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Original Article

Pattern and degree of hearing loss in chronic suppurative otitis media

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Abstract:

Objectives: To assess the pattern and degree of hearing loss in CSOM.

Methods: A prospective study was carried out from January, 2007 to December, 2008 at the department of Otolaryngology-Head & Neck Surgery, BSMMU, Dhaka This study included 150 cases with 198 ears of CSOM including both tubo-tympanic and attico-antral variety excluding intracranial complications if any.

Results: There were 81.31% cases of tubo-tympanic and 18.69% cases of attico-antral patients. Age of the patients was between 5-60 years, where male were 59.33% and female were 44.67%. Highest number of patients was in the age group of 21-30 years. Out of 198 ears, 102 had unilateral perforation and 96 had bilateral perforation. Most of the patients (53.33%) came from low income family and majority of them used to take their bath in the pond (29.34%) followed by tube-well (24.44%). Most of the patients had cleaning habit with clothes with sticks (53.5%).Majority of them resided in katcha house (52%) with poor hygienic condition. Central melleolar perforations were maximum (41.41%) and anterior central perforations were minimum (18.69%). According to sized of perforation, medium size central perforations were common (26.67%) It was shown that the site and sized of perforation affects the degree of hearing loss. Posterior central and attic perforations had greater hearing loss, 51.5 dB and 57.36 dB accordingly. On the basis of size, subtotal perforation had more hearing loss (54.54dB). It was also shown that posterior central perforation had greater hearing loss (51.5dB) than anterior- central (33.64dB) perforation. Hearing loss was more marked in patients with long duration of disease. In a history of 21-25years of disease, mean air conduction thresholds was 59 dB whereas of 0-5 years were 38.18 dB. Difference between them was statistically significant ($t=5.88$, $p<0.001$). Among the pattern of hearing loss, most of patients had conductive type (80.8%) hearing loss followed by mixed (17.17%) and sensorineural types (2.01%).

Conclusion: Site of perforation, size of perforation and duration of disease affects the degree of hearing loss in CSOM .

***Key words**: Hearing loss, CSOM, Tubo-tympanic, Attico- antral.*

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Introduction:

Chronic suppurative otitis media is one of the common ear diseases in developing countries which represents a terminal stage of the disease continuum of otitis media, is characterized by irreversible changes in the middle ear cleft. The otoscopic findings in a patient with CSOM include the presence of a defect or perforation of the pars tensa or pars flaccida. CSOM has been classified into tubo-

tympanic and attico-antral disease, the later category usually associated with the presence of cholesteatoma.[1]

Prevalence of CSOM in developing countries represents a wide range- .4% to 33.3%.[2] In Bangladesh its prevalence is 12.44%,[3] 7.39%.[4]

Hearing impairment is a major public health problem in developing countries. An estimated 2/3rd of the world's hearing impaired population are believed to be distributed among developing countries,[5] another study[6] stated that 13.8-36.2% people had been suffering from conductive hearing loss due to CSOM.

Conductive deafness is the most common pattern. Factors that influence the degree of conductive deafness are the size and position of the tympanic membrane defect, impairment of ossicular chain and the presence of middle ear pathology such as edema and granulation tissue that influence the sound conducting mechanism. Large perforation will reduce the efficiency of the tympanic membrane to a greater degree. Perforation exposing the posterior mesotympanum produces a more severe deafness owing to reduction of baffle affect on round window. Small anterior defect often produces no deafness.[7]

Average 44 dB loss in large perforation was observed whereas loss in small central perforation was average 31dB. The average hearing loss at 500 Hz was 46.4 dB, at 1000 Hz was 30.9 dB and 2000 Hz it was 31.9 dB.[8]

There are few reports of sensorineural hearing loss attributed to the passage of bacterial and host inflammatory mediators from middle ear through round window membrane into inner ear leading to biochemical alteration of inner ear fluids, serofibrinous precipitates and inflammatory cells in the scala tympani, all of which result in gradual organ dysfunction and accentuated thresholds shifting.[9]

A study[10] in BSMMU have shown sensorineural hearing loss mostly (3.85%) in patients with attico-antral disease, while other study[11] stated that there was a highly significant association between SNHL and chronic ear infection without cholesteatoma. It seems reasonable to implicate the infection alone as the cause of SNHL and streptococcus infections were found to cause more SNHL than do infections caused by other organisms. Other studies [12] have shown no evidence or minimal evidence of SNHL in CSOM, questioning the clinical significance of degree of hearing loss. They explained that audiometric abnormalities observed in CSOM may be the result of changes in the mechanics of sound transmission. Elevated bone conduction thresholds sometimes encountered in CSOM may actually express the component of sound traveling through ossicular chain and transmitted when sound applied to the skull, rather than true cochlear impairment.

