

Original Research Article

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Sensorineural hearing loss in chronic otitis media: analysis of an overlooked entity!

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ABSTRACT

Background: In developing countries, hearing loss continues to be the major public health problem. Among the various causes of hearing loss, chronic otitis media (COM) is one of the commonest. In COM, the presence of sensorineural hearing loss is well established. Our study intends to determine the prevalence of sensorineural hearing loss in chronic otitis media.

Methods: This was a cross sectional descriptive study of 151 subjects between the age group of 10 and 60 years. Patients having unilateral chronic otitis media of both mucosal and squamosal types were selected. All patients were evaluated clinically and audiologically. The type, duration of disease and type of perforation is correlated with degree of sensorineural hearing loss. Interaural differences in bone conduction thresholds at 500 Hz, 1 kHz, 2 kHz and 4 kHz were also noted.

Results: A statistically significant correlation was noted between type of disease and perforation with hearing loss. A significant interaural difference was noted across the speech frequencies. Sensorineural hearing loss of 19.1% was seen.

Conclusions: Significant sensorineural hearing loss is seen in chronic otitis media which was greater in squamosal disease. Statistically significant correlation was noted between type of disease and type of perforation with hearing loss.

Keywords: Sensorineural hearing loss, Chronic otitis media, Bone conduction threshold

INTRODUCTION

Hearing loss is one of the commonest complaints in chronic otitis media that can be prevented if detected early. Various studies have shown the prevalence of chronic otitis media in India to be 2-15%. It is seen that about 13.8-36.2% of people with COM have hearing loss. Alexandre et al conducted a retrospective study where the incidence of SNHL in patients of chronic otitis media was 13%.¹ The prevalence of sensorineural hearing loss was found to be 7.93% in mucosal and 11.58% in squamosal type of chronic otitis media.²

Otitis media is one of the most common diseases of childhood due to viral upper respiratory infections. 80% of acute bacterial infection occurs in children of 1 to 6 years age. Poor living conditions, overcrowding, poor hygiene and nutrition have been suggested for widespread prevalence of COM in developing countries. Acute or recurrent infection of the middle ear may result in a permanent perforation of the tympanic membrane and inflammatory changes in the middle ear and mastoid.³

Paparella et al found that the toxins cross the round window membrane and cause irreversible damage to cochlear hair cells in the basal turn of the cochlea. He proposed that temporary threshold shifts were caused by serous labyrinthitis while permanent threshold shifts occurred from permanent dysfunction of the organ of Corti. The anatomical characteristics of round window encourages the accumulation and stagnation of purulent secretions.⁴ Various studies showed that damage occurred in the round window membrane by potent pore-forming cytolytic (pneumolysin and streptolysin O) which lead to leakage of ions from the perilymph. Hence ionic disequilibrium and passage of toxic macromolecules to the cochlea could contribute to the disturbances of the inner ear function.⁵ Loss of bone conduction in COM can also be due to mechanical occlusion of the oval window by granulations, cholesteatoma or pus or as a result of stiffness of the ossicular chain which is called as cahart effect.⁶ However, there are not many studies in which this point has been taken into consideration in the discussion of the BC threshold in COM.

The present study is undertaken to determine the prevalence of sensorineural hearing loss in chronic otitis media.

METHODS

The present study was a cross sectional descriptive study conducted in the Department of Otorhinolaryngology at Justice K. S. Hegde Charitable Hospital, Mangalore from October 2017 to September 2018. Convenient sampling method was utilized to recruit 151 patients.

Inclusion criteria

Patients of age 10-60 years and patients with unilateral chronic otitis media were included in the study.

Exclusion criteria

Exclusion criteria were as follows: patients of age >60years, bilateral COM and diabetes and hypertension, family history of congenital/acquired sensorineural hearing loss, history of use of ototoxic drugs, prior history of ear surgery, history of noise exposure and history of head injury.

A detailed history and examination was done and the type of hearing loss was noted by tuning fork tests. Pure tone audiometry performed on all patients by using a pure tone audiometer, model GSI Grason Stadler 61. Air conduction and bone conduction was measured for frequencies of 500, 1000, 2000 and 4000 Hz. Masking was done using narrow band noise. Patients were considered to have SNHL when bone conduction thresholds were >25 db in two or more frequencies.

Ethical clearance was obtained from Institutional Ethics Committee.

The data collected was summarised by using frequency, percentage, mean and standard deviation (descriptive statistics). Chi-square test and Fisher's exact was used for correlation of different variables. p value of <0.025 was considered significant.

