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Correlation of the Puretone Audiometry Findings with Intraoperative Findings in Patients with Chronic Suppurative Otitis Media

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Abstract

Chronic suppurative otitis media is one of the common otological conditions in India for which patients seek advice from an otorhinolaryngologist. Chronic suppurative otitis media is recurrent and progressive disease which is characterized with tympanic membrane perforation and suppurative discharge. Pure tone audiometry is the most common test used to evaluate auditory sensitivity. Since hearing loss is a common complication of chronic suppurative otitis media, we designed this study to evaluate preoperative pure tone audiometry findings in patients with chronic suppurative otitis media and its correlation with the intra-operative findings. **Aims and Objectives:** 1] To assess the intra-operative findings in patients with chronic suppurative otitis media. 2] To evaluate the correlation between the preoperative pure tone audiometry findings and intra-operative findings in patients with chronic suppurative otitis media. 3] To assess the type of hearing loss and degree of hearing loss in patients with chronic suppurative otitis media. **Materials and Methods:** This is an Observational study carried over a period of 3 years from August 2011 to August 2013. Total number of patients included in this study was 100. **Result:** Out of 100 patients studied 69 % of patients had Tubo-Tympanic type of CSOM, 31 % of patients had Attico-antral type of CSOM. In patients of Safe CSOM; Central perforation was seen in maximum cases 46.4 % cases, anterior central perforations was seen in 8.7 % cases, posterior central perforations seen in 20.2 % cases, and subtotal perforations seen in 24.63 % cases. In patients of Unsafe CSOM posterosuperior cholesteatoma was seen in maximum cases 67.74 %, and attic cholesteatoma was seen in 32.2 % cases. In safe CSOM patients all ossicles were intact and mobile whereas in unsafe CSOM patients only 4 patients had intact ossicular chain, while maximum patients had ossicular defect. **Conclusion:** Hearing loss depends on size of perforation. Hearing loss increases as the size of perforation increases. Average air conduction threshold and air bone gap did not differ significantly between various groups of ossicular defect. This shows us that neither air conduction nor air bone gap are reliable parameters on basis of which we can predict ossicular status preoperatively

Keywords: Chronic Suppurative Otitis Media, Hearing Loss, Puretone Audiometry, Air Bone Gap

1. Introduction

Chronic suppurative otitis media is recurrent and progressive disease which is characterized with tympanic membrane perforation and suppurative discharge. It is defined as otitis media resistant to medical therapy and lasting more than three months[1].

Chronic suppurative otitis media is associated with

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significant limitation of hearing. CSOM produces mild to moderate conductive hearing loss in more than 50% of cases.

Pure-tone audiometry can play an important role in predicting the severity of the hearing loss which will in turn reflect on the integrity of the tympano-ossicular system. This will help the surgeon in preoperative planning before tympanoplasty surgery. The patient can also be informed regarding their hearing status and counselled about the results of surgery.

Since hearing loss is a common complication of chronic suppurative otitis media, we designed this study to evaluate preoperative pure tone audiometry findings in patients with chronic suppurative otitis media and its correlation with the intra-operative findings.

2. Aim and Objectives

1. To assess the intra-operative findings in patients with chronic suppurative otitis media.
2. To evaluate the correlation between the preoperative pure tone audiometry findings and intra-operative findings in patients with chronic suppurative otitis media.
3. To assess the type of hearing loss and degree of hearing loss in patients with chronic suppurative otitis media.

3. Materials and Methods

A. Study design – A Observational study.
B. Study setting – Department of ENT of Medical College and Tertiary Health Centre, Nashik.
C. Duration of the study – August 2011 to August 2013.
D. Sample size – 100.
E. Study Participant –

Inclusion Criteria –

1. Patients of all age group.
2. Both Males and Females.
3. Patients with safe and unsafe type of chronic suppurative otitis media.
4. Patients in whom pure tone audiometry is done.
5. Patients who satisfy the criteria of chronic suppurative otitis media and underwent tympanoplasty or modified radical mastoidectomy surgery.

Exclusion criteria –

1. Revision cases of tympanoplasty and mastoidectomy surgery.
2. Patients with extra and intra cranial complications of chronic suppurative otitis media.
3. Patients with traumatic perforation of tympanic membrane.
4. Patients with otitis externa.

F. Methodology

After the approval from the Ethics Committee, this observational study was carried out in our tertiary care hospital affiliated to a teaching institute. The period of the study was from August 2011 to August 2013.