Hearing loss in chronic otitis media depends on the duration of the disease, socio-economic condition and nutritional condition of patients and upper respiratory infection in children. A study[13] showed a comparative study of prevalence of CSOM between lower and higher socio-economic groups. That showed prevalence of CSOM in low socio-economic group was 9.4%, where as in elite group it was only 0.67%. Similar studies carried out at home and abroad have shown 9.44% and 1.3%,[14]11.11% and 1.3%[15] between lower and higher socioeconomic group respectively. Among the CSOM cases, 65.52% were aware and 34.48% were not aware about their disease and sequelae of CSOM.[4]

Aims and Objectives:

1. To find out the socio-demographic status.

2. To find out the type and degree of hearing loss in CSOM.
3. To correlate the degree of hearing loss with duration of disease.

Materials and Methods:

This study was conducted using following methods and materials:

Type of study : Cross sectional study

Place of study : Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka.

Period of study : From January, 2007 to December, 2008

Study population : Patients of chronic suppurative otitis media admitted in Otolaryngology- Head & Neck surgery and attending in Otology clinic, BSMMU, Dhaka

Sample size : 150 cases.

Selection of patients:

Inclusion criteria:

1. All patients of CSOM (tubo-tympanic and attico-antral variety).
2. Patients more than 5 years and below 60 years of age.

Exclusion criteria:

1. CSOM with intra-cranial complication.
2. Otitis externa or inner ear diseases.
3. Traumatic perforation of tympanic membrane.
4. H/O operation in the same ear.

Methods:

Patients were diagnosed as CSOM by detailed history, thorough ear, nose & throat examination and general & systemic examination. Patients were selected between 5 to 60 years of age. Patients below 5 years could not interpret pure tone audiometry properly and above 60 years – more chance of developing presbyacusis-may interfere the actual results of hearing loss due to CSOM. During history taking, the exact duration of disease was noted. Type of treatment received by patients was also noted. Number of topical drops used also taken into account.

The no. of patients having bilateral disease was 96 and unilateral disease was 102. So total number of ear with perforation were 198. On examination of the ear- condition of the pinna, pre-auricular region, post-auricular region and external auditory canal were noted. On otoscopy, site, size and shape of tympanic membrane perforation, condition of the rest of the tympanic membrane, condition of the middle ear mucosa and the ossicles were also noted. Perforations were grouped as anterior, posterior, central malleolar, subtotal, attic on the basis of their position. Site of perforation was morphologically classified arbitrarily, the demarcation with vertical line passing through the handle of malleus. Infront of the handle of malleus categorized as anterior, behind as posterior perforation in pars tensa. Central perforation exposing the handle of malleus was termed as central melleolar. Perforations were also categorized as small, medium, large and subtotal on the basis of the surface area of TM involved. Upto 25% of size of perforation was considered as small, 25 to 50% as medium and >50% as large and only rim present as sub-total. Test for facial nerve function, fistula test and tunic fork test were performed in every case.

Then, thorough examination of the nose & throat was carried out. General examination and examination of the chest and abdomen was also done.

Hearing impairment was assessed by pure tone audiometry with or without masking. X-ray mastoid & X-ray paranasal sinuses were also done to exclude any local pathology.

Criteria for hearing assessment –These patients were categorized as having conductive and sensorineural hearing impairment. The degree of hearing impairment was also assessed as by WHO guideline (1980) being mild (25-40dB), moderate (41-55dB), moderately severe (56-70dB), severe (71-90dB), profound (>90dB).

Results:

One hundred and fifty (150) cases with one hundred and ninety-eight ears of chronic suppurative otitis media were included in this study from the in-patient department of Otolaryngology-Head & Neck Surgery and patients attending in otology clinic of BSMMU, Dhaka, from January, 2007 to December, 2008.

In this study 89 (59.33%) cases were male and 61 (40.67%) were female where male outnumber the female in a ratio of 3:2. Age range was 5-60 years. Mean age was 29 years.