RESULTS

A total of 151 patients with unilateral chronic otitis media between the age group of 10-60 years were recruited. In the present study, 86.1% of cases are mucosal and 13.9% are squamosal. The mucosal active cases were 19.9%, mucosal inactive cases were 66.2%, squamosal active cases were 12.6% and squamosal inactive cases were 1.3%.

The mean age was 34 years and majority of the subjects were in the age group of 31-40 years and least in 51-60 years. 26.9% subjects in the age group of 31-40 years had mucosal disease and 28.6% had squamosal disease in both 21-40 years age groups. 40% of subjects of mucosal active (MA) belonged to the age group of 21-30 years and 32% of mucosal inactive subjects were of 31-40 years. In squamosal active (SA) subjects, 31.6% belonged to both 21-40 years age group.

In the present study, 63% are females and 37% are males. In mucosal disease, 37.7% were males and 62.3% were females. In squamosal disease, 33.3% were males and 66.7% were females.

The mean duration of disease was 10.33 years. 64.2% of patients had the duration of disease of <10 years. Majority of the subjects of mucosal and squamosal disease had <10 years of duration of disease. In subjects with duration of disease of <10 years, 64% had MI disease while 73.7% had SA.

In the present study, 47% had large central perforation in mucosal disease. In squamosal disease, 7.3% had attic perforation while 6.6% had posterosuperior retraction. 60% subjects of MA and 53% of MI disease had large central perforation while 57.9% of subjects of SA had attic perforation.

In the present study, sensorineural hearing loss was seen in 19.1% of subjects.

Higher bone conduction thresholds with an average of 30 dB were seen in squamosal disease which increased with increasing frequency. A statistically significant correlation was found between type of disease and degree of sensorineural hearing loss (Table 1).

In the present study, majority of the subjects had hearing loss with duration of disease of <10 years. There was no statistical significance between duration of disease and hearing loss with a p value of 0.061 (Table 2).

Table 1: Correlation of sensorineural hearing loss with type of disease.

Bone conduction	Mucosal (n=130)		Squamosal (n=21)	
	N	%	N	%
Normal	110	84.6	12	57.1
26-40	13	10	2	9.5
41-55	3	2.3	4	19
56-70	1	0.8	3	14.3
71-90	3	2.3	0	0
>90	0	0	0	0

Table 2: Correlation of sensorineural hearing loss with duration of disease.

Duration of disease	Bone conduction (dB)			
	26-40	41-55	56-70	71-90
	%	%	%	%
<10	53.3	85.7	50	100
11-20	26.7	0	50	0
21-30	13.3	0	0	0
31-40	6.7	14.3	0	0

In the present study, a high statistical significance (p<0.007) was noted between the type of perforation and sensorineural hearing loss (Table 3 and 4).

Table 3: Correlation of sensorineural hearing loss with type of perforation in mucosal disease.

Type of perforation	Bone conduction (dB)							
	26-40		41-55		56-70		71-90	
	N	%	N	%	N	%	N	%
Small	0	0	0	0	0	0	0	0
Medium	2	13.3	3	42.9	0	0	2	66.7
Large	9	60	0	0	1	25	1	33.3
Subtotal	2	13.3	0	0	0	0	0	0

Table 4: Correlation of sensorineural hearing loss with type of perforation in squamosal disease.

Type of perforation	Bone conduction (dB)					
	26-40		41-55		56-70	
	N	%	N	%	N	%
AP	1	6.7	2	28.6	2	5
PSR	1	6.7	2	28.6	1	25

In the present study, interaural differences were present in 42% and absent in 58% of the subjects. Of the 42% subjects, 39.2% was seen in mucosal and 69.1% in squamosal disease. Majority of the subjects i.e., 41% of MI and 68.4% of SA had significant interaural difference. The mean interaural difference was 16 dB and maximum difference was seen at 2 kHz.

DISCUSSION

Hearing loss is a major public health issue in developing countries. Chronic otitis media is the commonest cause of hearing loss, the prevalence being 72 per 1000 population and affecting all age groups.¹ Sensorineural hearing loss in chronic otitis media varies considerably.

