

Incidence of Sensorineural Hearing Loss in Chronic Suppurative Otitis Media

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Abstract:

Background: Sensorineural hearing loss is a common sequel of chronic suppurative otitis media and the round window membrane is currently being considered as a major route for noxious agent to pass from the middle ear cavity to the cochlea.

Objective: To evaluate the incidence and severity of sensorineural hearing loss in patients with chronic suppurative otitis media.

Methods: Prospective study on 93 patients from January 2010 to December 2014 in the AL-Karama Teaching Hospital. The patients were complaining of unilateral chronic suppurative otitis media they were grouped according to the pathology to active, inactive mucosal disease and active, inactive squamous epithelial chronic otitis media, based on clinical otoscopic examination. Audiological studies were done in Specialized Surgery Hospital/ Science Center of Otorhinolaryngology Hearing and Speech Unit.

Result: Forty-four percent of the patients with unilateral chronic suppurative otitis media had some loss of cochlear function. The range of difference between diseased and uninvolved ears was wider at the higher frequencies and related to the activity and duration of the disease.

Conclusion: Chronic suppurative otitis media may be associated with mixed rather than purely conductive hearing loss.

Keyword: Sensorineural hearing loss, chronic suppurative otitis media

Introduction:

Chronic suppurative otitis media has been an important cause of middle ear disease, it is usually classified into tubotympanic and atticointral disease, for diagnostic purposes to assess the ear, pathological definitions are increasingly being used in preference to anatomical ones: (1) healed otitis media (2) inactive "mucosal" chronic otitis media (3) active "mucosal" chronic otitis media (4) active squamous epithelial chronic otitis media "cholesteatoma" (5) inactive squamous epithelial chronic otitis media "retraction pocket"^[1].

The classic type of hearing loss described for chronic otitis media is conductive, several investigators have reported sensorineural hearing loss do occur concomitantly or as sequelae of chronic otitis media, despite the absence of symptoms of labyrinthitis^[2].

Round window membrane is permeable to certain biological substances, in purulent otitis media increased in thickness about 5-fold^[3-4].

Thickness of the round window membrane and the presence of granulation tissue within the niche reduce permeability of the membrane^[4-6].

In otitis media especially suppurative type including both acute and chronic can be by passage of inflammatory agent through the round window membrane cause temporary threshold shift from serous (toxic) labyrinthitis or permanent threshold shift limited to the cochlear basal turn^[7-8].

There is significant loss of outer hair cells or inner hair cells and decrease in area of stria vascularis in the basal turn of affected temporal bones as compared to age-matched controls are results of labyrinthine pathological changes secondary to otitis media^[9].

There are many potential reasons why an individual with chronic otitis media may have a mixed rather than a purely conductive impairment: the disease process may itself affect the cochlea:

potentially ototoxic ear drops are often given: the patients might have an unrelated sensorineural hearing impairment: and the artificial elevation of the bone conduction thresholds due to the Carhart effect have to be corrected for^[1].

Carhart effect which should be considered when study bone conduction threshold in chronically diseased ears. Chronic otitis media can result in loss of bone conduction due to mechanical occlusion of the oval window by granulations, cholesteatoma or pus or as a result of stiffness of ossicular chain^[10-12]. Bone conduction thresholds frequently are elevated in chronic otitis media^[13]. This is because of a combination of the Carhart and the high prevalence of sensorineural hearing impairment within the general population^[14-15].

Patients & Methods:

Case series study was done on 93 patients, who attended the AL-Karama Teaching Hospital complaining of unilateral chronic suppurative otitis media, from Jan 2010 to Dec 2014 to evaluate incidence and the effect of chronic suppurative otitis media on the function of the inner ear.

Criteria for selection:

The age ranged from 10 - 40 years to exclude presbycusis as a cause of sensorineural hearing loss. While patients younger than 10 years of age were excluded to avoid the inaccuracies of audiologic testing in children.

In the assessment excluded other causes of sensorineural hearing loss:

- 1- Previous ear surgery.
- 2- History of meningitis.
- 3- History of head injury.
- 4- Bilateral ear disease.
- 5- History of noise exposure.
- 6- Family history of hearing loss.
- 7- Labyrinthine fistula.
- 8- Systemic diseases that affect hearing.

We consider the age, sex, duration and the pathology of the disease.

The contralateral ear served as a control.

Patients were divided in to 4 groups according to the duration of the disease. They were grouped according to the pathology to active, inactive mucosal disease and active, inactive squamous epithelial chronic otitis media, based on clinical otoscopic examination.

Bone conduction thresholds were measured at 4 tests frequencies (500, 1000, 2000, 4000 Hz) with masking in Specialized Surgery Hospital/ Science Center of Otorhinolaryngology Hearing and Speech Unit.

Dry ear defined as at time of examination and history at least one month free from discharge.

Results:

Out of a total of 120 chronic otitis media patients; however only 93 patients met the selective criteria and were analyzed. 41 of the patients with unilateral chronic suppurative otitis media had some loss of cochlear function as showed by pure tone audiometry, so the incidence of sensorineural hearing loss in our study is 44%. The other 52 patients with chronic otitis media have normal range of bone conduction thresholds.

The clinical and demographic characteristics of these 41 patients were 26 males (63%) and 15 female (37%). 19(46%) were right diseased ears and 22(54%) were left diseased ears. The mean age was 25.8 years ranging from 10-40 years. Discharging

ears formed 32 (78%) while only 9(22%) were dry at the examination.

Distribution of patients according to the type of pathology, based on clinical otoscopic examination, are shown in table 1.

Distribution of patients according to the duration of pathology, are shown in table 2.

Table No.3 shows the mean and range bone conduction at each frequency in the uninvolved ears and diseased ears.

