THE NEW ARMENIAN MEDICAL JOURNAL
Vol.12 (2018), No 4, p. 53-57

# CORRELATION OF HEARING AND VESTIBULAR DISORDERS IN PATIENTS WITH CHRONIC SECRETORY OTITIS MEDIA

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*Received 15/03/2018; accepted for printing 22/09/2018*

***Abstract***

*There is no sufficient evidence of the level of vestibular and hearing function in patients with chronic secretory otitis media in relation to different stages of the eardrum retraction and the effectiveness of myringotomy and tube insertion in vestibular and hearing symptom resolution. Electronystagmography, Barany rotatory testing and Romberg's test were performed in a group of 30 patients with chronic secretory otitis media as well as in control group, matched with sex and age, before and a month after myringotomy and tube placement. The results were compared.*

*Hearing test with pure tone audiometry and impedance audiometry was performed in the same groups of patients. All patients and controls filled a questionnaire on their vestibular system dysfunction: vertigo, dizziness, tinnitus, tendency to fall, imbalance, clumsiness, and disequilibrium. Patients with sensoneural hearing loss, neuropsychiatric disorders, temporal bone fractures, epilepsy and ototoxicity were excluded.*

*The majority of patients presented significant improvement of their vestibular and hearing symptoms after ventilation tube insertion, while a small subgroup of patients with 2nd to 3rd degree retraction pockets in the epitympanum and the posterior part of the tympanic membrane were unresponsive to treatment.*

*We revealed correlation between vestibular, hearing disorders and retraction pockets of tympanic membrane in patients with unilateral and bilateral chronic secretory otitis media.*

*The level of vestibular and hearing function in patients with chronic secretory otitis media is an important clinical parameter. Insertion of ventilation tubes was sufficient to cure small retraction pockets and resolve vestibular and hearing symptoms. In contrast, patients with deep retraction pockets in the epitympanum and the posterior parts of the eardrum might be unresponsive to treatment, while vestibular disturbances and hearing disorders also persist.*

***Keywords:*** *chronic secretory otitis media, spontaneous nystagmus, eardrum retractions, miringotomty, hearing disorders.*

## Introduction

Diminished vestibular function in patients with chronic secretory otitis media is an important clinical parameter, since vestibular disturbance indicates the risk of disease complications. Furthermore, there is inadequate information on the level of vestibular function in the patients with chronic secretory otitis media in relation with different stages of eardrum retraction pocket formation [*Granot E et al., 1990; Casselbrant M, 1992; 1995; 2000; 2008; Ballenger J, Snow J, 1996; Avishay G et al., 1998; Koyuncu M et al., 1999*].

Balance is maintained by three main control systems: visual, vestibular and ankle-foot proprioception. The integrity of the vestibular apparatus for maintaining postural control is critical in the development of motor function and acquired vestibular deficiency might cause difficulties with balance in sensory conflict situations. Thus, any significant deterioration in balance due to chronic secretory otitis media may impair development and maintenance of normal motor coordination, making people with balance problems more prone to injuries such as bicycle accidents or falls from heights [*Tsuzunku T, Kaga K., 1992*]. A potential

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theory to explain vestibular dysfunction in chronic secretory otitis media deals with pressure changes in the tympanic cavity. According to this theory, the pressure changes cause displacement of the round window membrane, causing secondary perilymphatic movement [*Gates G, 1980*]. There is no dizziness or dysequilibrium during tympanometry, which implies that transient and moderate grades of negative middle ear pressure are probably unimportant in the genesis of vestibular symptoms [*Finitzo T.,* 1992; *Avishay G et al., 1998*]. With this theory, the suspicious point is that changes in the middle ear pressure do not affect equally both the round window membrane and the stapes base. The reason for this is that the mobilities of the stapes base and the round window membrane are not equal. There is insufficient documentation about the effect of chronic secretory otitis media on the vestibular labyrinth, the incidence of this effect, and the role of myringotomy with ventilation tube insertion to relieve vestibular symptoms. Rotation test, electronystagmography, posturography and inquiry have been used in these research [*Golz A et al., ;* 1991]. The studies revealed that 71% of 97 children aged 4 to 7 years with bilateral middle ear effusion had spontaneous, jerk-type horizontal nystagmus or positional nystagmus or both, compared with only 4% of 50 healthy children without middle ear disease.These abnormal electronystagmography findings resolved in 99% of the children in whom tympanostomy tubes were inserted [*Jones N et al., 1990*].

*Grace* and *Pfleiderer* used a questionnaire that determined that a history of balance-related symptoms should be actively sought in all children with otitis media with effusion (OME) and, if present, should be strongly considered as an indication for prompt surgery. Complete resolution of symptoms occurred in 85% of the children after myringotomy with ventilation tube insertion during the first month in the same study [*Grace A, Pfleiderer A, 1990*].

