EVALUATION OF SENSORINEURAL HEARING LOSS IN TUBOTYMPANIC TYPE OF CHRONIC SUPPURATIVE OTITIS MEDIA

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ABSTRACT

Background:

1. To know the prevalence of sensorineural hearing loss among chronic suppurative otitis media patients
2. To study the correlation between duration and clinical findings of CSOM with the degree of hearing loss.

Materials and Methods

Hospital based cross sectional study of patients aged between 10 to 45 years with unilateral chronic suppurative otitis media attending Tirumala Super speciality Hospital, Kadapa from December 2015 to November 2017 with sample size of 100 cases were taken.

Results: Out of the 100 cases, 10 patients were having sensorineural hearing loss. Thus the percentage is 10%. Out of the 10 cases of sensorineural hearing loss, no cases with sensorineural hearing loss between 10-15yr and 16-20yr age group. 2 were between in the age group of 26-30yr, 31-35yr and 36-40yr age group and 4 patients were in the age group of 41-45yr. Out of 100 patients 52 were males and 48 were females. Out of 10 patients with sensorineural hearing loss 6 were males and 4 were females. The duration of ear discharge ranged from 3 months to more than 15 years. Among the 100 patients studied 64 had ear discharge from 3 months to 5yr. 16 had ear discharge from 6-10yr, 11 had ear discharge from 11-15yr and 9 had ear discharge of more than 15 years.

Conclusion: Our study shows presence of significant (10%) sensorineural hearing loss in patients with chronic suppurative otitis media.

Duration of ear discharge correlates well with sensorineural hearing loss.

No significant correlation between sex and sensorineural hearing loss.

Keywords: Chronic suppurative otitis media, tubotympanic disease, sensorineural hearing loss.

Introduction

Chronic suppurative otitis media (CSOM) defined as a long-standing discharge either continuous or intermittent discharge through a non-intact tympanic membrane from either a perforation or a tympanostomy tube or it is an inflammatory process of the middle ear space for more than three months^{1,2}

CSOM can be classified on pathological bases into chronic suppurative otitis media tubotympanic type and chronic suppurative otitis media attic antral type. The disease may be active when infection & otorrhea are present or quiescent when they are not present. The length of active & quiescent periods varies from patient to patient. Individuals prone to upper respiratory infection & allergies tend to experience frequent & lengthier episodes of active disease³.

In fact, neglected acute suppurative otitis media of several months duration may still be essentially a self-limiting process that tends toward complete resolution, whereas epitympanic cholesteatoma from the very first day of otorrhea should be classified as CSOM. Thus it is not the duration of the discharge in days, weeks or months but rather the particular pathologic changes that cause otitis media to be classed as chronic rather than acute & self-limiting⁴.

Sensorineural hearing loss (SNHL) is indicated by air & bone thresholds that are or at least very close to one another. Sensorineural losses can be caused by a disorder of the cochlea or auditory nerve or both. The combined term (sensorineural) is used to highlight the fact that we cannot distinguish between cochlear (sensory) & eighth nerve (neural) disorders from the audiogram⁵. However, it is better to use the terms

cochlear & retro cochlear hearing loss if we use other audiological tests.

The SNHL associated with CSOM may be sudden onset, progressive or fluctuating. Disequilibrium or vertigo may or may not be present⁵. It has long been accepted that CSOM is often accompanied by SNHL related to the CSOM but not due to effect of conductive deafness on bone conduction⁶.

The presence of chronic middle ear infection and sensorineural hearing loss reveals various studies of this relationship, however there are few studies showing relationship between duration and clinical findings with sensorineural hearing loss.

