



Analysis of Sensorineural Hearing Loss in Chronic Otitis Media

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Abstract

Aim: To find out the prevalence of sensori neural hearing loss in patients with unilateral chronic otitis media using contralateral ear as control.

Objective: To evaluate the relationship of sensorineural hearing loss in patients with chronic otitis media where the bone conduction threshold in diseased ear were compared to contralateral ear, to correlate sensorineural hearing loss with the duration and type of disease and to identify the common organism isolated on culture in patients with chronic otitis media.

Methodology: This prospective cross sectional study was carried out in 63 patients who presented to Department of Otorhinolaryngology of RMMCH, Chidambaram from October 2019 to September 2021 with complaints of ear discharge. After taking detailed history of the patient complete examination of ear, nose and throat was carried out. pure tone audiometry was done in all subjects using arphi proton sx5 audiometer in a sound attenuated room. The results obtained were analysed.

Result: In present series of 63 patients we did not encounter any patient with SNHL when duration of the disease was less than 1 year. However when duration of disease ranged from 2 to 5 years and 6 to 10 years sensorineural hearing loss was encountered 1(10%) and 6(24%) patients respectively. There was statistical significance between bone conduction thresholds in control and diseased ear at frequencies 500Hz p=0.001, 1000Hz p=0.004, 2000Hz p=0.007, 4000Hz p=0.023. In 27 (42.9%) of patients in our study, ear swab for culture and sensitivity revealed pseudomonas aeruginosa, followed by MRSA in 18(28.6%) of patients.

Conclusion: A definitive correlation between duration and type of disease and development of sensorineural hearing loss mandates the need for early detection and timely treatment to prevent sensorineural hearing loss.

Keywords: Sensorineural hearing loss, chronic otitis media

Introduction

Chronic middle ear disease especially chronic otitis media (COM) is a major public health problem in developing countries. It usually leads to significant hearing impairment, sensorineural hearing loss being one of the complications. WHO estimated in 2004 that worldwide prevalence of COM is 65-330 million out of which 60% suffer significant hearing impairment¹ Relation between COM and SNHL has been controversial The round window membrane has been analyzed for its contribution to

sensorineural hearing loss in chronic otitis media. Round window membrane is a semipermeable membrane, which is breached by toxins released during the course of COM and causes biochemical changes in perilymph and endolymph finally leading to destruction of Organ of Corti. It has been observed that chronic inflammation enhances increased vascular and macromolecular (protein) permeability within the perilymphatic space.

Different investigators have different views and opinions over the relation between the duration of

disease, type of pathology and development of sensorineural hearing loss in COM. A definitive correlation between the duration or type of disease and development of sensorineural hearing loss would mandate the need for early detection and treatment of Chronic Otitis Media as a means to prevent sensorineural hearing loss.

Materials and Methods

This prospective cross sectional study was carried out in ENT department of RMMCH during the study period from October 2019 to September 2021. 63 patients with chronic otitis media was selected consecutively based on inclusion and exclusion criteria.

Inclusion Criteria

All patients attending ENT department of Raja Muthiah Medical College Hospital, Chidambaram with clinical diagnosis of unilateral chronic otitis media in the age group of 10-60 years were included.

Exclusion Criteria

1. Patients with bilateral disease.
2. Patients with congenital inner ear malformations.
3. patients less than 10 years of age and more than 60 years of age.
4. Patients in whom hearing loss can be attributed to reasons other than chronic otitis media Eg: following traumatic perforation, history of long term intake of systemic ototoxic drugs, previous ear surgery, meningitis, enteric fever, head injury, diabetesmilleteus, familial hearing loss, labrynthitis, labrynthine fistula were excluded from the study.

METHOD OF STUDY

A detailed history was taken in all patients and a thorough ENT examination was carried out to determine the type, size and site of chronic otitis media present. pure tone audiometry was done in all patients to assess the type of hearing loss and its severity.