Table- I

Distribution of patients by age (n=150)

Age group (years)	Male	Female	Total	Percentage (%)
0-10	7	4	11	7.33
11-20	27	15	42	28
21-30	33	25	58	38.67
31-40	15	9	24	16
41-50	5	5	10	6.67
51-60	2	3	5	3.33
Total	89	61	150	100

Table shows the distribution of age of the patients (by inclusive method). Majority of the patients were among the age group 21-30 years (38.67%). Age range was 5-60 years. Mean age of the patient was 29 years.

Table-II

Distribution of patients by sex (n=150)

Sex	No of patients	Percentage (%)
Male	89	59.33
Female	61	40.67
Total	150	100

Male comprises 59.33% and females were 40.67%. Male to female ratio was about 3:2.

Table- III

Distribution of ears by types of CSOM (n=198)

Site	No. of patients (No. of ears)		Total no. of ears
	Tubo-tympanic	Attico-antral	
Unilateral	75 (75)	27 (27)	102
Bilateral	43 (86)	5 (10)	96

Table shows most of the ears were tubo-tympanic type.

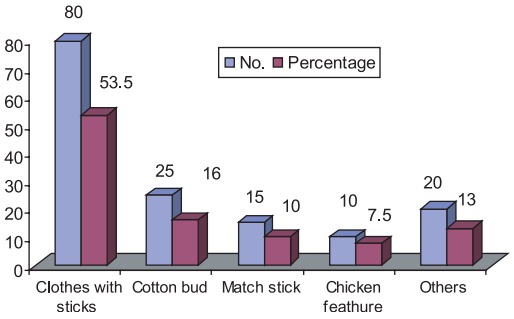

Fig.-1: *Distribution of patients by ear cleaning habit (n=150)*

Figure 1 shows cleaning habit with clothes with sticks was more common (53.50%) followed by cotton bud (16%).

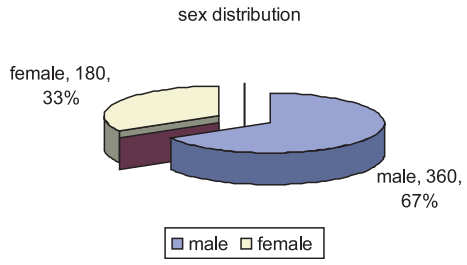

Fig.-2: *Distribution of patients by type of housing (n=150)*

Table- IV

Distribution of patients by habitat (n=150)

Habitat	No of patients	Percentage
Urban	52	34.67
Rural	98	65.33
Total	150	100

Table shows the distribution of habitat of the patients. 65.33% of the patients were from rural area and 34.67% were from urban area.

Table-V

Distribution of patients by monthly per capita income (n=150)

Monthly income	No of patients	Percentage (%)
Up to Tk. 5000	80	53.33
Tk. 5000-10000	49	32.67
More than Tk. 10000	21	14
Total	150	100

Above table shows that majority of the patients (53.33%) came from low income group family.

Most of the patients resided in katcha house (52%) followed by semi- pakka (35%).

Table-VI

Distribution of patients according to source of water supply for bathing (n=150)

Source of water	No. of patients	Percentage (%)
River	30	20
Pond	44	29.34
Well	9	6
Tube-well	41	27.33
Tape water	26	17.33
Total	150	100

Table shows most of the patients used to bath in pond (29.34%) followed by tube-well (27.33%) and river (20%).

Table-VII

Distribution of diseased ears on the basis of perforation size (n=198)

Size of	No of ears perforations	Percentage (%)
Small	35	17.67
Medium	53	26.67
Large	40	20.20
Subtotal	33	16.67
Attic	37	18.69
Total	198	100

Table shows medium sized perforations were maximum (26.67%), followed by large (20.20%) and attic (18.69%).

Table-VIII

Average hearing thresholds in relation to the site of tympanic membrane perforation (n=198).

Site of perforation	No of ears	Bone conduction thresholds Mean(dB)(SD)	Air conduction thresholds Mean(dB)(SD)	Air-bone gap Mean(dB)(SD)
Anterior central	37	9.21(1.29)	33.64(4.01)	24.03(3.07)
Posterior central	42	21.93(3.47)	51.5 (8.90)	26.07(4.26)
Central malleolar	82	20.25(4.53)	47.0 (4.76)	30.75(7.09)
Attic	37	25.89(5.6)	57.36(8.7)	37.47(8.72)

Table shows hearing thresholds in relation to various sites of tympanic membrane perforation. Mean air conduction threshold in anterior central perforation was 33.64dB (SD= 4.01) and in posterior central perforation was 51.5dB (SD=8.90). The difference was statistically significant (t=8.66, p<0.001, from unpaired 't' test). Air conduction threshold was highest 57.36dB (SD=8.7) in attic perforation.