One of the main consequences of CSOM is hearing loss. 80% of the people with CSOM present with hearing loss. It is calculated that about 13.8 - 36.2% of the people have hearing impairment due to CSOM⁷. The classic type of hearing loss described for this condition is conductive. However, several investigators have reported sensorineural hearing loss (SNHL) do occur concomitantly or as a sequel of CSOM⁷. The presence of SNHL has been ascribed to contribution of the middle ear in hearing mechanism by bone conduction which is also known as Carhart's effect and/or cochlear damage resulting from extension of the inflammation in the middle ear cleft through round window membrane. It can also be due to direct invasion of inner ear by organisms. Other confounding factors like chronic use of antibiotic ear drops which can have a deleterious effect in the inner ear should also be borne in mind. But some studies have found very little evidence of them causing significant sensorineural hearing loss⁸. With the prevailing studies, it is still a controversy whether SNHL is significantly associated with CSOM or not.

Round window membrane is extremely thin comprising only three layers: outer-epithelial, intermediate connective tissue and inner layer which is continuation of cells lining the scala tympani.

It has been reported that certain forms of otitis media can result not only in catastrophic inner ear changes but also in subtle functional and pathological cochlear changes characterised by sensorineural loss and or endolymphatic hydrops. Although there is a local lymphatic passage from round window membrane niche to the basal turn of cochlea, the round window membrane itself has been regarded as the main access for the potentially ototoxic substances from middle ear to inner ear.

Oval and round windows changes in otitis media in experimental animals were noted by Goycoolea M.V. et al(1980)⁹. The round window membrane changes from 1 day to 6 months after eustachean tube obstruction, revealed changes to be gradual and similar to that of mucoperiosteum. These changes noted are suitable for the changes of permeability and suggested that round window membrane is very likely pathway from middle to inner ear.

Materials and Methods

Hospital based study of patients aged between 10 to 45 years with unilateral chronic suppurative otitis media attending Tirumala Super speciality Hospital, Kadapa from December 2015 to November 2017 with sample size of 100 cases. Patients between age group 10-45 years with unilateral chronic suppurative otitis media who are attending OPD/ wards for treatment at Tirumala Super speciality Hospital, after excluding certain patients mentioned under exclusion criteria by history, clinical examination and relevant investigations.

Exclusion criteria:

The following patients were excluded from the study

1. Patients with bilateral chronic suppurative otitis media.
2. Patients with unilateral sensorineural hearing loss with a known cause like Meniere's disease, labyrinthitis, Acoustic neuroma, Temporal bone fracture, Syphilis, Meningitis.

Results

100 patients aged between 10 to 45 years with unilateral chronic suppurative otitis media attending ENT department of Tirumala Super speciality Hospital, Kadapa from December 2015 to November 2017 with sample size of 100 cases were studied.

Observations recorded in the study are described under the following heading.

1. Percentage of sensorineural hearing loss:

Out of the 100 cases, 10 patients were having sensorineural hearing loss. Thus the percentage is 10%.

Table 1:

Total no. of cases	100
Patients with SNHL	10
Percentage of SNHL	10%

2. Age distribution:

Age ranged from 10 to 45 years. The lowest age was 10yr and highest 45yr. Out of the 10 cases of

sensorineural hearing loss, no cases with sensorineural hearing loss between 10-15yr and 16-20yr age group. 2 were between in the age group of 26-30yr, 31-35yr and 36-40yr age group and 4 patients were in the age group of 41-45yr.

Age distribution of patients –

Table 2:

Age group (In years)	No. of cases	Cases with SNHL	Percentage
10-15	8	0	0
16-20	30	0	0
21-25	25	0	0
26-30	17	2	11.7
31-35	8	2	25
36-40	4	2	50
41-45	8	4	50

3. Sex distribution:

Out of 100 patients 52 were males and 48 were females. Out of 10 patients with sensorineural hearing loss 6 were males and 4 were females.

