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Original Research Article

Sensorineural hearing loss in patients with tubotympanic type of chronic suppurative otitis media: a prospective study

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is defined as a chronic inflammation of the mucosa of the middle ear cleft, which presents with recurrent or persistent ear discharge through a tympanic membrane perforation. Hearing loss associated with CSOM is conductive but sensorineural hearing loss has also been observed which may be due to toxins produced during infection that can damage the hair cells on the basal turn of the cochlea. To study the relationship between sensorineural hearing loss (SNHL) and tubotympanic type of Chronic Suppurative Otitis Media.
Methods: This was a prospective study conducted on 60 patients of tubotympanic type of CSOM attending the ENT OPD at SMGSH, Jammu after getting (Institutional Ethical Committee) IEC clearance.
Results: In the present study, 8 (13.3%) out of 60 patients of tubotympanic or mucosal type of CSOM had SNHL.
Conclusions: Although it is a known fact that tubotympanic type of CSOM causes conductive hearing loss due to perforation in the tympanic membrane and ossicular damage but it is concluded from the present study that tubotympanic type of CSOM carries a risk of SNHL in significant percentage of patients. Hence, it is advocated that patients should be made aware of risk of development of SNHL in tubotympanic type of CSOM if left unoperated for a longer duration.

Keywords: Air conduction, Bone conduction, Chronic suppurative otitis media, Hertz, Sensorineural hearing loss

INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as a chronic inflammation of the mucosa of the middle ear cleft, which presents with recurrent or persistent ear discharge (otorrhoea) through a tympanic membrane perforation.[1] Chronic Suppurative Otitis Media (CSOM) is a common ENT problem, highly prevalent worldwide.[2,3]

Incidence of CSOM is higher in developing countries because of poor socioeconomic standards, poor nutrition and lack of health education. Hearing loss associated with CSOM is conductive but sensorineural hearing loss has also been observed which may be due to toxins which are produced during infection which when cross the membrane of round window causes alteration in the permeability and causes the damage to hair cells on the basal turn of the cochlea.[4] Moreover, the chronic inflammation on the round window causes circulatory disturbance (intermittent vasodilatation and vasoconstriction of the vessels) leading to negative influential role on middle ear. These toxins also cause damage to the organ of Corti.[5] The relationship between SNHL and CSOM has been a controversial issue for quite some time.

The SNHL in CSOM has been calculated to be up to 24% by Kaur et al, 9.4% Sharma R et al.[6,7] Different studies have calculated varying number of patients of sensorineural deafness with CSOM (Tubotympanic type) has relation with the age being established that SNHL is

more in older age group. It is seen that more is the duration of the disease, more is the hearing loss. This is also established by comparison based on age between SNHL and increased age of the patient in CSOM (>40 years) and increased duration of CSOM (>10 years).[7] While conductive hearing loss can be minimized through surgery, sensorineural hearing loss constitutes a permanent effect. A positive correlation between SNHL and duration of CSOM means an early intervention will be beneficial to the patient. Thus, this study was conducted with an aim to study the relationship between sensorineural hearing loss and tubotympanic type of chronic suppurative otitis media.

METHODS

The study consisting of 60 patients of tubotympanic type of CSOM (Mucosal; Safe) was conducted in the Department of Otorhinolaryngology and Head and neck surgery, SMGSH, Government Medical College Jammu for a period of one year w.e.f 1st November 2018 to 31st October 2019 after taking approval from the Institutional Ethical Committee (IEC), Govt. Medical College, Jammu.

Inclusion criteria

Patients of Unilateral CSOM-Tubotympanic type (Mucosal; Safe) with normal hearing in contralateral ear as control ear.

Exclusion criteria

Patients younger than 10 years of age to eliminate the possibility of inaccuracies of audiological testing in children, patients older than 50 years of age because of the increased incidence of presbycusis in this age group, patients with history of otologic surgery/ familial hearing loss/ prolonged exposure to noise or head trauma were excluded from the study.