Inflammation in the middle ear can facilitate the passage of toxins through the round window membrane and damage the inner ear which results in sensorineural hearing loss in middle and high frequencies.⁷ The chronicity of disease causes structural changes in the round window membrane resulting in thickening of epithelial and sub-epithelial layer which in turn blocks the toxins diffusing into the inner ear.⁸ Hence one cannot

explain SNHL solely because of passage of toxins. Hence the pathogenesis that can be formulated apart from toxic are circulatory, hypoxic and mechanical factors. Circulatory disturbances and possible lymphatic blockage at sub-epithelial layer of round window could occur.⁹ The chronic inflammatory process produced hypoxic damage due to the thickened round window membrane which resulted in blockage of diffusion of oxygen into the perilymph from middle ear. A difference in partial pressure of oxygen at the round window and basilar membrane facilitated the diffusion of oxygen into perilymph which was reduced when there was thickening of the round window membrane.¹⁰ The mechanical factors altering the mass and stiffness of middle ear can also contribute to the pathogenesis.¹¹ Schuknecht suggested that local toxic effects can also increase the atrophic changes in the supporting cells of the cochlea which resulted in membrane which hence forth caused altered displacement of cochlear partition in response to sound.

In the study conducted by Cusimano et al showed a linear regression analysis with a significant correlation between the bone conduction thresholds at different frequencies and duration of disease.¹² Amali et al also showed similar

results. But the present study did not show any statistical significance between the two.¹³

A retrospective study conducted by Macandie et al showed no statistical significance between duration of disease and presence of cholesteatoma with degree of SNHL.¹⁴ However the difference in BC thresholds between the diseased and control ears varied from 5.24-9.02 dB across the frequency range. Da Costa et al also showed a similar observation.¹⁵ In the present study, the interaural difference ranged between 14-16 dB at different frequencies which was statistically significant.

A study by Kasliwal et al showed that the degree of SNHL correlated with duration and presence of cholesteatoma and ossicular erosion.¹⁶ Interaural difference was statistically significant at 2 kHz and 4 kHz. A similar result was obtained by Kaur et al who attributed a 24% incidence of SNHL in their series.⁴ The present study showed 19.1% SNHL in diseased ears.

In contrast to other studies, de Azevedo studied 115 patients and observed that there was no statistical correlation between the degree of SNHL with duration of disease and presence of cholesteatoma.¹⁷ He found correlation with respect to age and with every 4 years increase, a reduction of 1dB in bone conduction was noted. The frequency of SNHL in his study was 13%. However, Kolo et al found no significant correlation between age and duration of otorrhea with the degree of SNHL.¹⁸ But the mean BC thresholds ($P < 0.05$) in speech frequencies were significantly higher in COM compared to the control ears and higher frequencies were affected. The range was from 21.69 to 34.52 dB across the frequencies 0.5, 1.0, 2.0, and 4.0 kHz. Similar results were seen in a study conducted by Jan et al.¹⁹ The present study also showed BC thresholds between 18-33 dB similar to the above study.

In a study conducted by Yoshida et al, there was no correlation between the size of perforation and bone conduction thresholds.²⁰ However in contrast, the present study showed a significant correlation with a p value of < 0.007 .

A study done by Sharma et al observed that the mean BC threshold in the control ear was 12 dB and in diseased ear was 15.03 dB.²¹ This difference although not large but was statistically significant ($P < 0.05$). He also found that mean BC threshold was not affected with the duration of discharge, but correlated with increasing age and presence of cholesteatoma. Higher bone conduction thresholds were observed in the diseased ear which was statistically significant at 1 kHz and 2 kHz. Padmanabhan et al showed that SNHL was present in 12% of mucosal and 36% of squamosal disease.¹ The present study also showed a statistically significant correlation between squamosal disease and hearing loss, where 15.3% SNHL was seen in mucosal disease while 42.8% was seen in squamosal.

Roy et al found in their study an incidence of 11.43% of sensorineural hearing loss with 37.5% in the age group 41-50 years, indicating that age was risk factor for progression of SNHL.²² He also showed that bone conduction loss of 20 dB or more was present at frequencies 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz. His findings were consistent with that of Azevedo.

Kumar et al found hearing loss with increase in duration of pathology which was statistically significant ($p > 0.05$).²³ In his study, bone conduction hearing loss > 15 dB at one frequency in 42.8% of the patients and > 15 dB hearing loss at two frequencies or more in 21.4% of the patients was noted. A statistically significant ($p < 0.01$) correlation was seen between bone conduction thresholds and granulation tissue, polyp, and cholesteatoma. There was no significant effect on bone conduction of diseased ear with site and size of the perforation.

CONCLUSION

Chronic otitis media is known to cause sensorineural hearing loss. There is a strong correlation between the type of disease and size of perforation with the degree of hearing loss. To conclude, sensorineural hearing loss in chronic otitis media is significant and can be prevented by timely surgical intervention.

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