Table 3:

Age group	Male	Female	Total	With SNHL		
				Male	Female	Total
10-15	08	12	20	1	0	1
16-20	16	17	33	1	1	2
21-25	06	6	12	0	0	0
26-30	06	9	15	0	0	0
31-35	05	2	7	0	2	2
36-40	04	1	5	2	0	2
41-45	07	1	8	2	1	3
Total	52	48	100	6	4	10

Table 5:

	250Hz		500Hz		1KHz		2KHz		4KHz	
	Diseased	Normal	Diseased	Normal	Diseased	Normal	Diseased	Normal	Diseased	Normal
Mean (db)	6.60	1.60	12.36	2.78	17.03	3.07	22.78	4.20	28.82	5.00
SD	6.12	2.54	9.7	3.01	11.75	3.20	13.61	3.59	14.43	4.31
Md	5.00		9.58		13.96		18.58		23.82	
SDd	3.58		6.73		8.54		10.02		10.13	
't'	7.77		9.66		11.81		13.64		16.28	
'p'	<0.001		<0.001		<0.001		<0.001		<0.001	

SD: Standard deviation

Md: Mean difference

SDd: Standard deviation difference

Discussion

In the present study, sample sizes of 100 patients were taken in which 10 patients presented with SNHL. Age distribution ranged from 10 to 45 years in

4. Relation between duration of ear discharge and sensorineural hearing loss:

The duration of ear discharge ranged from 3 months to more than 15 years. Among the 100 patients studied 64 had ear discharge from 3 months to 5yr. 16 had ear discharge from 6-10yr, 11 had ear discharge from 11-15yr and 9 had ear discharge of more than 15years.

Table 4:

Duration of ear discharge	Total no. of patients	Patients with SNHL
3 Months- 5 Years	64	1
6-10 years	16	1
11-15 years	11	2
>15years	9	6

5. Frequency analysis of sensorineural hearing loss:

Mean bone conduction at different frequencies was calculated, and compared with normal ear.

The mean bone conduction thresholds in unilateral diseased ears were significantly raised than normal control ears at all frequencies. Furthermore the mean bone conduction threshold differences were statistically significant and ranged from 5 to 23.82 dB across the frequency range with greater mean bone conduction differences at higher frequencies, by applying "t" test.

which lowest age was 10years and highest being 45years. Out of the 10 cases of SNHL, none of the patients were between 10 to 25yr age group, whereas 2 patients were recorded in 26 to 30(11.7%), 31 to 35(25%) and 36 to 40(50%) years age group and four patients in 41 to 45(50%) years age group. Out of 100 patients, 52 were male and 48 were females, in which 10 patients who had SNHL showed sex

distribution of 6 male patients with SNHL and 4 female patients. The duration of ear discharge ranged from 3 months to 15 years. Among these 100 patients studied, 64 had ear discharge from 3 months to 5 years, 16 patients had ear discharge from 6 to 10 years, 11 had ear discharge between 11 to 15 years and 9 had ear discharge of more than 15 years showing that SNHL is mainly dependent on the duration of ear discharge and not in relation to sex of an individual. The frequency analysis of sensorineural hearing loss that the mean bone conduction thresholds in unilateral diseased ears were significantly raised than normal ears in all frequencies. Furthermore the mean bone conduction thresholds differences were statistically significant and ranged from 5 to 23.82 dB across the frequency range with greater than mean bone conduction differences at higher frequencies, by applying "t" test. At 250 Hz the mean hearing loss in diseased ear is 6.60 dB where as in normal ear, it is 1.60 dB. At 500 Hz, the mean loss in diseased ear is 12.36 dB whereas in normal ear it is 2.78 dB loss. At 1 KHz, the mean loss in diseased ear is 17.03 dB where as in normal is 3.07 dB. At 2 KHz mean loss in diseased ear is 22.78 dB whereas in normal is 4.20 dB. At 4 KHz, the mean loss in diseased ear is 28.82 dB whereas in normal is 5 dB loss.

One of the earliest observations was made by Huizing E.H¹⁰. In 1964 acknowledged the presence of bone conduction loss in otitis media, stating that while the loss is generally considered to be due to cochlear damage resulting from inflammation, more often lowered bone conduction thresholds have middle ear origin which he described as "middle ear bone conduction loss" and a "pseudo perceptive loss".