Work-up of patients

After obtaining informed consent, the patients underwent a detailed ENT examination with special emphasis on ear and tuning fork tests. They were subjected to audiological assessment i.e., PTA in a sound-treated room which conformed to American National Standards Institute (ANSI) (1977) and International Organization for Standardization (ISO) standards for maximum permissible noise level including PTA.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft excel) and then exported to data editor of statistical package for the social sciences (SPSS) version 2.0. Continuous variables were expressed as mean±SD and categorical variables were summarized as percentages.

RESULTS

The maximum number of patients (31.67%) were in the age group of 31-40 years with a mean age of 32±10 years. Our study had a male to female ratio 1:0.93. The maximum number of patients (51.67%) presented with the duration of their symptoms less than 15 months, (30%) patients presented with duration of the symptoms about 15-30 months, (3.33%) patients had symptom duration of 31-45 months and (15%) patients had a history of symptom duration of more than 45 months. 55% patients had involvement of their left ear and 45% patients with right ear involvement. The maximum number of patients (41.67%) had perforation in the anterosuperior quadrant of pars tensa, (40%) patients had anteroinferior quadrant perforation and (18.33%) patients had posterosuperior quadrant perforation.

Air Conduction and bone conduction threshold of diseased ear at various frequencies ranging from 500Hz to 4000Hz. AC threshold at 500 Hz frequency showed a mean±SD of 27.58±3.73 db, Mean of 30.16±4.09 db at 1000Hz, Mean±SD of 31.92±4.79 db at 2000 Hz, Mean±SD was 33.5±5.98db at frequency of 4000 Hz. BC threshold at 500 Hz frequency showed a mean of 13.33db with a standard deviation of 5.79, Mean±SD of 17±6.18db at 1000Hz, Mean±SD at 2000 Hz were found to be 21.58±6.67db and Mean±SD of 24.5±6.74db at frequency of 4000 Hz.

Out of 60 patients, 8 patients were having significant SNHL (Avg. BC Threshold>25dB) and 52 (86.67%) patients had no significant SNHL.

The mean age of the patients with SNHL had a mean of 42.87 years with SD of 4.38 years and duration of disease had a mean of 94.5 months with a SD of 28.27 months.

Out of the eight patients with SNHL (50%) patients were males and (50%) patients were females with a male: female ratio of 1:1. The Otoscopic findings in patients with SNHL shows maximum number (37.50%) patients were having antero-inferior quadrant perforation, (37.50%) patients antero-superior quadrant perforation and (25%) patients had postero-inferior quadrant perforation.

AC threshold at frequency of 500Hz showed a mean±SD of 27.88±3.75db, mean±SD of 30.57±4.04 db at frequency of 1000Hz, mean±SD of 32.31±4.69 db at frequency of 2000 Hz and a mean±SD of 34.04±5.86 db at frequency of 4000 HZ. The bone Conduction threshold at frequency of 500Hz showed a mean±SD of 31.20±3.76 db, mean±SD of 14.23±5.63 db at frequency of 1000Hz, mean±SD of 17.88±6.13 db at frequency of 2000Hz, and a mean±SD of 22.69±6.29 db at frequency of 4000Hz.The average of Air Conduction threshold and Bone Conduction threshold at various frequencies which showed a mean±SD of 34.04±4.34 db for average AC

threshold and a mean±SD of 39.95± 4.95 db for average BC threshold.

Maximum hearing loss was seen involving higher frequencies at 4000Hz and 2000 Hz with a mean±SD of 39.375±4.95 and mean±SD of 35±2.67 respectively. At 500Hz, the mean deviation of BC threshold in normal ear was found to be 10.45db and diseased ear was 14.95 db and the difference between two was statistically significant. At a frequency of 1000Hz, the mean deviation in normal and diseased ear was found to be 11.95 and 21.34 db respectively and the difference between them was found to be statistically significant. At 2000Hz, the mean deviation of BC threshold in normal ear was found to be 16.45 db and diseased ear was 29.95 db and difference between two was statistically significant. At a frequency of 3000Hz, the mean deviation in normal and diseased ear was found to be 21.27 and 37.32 db respectively and difference between them was statistically significant.