In recent years chronic secretory otitis media research has been focused on auditory symptoms and complications, such as hearing loss, delayed speech development and childhood learning difficulties. Despite the fact that chronic secretory otitis media with effusion can affect vestibular function and cause balance disorders the role of vestibular dysfunction in childhood development and learning disabilities has been also overlooked [*Granot E et al., 1990; Casselbrant ML, 1992; 1995; 2000; 2008; Koyuncu M.,1999*].

Over the past few years of our practice we came across and treated a considerable number of adult patients with chronic secretory otitis media and balance disorders. Only a part of them responded with regression of the balance disturbances after myringotomy and ventilation tubes insertion, while in the rest of them progression of their symptoms was observed.

While searching the literature, we concluded that there is not enough information concerning the level of vestibular function in patients with chronic secretory otitis media in relation to different stages of the eardrum retraction and hearing disorders. We decieded to investigate prospectively chronic secretory otitis media with vestibular dysfunction in population, taking into account the localization, the degree of retraction of the tympanic membrane and hearing disorders. In addition, the effectiveness of myringotomy and tube insertion in vestibular and hearing symptom resolution in patients with different stages of the eardrum retraction was investigated [*Tsuzunku T, Kaga K, 1992*; *Arick D, Silman S, 2005*; *Dhooge I et al., 2005*; *Diacova S, McDonald T, 2007*].

In the present study we have discovered that over a 3-year-period in our practice 30% of adult patients, presented with chronic secretory otitis media had vestibular disorders and deep retraction pockets in the epitympanum or/and the posterior part of the tympanic membrane. Vestibular testing indicated that the level of vestibular dysfunction correlated with hearing loss and advanced retraction stage. Vestibular and hearing test results returned to normal, and the symptom-related vestibular disturbance improved after myringotomy with ventilation tube insertion in the majority of patients, but that was insufficient in a group of patients with vestibular and hearing disorders and severe eardrum retraction. In these patients the disease progressed despite repeated grommet insertion, indicating the need for early chronic secretory otitis media treatment prior to deep retraction pocket formation and prior to permanent impact on vestibular and hearing function [*Tos M, Poulsen G, 1980; Tos M, 1981; Sade J, 1982; Tos M et al., 1987; Goycoolea M et al., 1988; Sade J et al., 1989; Balasubramanian M, 2006; Jezewska E et al., 2008; Mirakyan G, 2009*].

### *Material and methods*

A group of 30 patients, aged from 20 to 65 years, with chronic secretory otitis media, presented over the period from 2013 to 2015 was created. A control group of healthy individuals matched for age and sex was created from the hospital personnel volunteers. Both groups underwent a through otorhinolaryngologic examination. Furthermore evaluation by a family therapist and a neurologist was performed to exclude the presence of any co-morbid conditions and diseases affecting the central nervous system. Patients with sensoneural hearing loss, neuropsychiatric disorders, temporal bone fractures, epilepsy and ototoxicity were excluded.

A chronic secretory otitis media diagnosis was made on the basis of patient complaints, otomicroscopy, pure tone and impedance audiometry. According to findings flexible nasopharyngolaryngoscopy, mastoid X-ray according to Schüller and computerized tomography of the temporal bones were performed to some patients. All patients and controls filled out a questionnaire relating to their vestibular system dysfunction: vertigo, dizziness, tinnitus, tendency to fall, imbalance, clumsiness, and disequilibrium.

Spontaneous nystagmus was assessed by electronystagmography (electronystagmograph-Model N500), ICS Medical, USA) and was recorded in the patient in a sitting position, looking steadily at a fixed point for 30 seconds with their eyes opened and closed. The results were assessed according to Cogan's classification (Table 1).

***Table 1***

Cogan's classification of spontaneous nystagmus

| Type of nystagmus | | Diagnosis |
|---|---|---|
| I. | Normal | Vertical, behind closed eyelids |
| | | Horizontal, behind closed eyelids, 7 to 8 degrees/turn |
| | | Voluntary |
| II. | Vestibular (otologic) | Fast and slow phases |
| | | Horizontal |
| | | Conjugate |
| | | Suppressed by visual fixation |
| III. | Ocular (ophthalmologic) | Congenital |
| | | Occupational |
| IV. | Central (neurologic) | Diagnosis made by exclusion of other types |

Romberg's test was performed by asking the patient to stand straight with the eyes closed, and results were compared with those taken with the eyes open. If, on closing eyes, the patient immediately became unstable and fell to the ground, results were considered positive. Barany's rotatory tests were also carried out to assess vestibular function of the patients and controls.

### *Results*

Among the patients, 13 had bilateral and 17 had unilateral chronic secretory otitis media with effusion. According to audiological evaluation, they presented mild to moderate conductive hearing loss, in addition to a type 'B' tympanogram (Table 2).

Retraction pockets were revealed by otomicroscopy in all the patients - in the majority of cases in the epitympanum and in a few cases at the posterior part of eardrum.