Dorothy C Moore¹¹ et al in 1980 selected a sample of 80 children with otitis media and sensorineural involvement and was compared to 80 children with same histories, but whose audiogram does not display any sensorineural hearing loss. 95% of patients with sensorineural involvement showed a dip at the frequencies 2 and 4 KHz. Analysis of other 80 children showed, 70% of the developed spontaneous perforation and achieved normal hearing after some time. They hypothesized that the absence of sensory neural loss in control group could be due to perforation, resulting in the release of middle ear fluid and cochlea was no longer at a risk of chemical contamination.

Paperalla¹² et al in 1984 presented additional evidence to support the hypothesis that both acute purulent otitis media and chronic suppurative otitis media can cause high frequency hearing loss. In selected patients and in animals (chinchillas), using electrophysiological methods- both, temporary threshold shifts as well as permanent threshold shifts of basal cochlear turn were demonstrated in purulent otitis media. Patients with purulent otitis media are more susceptible to regional basal turn temporary threshold shifts than patients with chronic otitis media.

Papp Z¹³ et al (2003) studied patients with unilateral chronic suppurative otitis media and concluded that chronic suppurative otitis media was seen to be associated with sensorineural hearing loss under threshold shift was accentuated as age increased.

Karan Sharma et. Al¹⁴ in 2005 studied sensorineural hearing loss in safe type of CSOM, and reported 9.7% sensorineural hearing loss. They further observed that severity of sensorineural hearing loss increased with increase in size of perforation and duration of disease.

According to our study, the relationship of SNHL was found to be significant even for tubotympanic type of CSOM despite the common notion that it occurs more in Attic type of CSOM. Risk of SNHL in Chronic otitis media of tubotympanic variety was found by Mohsin et al¹⁵ and Azevedo et al¹⁶. But study by Razooqi et al¹⁷ stated that the presence of cholesteatoma has a significant correlation with the occurrence of SNHL.

Though gender didn't have any positive correlation with regards to SNHL, there was a male predominance in our study group. The same male predominance was noted in the study conducted by Mohsin et al¹⁵ and Gulati et al¹⁸. Females were the predominant population in the study carried out by Md Daud et al¹⁹. In contrast, Alabbasi et al²⁰ found that there was no significant gender difference in CSOM patients.

Kamaljit Kaur et al²¹ found that that incidence of SNHL in CSOM is 24% and incidence of SNHL increased with the increasing duration of disease. They advised high frequency audiometry test (i.e. 10,000 Hz to 20,000 Hz) in all patients of CSOM. However in our study the percentage of SNHL came to be 10%. The highest frequency we took into consideration was 8000 Hz.

Rohit Sharma et al²² proposed that though greater SNHL was seen in patients of CSOM with cholesteatoma, it was not statistically significant.

The results of the study by Aws A. Hussona et al²³ in 2008 indicate that there is a definite sensorineural component to the hearing loss in cases of Chronic suppurative otitis media. Bone conduction in diseased ears is depressed to a statistically significant degree when compared to that in normal control ears. The longer the disease process and the more complicated the pathology (Polyp or granulation tissue) the greater the possibility of sensorineural hearing loss.

Conclusion

1. Our study shows presence of significant (10%) sensorineural hearing loss in patients with chronic suppurative otitis media.
2. Sensorineural hearing loss was found to be more in patients between the age group of 36-45 years.
3. In this series male to female ratio is approximately 1.08:1.
4. Duration of ear discharge correlates well with sensorineural hearing loss.
5. No significant correlation between sex and sensorineural hearing loss.
6. Higher frequencies are more affected than lower frequencies.

In the light of the study, there is a need for continual assessment of sensorineural function in patients with CSOM and it should be managed effectively so as to prevent the chances of developing sensorineural hearing loss.

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