Audiometric evaluation was performed according to the recommendations of WHO. The pure tone average upto 25dB was considered as normal, 26-

40dB mild, 41-60 dB moderate, 61-80 dB severe, over 81 dB profound. The air conduction thresholds was determined at frequency of 500, 1000, 2000, 4000 Hz, 6000Hz & 8000Hz and the bone conduction thresholds was determined at frequency 500, 1000, 2000, 4000Hz in both ears. The difference in bone conduction thresholds of diseased ear and healthy ear was calculated. The results were statistically analysed using Pearson Chi-square test, significance was defined by P values less than 0.05 using a two tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Science Inc., Chicago, IL).

OBSERVATION AND RESULTS:

In the present series 63 patients were evaluated, out of 63 patients 42 were females and 21 were males, the age of these patients ranged from 10-60 years. Majority of patients were in the age group of 21-30 years and female patients formed 42 (66.7%) in our study. Duration of disease was found to be affecting the occurrence of SNHL. In our study we did not encounter any patient with SNHL when duration of the disease was less than 1 year. However when duration of disease ranged from 2 to 5 years and 6 to 10 years sensorineural hearing loss was encountered 1 (10%) and 6 (24%) of patients respectively. (Table 1) In our study 6(9.5%) patients had attic antral type of disease and 57 (90.5%) patients had tubotympanic type of disease. In patients with tubotympanic disease 54 (94.7%) patients had conductive hearing loss and 3(5.3%) patients had sensorineural hearing loss, In patients with attic antral disease 4 (66.7%) patients had sensorineural hearing loss and 2 (33.3%) patients had conductive hearing loss. There was statistically significant association between type of chronic otitis media and type of hearing loss. (Table 2) The mean difference in the bone conduction thresholds in the normal ears and ears suffering from COM ranged between 2.78 to 2.93dB. There was statistical significance between bone conduction in control and diseased ear at frequencies 500 Hz $p=0.001$, 1000Hz $p=0.004$, 2000Hz $p=0.007$, 4000Hz $p=0.023$. (Table 3) In 27 (42.9%) of patients in our study, ear swab for culture and sensitivity revealed pseudomonas aeruginosa, followed by MRSA in 18(28.6%) of patients. (Table 4)

Table 1 Cross-tabulation of the duration of disease with the type of hearing loss

			Type of HL		Total	p value
			CHL	SNHL		
Duration	<1 year	Count	28	0	28	0.021
		% within duration	100.0%	0.0%	100.0%	
	2-5 years	Count	9	1	10	
		% within duration	90.0%	10.0%	100.0%	
	6-10 years	Count	19	6	25	
		% within duration	76.0%	24.0%	100.0%	
Total		Count	56	7	63	
		% within duration	88.9%	11.1%	100.0%	

Table 2 Cross-tabulation of type of COM with the type of hearing loss

Type of COM			Type OF HL		Total	p value
			CHL	SNHL		
Type	AAD	Count	2	4	6	<0.0001
		% within type	33.3%	66.7%	100.0%	
	TTD	Count	54	3	57	
		% within type	94.7%	5.3%	100.0%	
Total		Count	56	7	63	
		% within type	88.9%	11.1%	100.0%	

Table 3 Comparison of bone conduction threshold between diseased and control ear in different frequencies

Frequency (Hz)	GROUP				Difference in BCT	p-value
	Diseased ear		Control ear			
	Mean	Standard Deviation	Mean	Standard Deviation		
500	8.10	6.50	5.32	1.23	2.78	0.001
1000	8.49	6.99	5.79	1.84	2.7	0.004
2000	9.52	8.02	6.59	2.67	2.93	0.007
4000	10.48	8.60	7.78	3.57	2.7	0.023

Figure 1 Comparison of bone conduction threshold between diseased and control ear in different frequencies