Mean air conduction threshold of posterior central perforation was 51.0dB (SD=8.90) and for attic was 57.36dB (SD=8.7). Difference between these two were statistically not significant (t=2.54, p>0.005).

Table-IX

Distribution of pattern of hearing loss according to duration of disease (n=198).

Duration (years)	Conductive No. (%)	Mixed No. (%)	Sensorineural No. (%)
0-5	32 (16.16)	4 (2.02)	_
6-10	54 (27.27)	10 (5.05)	_
11-15	42 (21.21)	10 (5.05)	_
16-20	22 (11.11)	6 (3.03)	1 (0.5)
21-25	6 (3.03)	2 (1.01)	1 (0.5)
26-30	4 (2.02)	2 (1.01)	2 (1.01)
Total	160 (80.8)	34 (17.17)	4 (2.01)

Table shows most of the patients suffered from conductive type of hearing loss (80.8%) Most of the patients fall in 6-10 years of disease. Sensorineural hearing loss was the least common type (2.01%).

Table-X

Hearing thresholds in relation to duration of disease (n=198).

Duration of disease (years)	Bone conduction threshold Mean(dB)(SD)	Air conduction threshold Mean(dB)(SD)	Air-bone gap Mean(dB)(SD)
0-5	14.73(2.41)	38.18(6.81)	25.42(4.74)
6-10	14.46(4.46)	46.42(6.9)	27(6.66)
11-15	15.44(5.83)	49.11(7.47)	33.37(8.23)
16-20	20.5(7.2)	55(9.73)	34.5(9.26)
21-25	32(8.4)	59(10.12)	27(9.7)
26-30	43.75(9.3)	72.5(11)	28.76(10.29)

Table shows mean air conduction thresholds for 0-5 years of disease was 38.18 dB (SD=6.81) and for 21-25 years mean air conduction thresholds was 59 dB (SD=10.12). Difference between these two were statistically significant (t=5.88, p<0.001).

Discussion:

Chronic suppurative otitis media is one of the common ear diseases in developing countries. Tympanic membrane perforation due to CSOM is one of the common reasons of hearing impairment.

In this series one hundred & fifty (150) patients of CSOM of different age group were studied. Here 48 patients had bilateral disease, so total 198 ears were included in this study. Majority of the patients were in 2nd and 3rd decade i.e. 28% and 38.67% respectively.

Tubo-tympanic type of CSOM was found in 81.31% while attico-antral was 18.69%. This is consistent with other studies.[10,15]

In this study, male (59.33%) were found more affected than female (40.67%) with a male to female ratio of about 3:2. This might be due to increased prevalence of CSOM among male or it might be simple reflection of overall high male attendance in hospital. Females were also reluctant to come forward for treatment in our country.

In this study maximum patients (29.34%) used pond, while another study showed that maximum used river water for bathing.[15]

Majority of the patients (52%) lived in katcha house resided in congested area and with poor hygienic condition. This finding was well supported with WHO/CIBA-workshop in 1996, where poor housing had been recognized as a risk factor for CSOM.

Prevalence of CSOM is more in low socio-economic groups world wide due to malnutrition, overcrowding, poor hygienic condition, and passive smoking, ignorance regarding ear disease and lack of medical facilities. In this series, most of the patients (53.33%) came from low income group family. This finding resembles with other studies.[3,9]

Majority of the patients (53.33%) used to clean their ear by clothes with sticks followed by cotton bud (22.22%). In a study it was showed that 37.75% had cleaning habit with matchsticks. Infective process continues due to cleaning with these dirty materials.

On clinical examination, maximum patients were found to be tubo-tympanic type of CSOM and perforation was in the pars-tensa (81.31%) whereas perforation in the attic region was 18.69%. Out of 151 perforations in the pars-tensa, 35 were small perforation, 53 medium, 40 large and 33 subtotal.

Mean air conduction thresholds of small perforation was 33.5 dB (SD= 4.76) and for large perforation mean was 47.25 dB (SD= 5.76). Difference between these two groups was statistically significant (t= 7.05, p<0.001). On the other hand, air-conduction thresholds between large central and attic perforations were also significant (t= 4.18, p <0.05).