Table 1: Age distribution, sex distribution, laterality, duration of symptoms and otoscopic finding among patients with chronic suppurative otitis media.

Age (in years)	No. of patients	%
10-20	8	13.3
21-30	17	28.33
31-40	19	31.67
41	16	26.67
32±10 (mean±SD)	60	100
Gender		
Male	31	51.67
Female	29	48.33
M:F ratio	60	1:0.93
Duration (in months)		
<15	31	51.67
16-30	18	30
31-45	2	3.33
>45	9	15
Laterality		
Right	27	45
Left	33	55
Otoscopic findings (perforation)		
Anterio-superior	25	41.67
Anterio-inferior	24	40
Posterio-superior	11	18.33

Table 2: Air conduction threshold and bone conduction threshold.

Frequency	Air conduction (mean±SD) Db	Bone conduction (mean±SD) Db
500 Hz	27.58±3.73	13.33±5.79
1000 Hz	30.16±4.09	17±6.18
2000 Hz	31.92±4.79	21.58±6.67
4000 Hz	33.5±5.98	24.5±6.74

Table 3: Average bone conduction threshold among patients with sensorineural hearing loss.

SNHL	No. of patients	%
BC threshold 25 db (sig)	8	13.33
BC threshold (<25 db (in.sig)	52	86.67

Table 4: Mean age and mean duration of disease in patients with significant SNHL (n=8).

Patients with SNHL	Mean	SD
Age (in years)	42.87	4.38
Duration of disease (in months)	94.5	28.27

Table 5: Gender wise distribution among patients with SNHL (n=8).

Sex	No. of patients	%
Male	4	50
Female	4	50
Total	8	100
Otoscopic finding (perforation)		
Anterio-inferior	3	37.50
Anterio-superior	3	37.50
Posterio-inferior	2	25

Table 6: Ac threshold and bone threshold among patients with SNHL (n=8).

Frequency	Air conduction-Db (mean±SD)	Bone conduction-Db (mean±SD)
500 Hz	27.88±3.75	31.20±3.76
1000 Hz	30.57±4.04	14.23±5.63
2000 Hz	32.31±4.69	17.88±6.13
4000 Hz	34.04±5.86	22.69±6.29
Average	34.04±4.34	39.95±4.95

Table 7: SNHL hearing loss according to frequency.

Hearing loss (SNHL)	frequency			
	500 Hz	**1000 Hz**	**2000 Hz**	**4000 Hz**
20-30 db	8	6	1	1
31-40 db	0	2	7	5
41-50 db	0	0	0	2
51-60 db	0	0	0	0
>60 db	0	0	0	0
Mean±Sd	24.375±1.76	28.75±4	4 35±2.67	39.375±4.95

Table 8: Frequency analysis and comparison of unilateral diseased ear with normal control ear.

Frequeny	500 Hz		1000 Hz		2000 Hz		4000 Hz	
Normal/dis	**NOR**	**DIS**	**NOR**	**DIS**	**NOR**	**DIS**	**NOR**	**DIS**
Mean deviation (db)	10.45	14.95	11.95	21.34	16.45	29.95	21.27	37.32
P value	<0.001		<0.001		<0.0001		<0.0001	

DISCUSSION

CSOM is one of the most common conditions encountered by an otologist in his day-to-day practice. After a lot of debate, even though SNHL is considered by a many to be a complication of COM, detailed studies on individual types of COM are scarce.

In many studies, SNHL in mucosal COM was given a very little significance. In our study, we have made an attempt to study about SNHL in mucosal type of COM and various characteristics that influence it.

Incidence

In our study, the number of patients of Unilateral CSOM (Tubotympanic, Mucosal type) was 13.33% which is higher as compared to study by Kumar N et al, 2012, who reported the incidence at 7.82% and lower as compared to Kaur K et al 2003 at 24% and Malashetti et al, 2018 at 28.57% and is comparable to Mohsin A. et al, 2013 who found SNHL to be present in 16% of patients.[7-10]

Age distribution

In our study, the relevance of SNHL with relation to age was studied.