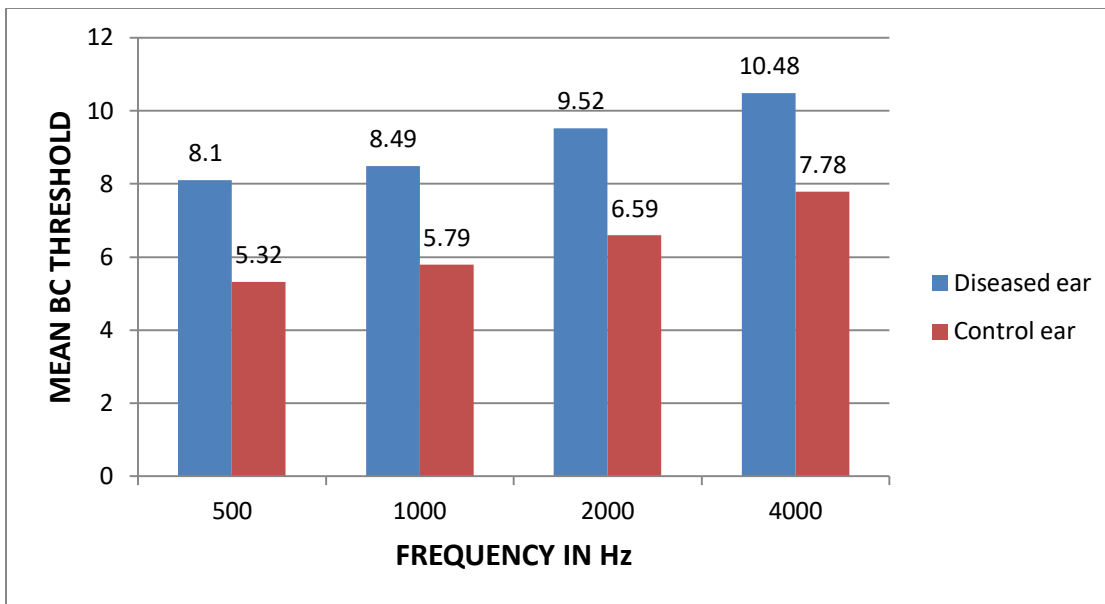


Table 4 Organism Distribution

C/S Organism	Frequency	Percent
E.coli	1	1.6%
Klebsiella	10	15.9%
MRSA	18	28.6%
Pseudomonas	27	42.9%
No growth	7	11.1%
Total	63	100.0%

DISCUSSION:

Conductive hearing loss is a well known effect of COM. Several investigators have reported a loss of cochlear function and hence sensorineural hearing loss. The present study was undertaken to evaluate the relationship of SNHL and COM in patients with unilateral chronic otitis media using pure tone audiometry.

In our study comprising of 63 patients with unilateral COM the age ranged from 10-60 years. In a study done by Amit Kumar Rana *et al*¹ the age of the patients ranged from 10-60 years with mean age of 41.45 ± 8.90 years. This is consistent with the age group in our study. There were 42 (66.7%) females and 21(33.3%) in our study. Similar findings were reported in a study by Rohit Kumar *et al*⁵, where 36% were males and 64% were females.

In our study 6 (9.5%) patients had attico antral type of disease and 57 (90.5%) patients had tubotympanic type of disease. In patients with tubotympanic disease 54 (94.7%) had conductive hearing loss and 3 (5.3%) had sensorineural hearing loss, In patients with atticoantral disease 4 (66.7%) had sensorineural hearing loss and 2(33.3%) of patients had conductive hearing loss. There was statistically significant association between type of chronic otitis media and type of hearing loss. In a study by Amit kumar *et al*¹, the progression of sensorineural hearing loss was much more rapid in atticoantral disease than tubotympanic type. Conversely Mac andie *et al*⁸ found no association between type of disease and hearing loss. Rohit Sharma *et al*⁵ conducted a study and concluded that there was no significant association between the type of chronic otitis media and hearing loss.