According to the retraction degree classification by M.Tos, G.Poulsen, 6 patients had a 1st degree retraction pocket, 15 patients had 2nd degree, 5 patients had 3rd degree, 3 patients had a 3rd degree

***Table 2***

Audiological evaluation results in chronic secretory otitis media patients with unilateral and bilateral conductive hearing loss

| Audiological diagnosis | Number of patients | Average of hearing loss (*dB*) | | Type of tympanogram | | Acoustic reflexes +/- | |
|---|---|---|---|---|---|---|---|
| | | AS | AD | AS | AD | AS | AD |
| Unilateral (Left side-AS) | | | | | | | |
| I° | 6 | 23.2-40 | | B | A | - | + |
| II° | 3 | 41.2-45 | | B | A | - | + |
| III° | 1 | 66. | | B | A | - | + |
| IV° | 1 | 80 | | B | A | - | + |
| Unilateral (Right side-AD) | | | | | | | |
| I° | 4 | 22.5-35 | | A | B | + | - |
| III° | 2 | 67.5-73.7 | | A | B | + | - |
| Bilateral | | | | | | | |
| I° | 4 | 21.7-35 | 23.7-38.4 | B | B | - | - |
| II° | 4 | 40-47.5 | 42.5-48.5 | B | B | - | - |
| I-II° | 4 | 28.7-4 | 38.7-43.7 | B | B | - | - |
| mix II° | 1 | 50 | 33.7 | B | B | - | - |

Notes: Right side-AD; Left side-AS

retraction pocket in the epitympanum accompanied with a 2nd degree retraction in the posterior part of the eardrum and 1 patient had a 4th degree retraction in the epitympanum accompanied by a 3rd degree in the posterior part of the eardrum.

Spontaneous nystagmus was assessed by electronystagmography. Results were assessed according to Cogan's classification. Spontaneous nystagmus was revealed only in 5 patients. It was characterized by slow and fast phases, horizontal, conjugated, slow phase velocity greater than 7-8 degrees/second and suppression on visual fixation. These features are considered to indicate peripheral vestibular pathology. These test results were within the normal limots in the controls.

Barany's rotatory testing revealed hyperreactivity of the vestibular function in 8 patients. The test was discontinued in 3 patients because of severe vestibular reactions. Spontaneous nystagmus in the electronystagmography investigation occurred in 5 of these patients. No abnormal findings were found in the control group. Results of Romberg's test were positive in 8 of 10 patients with abnormal vestibular testing. According to this, sensitivity of Romberg's test was 80%.

From the data collected by questionnaire 5 patients reported vestibular complains, such as slight dizziness and incoordination. No vestibular complaints were found among the rest of the examined patients and controls. All the patients with vestibular disorders (10 according to Barany rotatory testing) had deep retraction pockets in the epitympanum or/and the posterior segment of the tympanic membrane. Neither of them presented any co-morbid conditions or/and neuropsychiatric disorders.

In these tables we introduce the correlation between vestibular, hearing disorders and retraction pockets of tympanic membrane in patients with unilateral and bilateral chronic secretory otitis media (Table 3).

***Table 3***

Correlation of vestibular, hearing disorders with tympanic membrane retractions in patients with unilateral and bilateral chronic secretory otitis media

| Hearing loss level | Barany rotatory testing | The stage of tympanic membrane retraction |
|---|---|---|
| Unilateral chronic secretory | | |
| III° | not completed | III |
| IV° | not completed | III |
| II° | test hyperreaction | III |
| I° | not completed | III |
| I° | test hyperreaction | III |
| I° | not completed | IV |
| IV° | not completed | III-IV° posterior |
| II° | test hyperreaction | III |
| II° | test hyperreaction | III |
| II° | test hyperreaction | III |
| Bbilateral chronic secretory | | |
| II°-II° | test hyperreaction | III-IV |
| I°-II° | test hyperreaction | III-III |
| I°-II° | test hyperreaction | II-II |

## *Discussion*

All patients with chronic secretory otitis media were treated by myringotomy and grommet insertion under either local or general anesthesia. Vestibular and hearing testing were repeated a month after treatment. The majority of patients presented significant improvement. In 5 patients no improvement was observed after ventilation tube insertion in relation with their vestibular dysfunction. In contrast, the disease with hearing disorders progressed. This unresponsive subgroup consisted of patients with 3rd to 4th degree retraction pockets in the epitympanum and the posterior part of the tympanic membrane and 3 of 5 patiens had a history of prior myringotomies with grommet insertion during the course of disease.

## *Conclusion*

The level of vestibular function in patients with chronic secretory otitis media is an important clinical parameter. Insertion of ventilation tubes was sufficient to cure small retraction pockets. In contrast, the patients with deep retraction pockets in the epitympanum and the posterior parts of the eardrum did not respond to treatment, while vestibular disturbances and hearing disorders also persisted. Thereafter deep retraction pockets, hearing and vestibular disorders are the greatest problem in chronic secretory otitis media therapy and future studies should be conducted to customize appropriate, timely and adequate surgical treatment.

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