relative numbers of older people. They reached 7.2% in (2006) according to the last Egyptian census ***(EDHS, 2008).*** Approximately one-third of persons over 65 years are affected by disabling hearing loss ***(WHO, 2012)*** and about one out of three older adults falls each year which is a major public health problem ***(Tromp et al, 2001).***

The audio-vestibular systems experience age related changes causing functional decline that is considered part of the normal aging process ***(Dalton et al, 2003).*** Age- related vestibular system changes started from the age of 55 and includes loss of sensory hair cells, otoconia, vestibular nerve fibers, Scarpa's ganglion cells and vestibular nucleus neurons with decreased blood flow to the inner ear ***(Park et al, 2001; Rauch et al, 2001; Tang et al, 2001).***

In addition to vestibular sensory loss, the elderly are prone to a variety of diseases that affect audio-vestibular and postural control systems, including glaucoma, diabetic and hypertensive retinopathy, which all affect vision; diabetic peripheral neuropathy, which affects position sense in the feet and legs, ect...***(Hoffman et al, 2006).***

The previously mentioned age related changes and pathologies in the audio-vestibular system can have severe consequences. The older adult with hearing impairment is more limited in verbal communication, with effects on productivity, quality of life, cognitive and emotional status ***(Van Eyken et al, 2007)***, whereas the individual with balance dysfunction is more prone to experience dizziness and has an increased risk for falls, which is a major public health problem ***(Agrawal et al, 2009).***

The diagnostic process of hearing loss and imbalance in elderly people is more or less a complicated task and must distinguish between otologic, central, medical, and psychogenic etiologies. In order to reach proper diagnosis in those patients specific equipment for neuro-otologic, audiometric and laboratory vestibular investigations are required ***(Agrawal et al, 2012).***

In the last few years, the attention is being focused on VEMP as a potential electrophysiological method to reflect the function of the otolith and its central vestibular connections which considered one of the primary vestibular contributions for postural control ***(Serrador et al, 2009).*** Sound-evoked cervical vestibular-evoked myogenic potential (cVEMP), and ocular vestibular-evoked myogenic potential (oVEMP) latencies and amplitudes are used as a measure of saccular and utricular function, respectively ***(Patko et al, 2003).***

VEMP is considered an objective, secure, simple and comfortable method to evaluate vestibular pathology mainly in people with balance dysfunction. Its recording provides both a straightforward non-invasive exploration of each vestibule independently and a precise method to explore the utricle, saccule and vestibulospinal tracts ***(Ferber-Viart et al, 1999; Colebatch, 2001).***

Many studies were done to investigate the effect of aging process on the auditory and vestibular function, however only a few investigations had evaluated the relationship of the functional decline in these two systems, so the present work was planned to study the relation between the hearing loss and otolith organ dysfunction in elderly and to evaluate the effect of risk factors on the two systems.