We observed SNHL in 7(11.1%) patients, 56 (88.9%) patients had conductive type of hearing loss. In a study conducted by Amit Kumar Rana *et al* 17.38% of patients had sensorineural hearing loss.¹ In a study by Blaklay *et al* 7.7% patients had sensorineural hearing loss due to COM.¹⁵

There was a significant correlation between the duration of disease and SNHL & yet another study by Vertianinen *et al* showed that sensorineural hearing loss occurs particularly in older patients with COM which has usually been present for longer duration¹⁶. We did not encounter any patient with SNHL when duration of the disease was less than 1 year. However, where duration of disease ranged from 2 to 5 years and 6 to 10 years we encountered sensorineural hearing loss in 1 (10%) and 6 (24%) of patients respectively. Amit Kumar *et al*¹ suggested in their study that the duration of disease was found to be affecting the occurrence of sensorineural hearing loss. In their study more cases of mucosal disease showed sensorineural hearing loss when disease persisted for greater than 5 years whereas squamosal disease caused progression to sensorineural hearing loss even when disease was present for shorter duration of time. Hussaona AA and Kaur K noted similar results in their study¹⁷. Radelli *et al* concluded that mean bone conduction threshold differences increased with increasing duration of middle ear disease¹³. Neeraj Kasliwal *et al* found consistent correlation between severity of SNHL and duration of middle ear disease.¹⁰

Conversely Rohit Sharma *et al*, Alexandre fernandes de Azavedo *et al*. Amin Amali *et al* found no relation between SNHL and duration of disease.^{5,2,12}

In our study the mean BC thresholds across the speech frequencies were significantly higher in diseased ears as compared to control ear. When bone conduction threshold in diseased ear and control ear was compared, it was seen that mean bone conduction difference between both ears increased with increasing frequency and was maximum at 2000Hz. The mean difference in the BC thresholds in the normal ears (control group) and ears suffering from COM group ranged between 2.78dB to 2.93dB. We found a statistical significance between bone conduction in diseased and control ear at 500Hz $p < 0.001$, 1000Hz $p = 0.004$, 2000Hz $p = 0.007$, 4000Hz $p = 0.023$.

MacAndie and O'Reilly in their study observed that the bone conduction threshold between diseased ear and control ear varied 5.24-9.02 across the frequency range and found it to be statistically significant.⁸ Redaelli *et al*. stated that differences in mean BC thresholds varied from 0.6dB at 500Hz to 3.7dB at 4KHz¹³. In the series by Noordzig *et al*. It was found that mean bone conduction threshold values were -0.5dB at 500Hz, 0.9dB at 1KHz, 4.4dB at 2KHz and 3.6dB at 4KHz.¹⁸ In a study by Rohit Sharma *et al*⁵ the mean difference in bone conduction thresholds were 2.6dB at 500Hz, 3.4dB at 1000Hz, 4.4dB at 2000Hz and 1.8dB at 4000Hz⁵.

In 27 (42.9%) of patients in our study, ear swab for culture and sensitivity revealed pseudomonas aeruginosa, followed by MRSA 18 (28.6%) of patients. GW Brobby *et al*⁶ found streptococcus pyogenes in 25.5%, Pseudomonas aeruginosa 18.5%, staphylococcus aureus 14%, corynebacterium spp 12%, coliforms 11.1%, proteus spp 7% as causative organism in chronic otitis media.

M.Chirwa *et al*⁹ in their study found that the most common bacterial isolate in chronic otitis media was proteus mirabilis, pseudomonas aeruginosa and staphylococcus aureus. In a study of breakdown of round window membrane permeability Engel *et al* proposed that damage to the round window membrane by potent pore-forming cytolysins (pneumolysin and streptolysin O) lead to leakage of ions from the perilymph. Ionic disequilibrium and passage of toxic macromolecules to the cochlea could contribute to disturbances of the inner ear function.¹¹

From the detailed statistical analysis of our study along with the review of available literature on the subject, we infer that COM can cause variable degree of SN hearing loss.

CONCLUSION:

A definitive correlation between duration and type of disease and the development of sensorineural hearing loss mandates the need for early detection and timely treatment to prevent sensorineural hearing loss.

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