Air conduction thresholds at different speech frequency were also noted. In small central perforation, mean air conduction thresholds at 1000 Hz was 29.34dB (SD= 6.83) whereas for large central perforation at same frequency, mean was 49.52dB (SD=11.17). Difference between these two were statistically significant (t= 6.88, p<0.001). These results are also consistent with other studies.[8,16]

Here, anterior central perforation was seen in 37 ears and posterior central was seen in 42 ears. Mean air conduction threshold of anterior-central perforation was 33.64 dB and SD was 4.01, whereas mean air-conduction thresholds of posterior central perforation were 51.5 dB and SD was 8.90. Hearing loss was more in posterior central perforation and difference between these two sites were statistically significant (t=8.66, p<0.001). Above result was similar to other study.[16] The probable explanation is that perforation in the posterior quadrant/postero-superior marginal perforation causes more disruption of ossicular chain and also exposing the posterior mesotympanum produce a more severe deafness owing to reduction of baffle affect on round window.

Mean of posterior central perforation at air-conduction threshold was 51 dB (SD= 8.9) whereas mean of air conduction threshold of attic perforation was 57.36 dB (SD= 8.7) and difference between these two was not statistically significant (t=2.54, p > 0.005).

Mean hearing threshold at speech frequency for different sites were also measured. Mean hearing threshold of air conduction at 1000 Hz for anterior-central perforation was 33.64 dB (SD= 4.01) and for attic perforation the mean was 49.65 dB (SD= 5.57). Difference between these two sites were statistically significant (t=8.7, p < 0.001). These results are also consistent with other studies who showed that attico-antral disease was associated with more hearing loss.[9,10] The probable cause was more destruction of ossicular-chain specially if associated with cholesteatoma.

Among the pattern of hearing loss, this series showed that 80.8% patients had conductive type of hearing loss, 17.17% had mixed type and only 2.01% patients developed sensorineural type of hearing loss. Conductive type of hearing loss was the most common type and this was consistent with other study[10]. Though rare possibilities, sonsorineural hearing loss occurs in chronic otitis media. One study showed 7.7% patients suffered from sensorineural hearing loss due to CSOM[14] & another study showed that sensorineural hearing loss occurs particularly in older patients with CSOM which has usually been present for longer periods[11]. The probable causes are the passage of toxin through round window membrane that causes biochemical changes in the perilymph and endolymph resulting in gradual destruction of organ of corti.[17] In anotherstudy found it was that SNHL more in attico-antral type of CSOM, while have shown SNHL was more with chronic infection of middle ear without cholesteatoma and also more with streptococcal infection than infections caused by other organisms.[10,11]

Hearing loss increases with duration of disease. Mean bone conduction threshold up to 5 years duration of disease was 14.73 dB (SD= 2.41). Mean air conduction threshold for same duration was 38.18 dB (SD= 6.81),

air-bone gap was 25.42 dB (SD= 5.74). On the other hand, mean bone conduction threshold with the duration of 21-25 years was 32 dB (SD= 8.4) and mean air conduction threshold was 59 dB (SD= 10.12). Difference between hearing thresholds of air conduction according to duration of disease was statistically significant (t=588, p<0.001). The mean duration of CSOM is greater in patients with SNHL, suggesting that the severity of hearing loss may be associated with increasing duration of disease.[9]

In this series patients using topical ototoxic antibiotics were not excluded since most of patients were treated with these medications. This complicates the interpretation of the cause of any additional sensorineural hearing loss in the diseased ear but there is little evidence that topical antibiotics produce measurable sensorineural hearing loss in human.[18]

Conclusion and Recomendation:

From this study it can be concluded that the site of tympanic membrane perforation affects the degree of hearing loss. Posterior central and attic perforation showed greater hearing loss. Size of the perforation also affected the degree of hearing loss. Subtotal perforation showed more hearing loss. Hearing loss increases with the longer duration of disease. To limit hearing loss due to chronic suppurative otitis media, proper diagnosis and treatment must be started as early as possible. So awareness should be developed among the general population about CSOM and its sequelae and trained health team including doctors, nurses, medical technologist should be developed by government health project at Upazilla health complex and Union-sub centre level. Selected cases should be referred to tertiary level hospital for microsurgical treatment. The limitation of this study was small number of cases and short study period. Study should include large number of cases over different districts for long duration to reveal actual status of hearing in case of CSOM. Although limitation, this study will help in identifying type and degree of hearing loss and also in planning modern microsurgical treatment for preservation and improvement of hearing and also rehabilitation of some cases.

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