Table No.4 shows the mean bone conduction threshold differences in decible relative to various sound frequencies as detected by audiometry, the mean bone conduction difference for pure tone averages was 9.1 dB, ranged from 6.83 – 11.34dB. These differences tended to increase with increasing frequency.

Table No.5 shows the mean bone conduction hearing threshold at each frequency in the diseased ear in relation to the duration of pathology, it shows increase hearing loss with increasing duration of pathology.

Table No. 6 shows mean bone conduction hearing thresholds at each frequency in relation to the type of pathology. There is increase in bone conduction hearing threshold with active mucosal and active squamous epithelial disease which diagnosed with otoscopic examination

There is no significant effect on bone conduction of diseased ear in relation to the size and location of perforation.

Table 1: The distribution of patients according to the type of pathology.

Pathology	No	%
Inactive mucosal chronic otitis media	9	22
Active mucosal chronic otitis media	30	73
Active squamous epithelial disease (cholesteatoma)	2	5
Inactive squamous epithelial disease (retraction pocket)	0	0

Table 2: The distribution of patients according to the duration of pathology.

Duration (years)	No	%
1 – 5	22	53.6
6 -10	8	9.5
11 - 15	6	14.6
16 – 20	5	12.1

Table 3: The mean and range bone conduction threshold at each frequency in normal and diseased ear.

Frequency (Hz)	Mean (dB)	Range (dB)
Uninvolved ear		
500	3.41	0 – 10
1000	2.92	0 – 15
2000	5.97	0 – 20
4000	9.51	0 – 25
Diseased ear		
500	10.24	0 – 35
1000	10.36	0 – 30
2000	16.46	0 – 50
4000	20.85	0 – 55

Table 4: The mean bone conduction threshold differences at each frequency.

Freq (Hz)	500	1000	2000	4000
Mean (dB)	6.83	7.44	10.49	11.34

Table 5: The mean bone conduction in the diseased ear at each frequency in relation to duration of pathology.

Frequency Hz	Duration years			
	(1-5)	(6-10)	(11-15)	(16-20)
500	6.6	8.6	13.75	14
1000	8.33	8.6	15	15
2000	14.1	17.5	20	24
4000	19.77	20	20	26

Table 6: The mean bone conduction threshold according to the pathology at each frequency.

Pathology	500 Hz	1000Hz	2000Hz	4000Hz
Inactive mucosal chronic otitis media	9.44	8.88	13.33	15
Active mucosal chronic otitis media	10.15	11.1	17.5	21.87
Active squamous epithelial disease (cholesteatoma)	20	27.5	30	32.5
Inactive squamous epithelial diseases retraction pocket	-	-	-	-

Discussion:

Sensorineural hearing loss resulting from chronic otitis media is defined as the difference in bone conduction thresholds between diseased and normal contralateral ears [16].

Case series study was on 93 patients with unilateral chronic suppurative otitis media to assess the sensorineural component of hearing loss.

In our study 44% of the patients with unilateral chronic suppurative otitis media have some loss of cochlear function and there was 10 dB or greater bone conduction hearing loss at more than 2000 Hz frequency.

Paparella et al had reported 43% of ears with unilateral chronic otitis media had 15 dB or greater at one or more frequencies [7].

Levine et al reported the majority of the patients had little difference between diseased and control ears. About 45% of the patients had a difference of more than 10 dB for high frequencies; however, less than 12% had a difference of more than 20 dB for the pure tone average [17].

Zultan Papp et al reported sensorineural hearing loss at 4 kHz seemed to be higher than that at the speech frequencies [18].

Cusimano et al reported 33% of the patients with unilateral chronic otitis media have sensorineural hearing loss [19].

Sady S. Costa et al reported bone conduction threshold averages in the normal side were smaller than those of the chronic otitis media ear, and it is associated with decrease in cochlear function [20].

In our study the mean bone conduction difference for pure bone average was 9.1 dB and range from 6.83 – 11.34 dB. Levine et al reported the mean bone conduction differences, ranging from 5.6 – 12.8 dB across the frequencies [17]. Noordzij et al reported the mean bone conduction thresholds of the diseased and control ears ranged from (-0.5 – 4.4 dB) [21]. C. Macandie et al reported the mean bone

conduction thresholds differences between diseased and control ears range from 5.24 – 9.02 dB [16].

In our study there were differences in bone conduction thresholds between diseased and control ears at all frequencies specially at higher frequencies, these differences increased with duration and in active mucosal disease with granulation tissue and in active squamous epithelial disease with cholesteatoma, confirmed on clinical otoscopic examination. Levine et al reported the most affected frequencies were 2000 and 3000 Hz, relationships were noted between sensorineural hearing loss and cholesteatoma in the middle ear [17].

Cusimano et al reported sensorineural hearing loss, more evident in patients with cholesteatoma or granulation tissue, the loss of bone conduction was related to the duration of the disease, but not with the age of onset of chronic otitis media [19].

Dumich et al reported differences in bone conduction thresholds more with high frequencies and related to the duration of the disease [22].

English et al found mean sensorineural hearing loss of 10 dB for most frequencies and 15 dB for 4000Hz [23]. Noordzij et al reported the differences being at 2000-4000 Hz [21].

C. Macandie et al reported these differences tended to increase with increasing frequency [16]. Sady S. Costa et al reported the threshold shift was significant in each frequency but in 500 Hz. There were no differences in the role of age in the sensory hearing loss [20].

In conclusions, chronic suppurative otitis media associated with mixed rather than purely conductive deafness, the higher frequencies sensorineural hearing loss are more affected than the lower frequencies. Duration of the disease correlated with severity of sensorineural hearing loss. Audiological studies are important for assessment the clinical condition.

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