We excluded the patients beyond 50 years to prevent naturally occurring old age onset SNHL. Paparella et al, 1972 found SNHL in all age ranges. However, in our study, the percentage was more in higher age groups i.e. out of 8 patients of SNHL the majority of the patients with SNHL were in the age group of 40-50 years (75%) and no. of cases in 30-40 years age group were 25%.[4]

Gender distribution

SNHL with relevance to gender was studied. Male to female ratio who participated in our study group was 1:1. In patients with SNHL, the male to female ratio was 1.4:1. So, it is comparatively more in males. Similar observation of male predominance of 3:2 has been reported by Gulati et al, 2002. Malashetti et al, 2018 has reported male to female ratio-of 1:1.3. In our study, there was no correlation between the gender of the patient with mucosal CSOM and SNHL.[9,11]

Duration of disease

In our study, none of the patients with a history of ear discharge for less than 4 years had pure SNHL. There was a steady increase in the incidence of SNHL with increasing duration of ear discharge. The incidence was highest when the duration of the disease was more than 10 years with SNHL present in 40% of cases. These findings are in consistence with that of Nanda MS et al, 2015 where there was highest no. of patients with longer duration of disease i.e., 30.3% patients with disease duration more than 10 years.[12]

Ear discharge

In present study, almost all of the patients with SNHL presented with complaint of both hearing loss and history of recurrent discharge from the ear. These results were supported by the studies in which it was inferred that with the longer duration of the disease patients had more chances of developing SNHL. It was hypothesized that as duration of disease increases, there is prolonged exposure of inner ear to toxins that diffuse through round window membrane, resulting in SNHL. Round window plays a significant role in the development of SNHL in CSOM.

Round window is a semi permeable through which certain substances can pass. Some of the substances can pass through it in physiological conditions. However, others such as micro toxins can only pass during active inflammation when there is lowering of the pH. The duration of disease when compared with incidence of SNHL, a progressively high incidence of SNHL was found as the duration of the disease increased. This result was not supported by Noordzij JP et al, 1995 where no consistent relationship was found between the amount of relationship was found between the amount of relative SNHL and character of ear discharge.[13]

Frequency analysis of SNHL

Mean bone conduction threshold was calculated and compared with the normal opposite ear. The mean bone conduction thresholds in unilateral diseased ears were significantly raised than normal control ear at all frequencies. The BC threshold differences between the two ears in the same patient ranges from 10 to 35 dB across various frequencies. This difference is highest at higher frequencies. These findings are consistent with Mohsin et al, 2013 who concluded the mean bone conduction threshold differences to be statistically significant and ranging from 5 to 23.82 dB across the frequency range with greater mean bone conduction differences at higher frequencies. Nanda MS et al, 2015 found that the larger number of patients had bone conduction threshold more than 25 dB at higher speech frequency (at 4000Hz) as compared to lower speech frequencies. In our study, we found that more patients had bone conduction thresholds greater than 25 decibels which is indicative of SNHL at higher frequencies with maximum at highest frequency of 4000Hz.[10,12]

Since our study was conducted over a limited period of time, we had a small sample size. If comparison was performed with larger groups, the relationship of chronic suppurative otitis media and SNHL would have been better established.

CONCLUSION

Although it is known fact that Tubotympanic type of CSOM causes conductive hearing loss due to perforation in the tympanic membrane and ossicular damage but it is concluded from the present study that it also carries a risk of SNHL in significant percentage of patients. While conductive hearing loss can be minimized through surgery, sensorineural hearing loss constitutes a permanent effect. A positive correlation between SNHL and duration of CSOM means an early intervention will be beneficial to the patient. Hence it is advocated that patients should be made aware of risk of development of SNHL in Tubotympanic type of CSOM if left unoperated for a longer duration.

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