Patients were diagnosed as CSOM by detailed history, through ear, nose, and throat examination. Patients of all age were included in the study. The total number of patients in the study was 100. Patients with both tubotympanic and attico-antral type of CSOM were included in the study.

Perforations were grouped as anterior central, posterior central, central perforation, and subtotal on the basis of their position. Site of perforation was morphologically classified arbitrarily, the demarcation with vertical line passing through the handle of malleus. Perforation anterior to the handle of malleus categorized as anterior central perforation, behind the handle of malleus as posterior central perforation in pars tensa. Central perforation term was used for perforations which had either involved both the anterior and posterior quadrants together like anteroinferior+ posteroinferior or had involved more than 2 quadrants like anterorsuperior+ anteroinferior+ posteroinferior. Subtotal perforation when only rim of tympanic membrane is present.

Perforations in pars tensa of tympanic membrane were also categorized according to size of perforation as small, medium, large, and subtotal.

When single quadrant of pars tensa is involved it was termed as small, when two quadrant were involved it was termed as medium, when three quadrant were involved it was termed as large perforation, and when four quadrant were involved with only rim of tympanic membrane present than it was termed as subtotal perforation.

Patients who had cholesteatoma in attic region were termed as attic cholesteatoma, and cholesteatoma in posterosuperior region was termed as posterosuperior cholesteatoma.

Status of ossicular chain classified as intact and mobile. In ossicular defect we considered erosion and absence of ossicles together. We grouped the ossicular defect as:

1. No defect: Simultaneously all three ossicles intact (malleus, incus and stapes intact).
2. Single defect: means any single ossicle was affected with other two ossicles intact.
3. Any two defect means: any two ossicles are affected with third ossicle intact.
4. All three defect means: all three ossicles are affected simultaneously.

Audiometric assessment was performed by using a clinical audiometer; ALPS Advanced Digital Audiometer AD 2100 calibrated according to International Organization for Standardization (ISO). The patient's hearing levels in decibel were assessed.

Mean air and bone conduction thresholds were determined at 5 frequencies 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz. The mean air-bone gap was than calculated. The air-bone gap is a measure of the degree of conductive deafness. "Hearing level" was taken as the mean air conduction threshold at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz. When evaluating correlation between middle ear pathology and hearing loss we used average air and bone conduction thresholds and average air-bone gap.

From the air conduction threshold levels the deafness can be graded into several categories according to WHO classification (1980); Normal hearing level (0-25 dB), mild (26-40 dB), moderate (41-55 dB), moderately severe (56-70 dB), severe (71-90dB), profound (> 90 dB).

Hearing loss type of the patients were classified as conductive type hearing loss when bone conduction threshold is within normal levels and air conduction threshold is over 20 decibels; as sensorineural hearing loss when air and bone conduction threshold is over than 20 decibels and air bone gap is lower than 10 decibels and lastly as mixed hearing loss when air conduction threshold is over 20 decibels but air bone gap is larger than 10 decibels.

The entire statistical analysis was done using Statistical Package for Social Sciences (SPSS version 12.0) for MS Windows.

4. Observations and Result

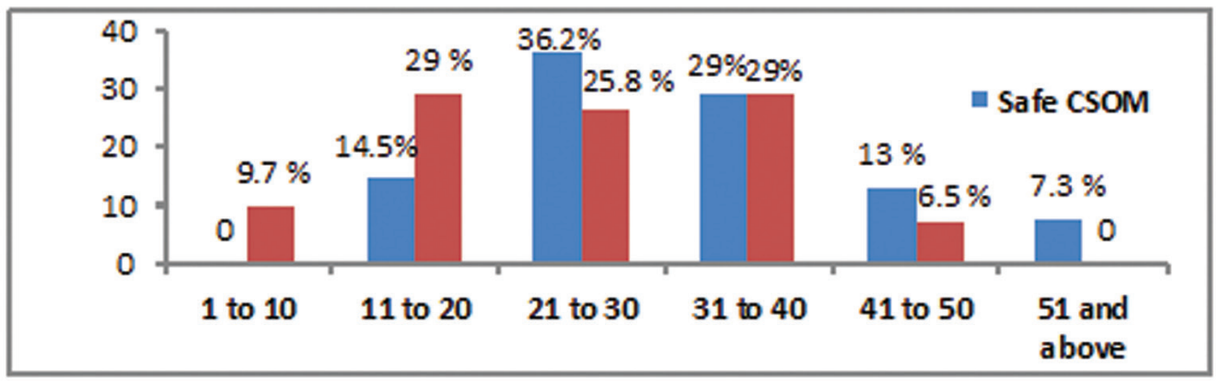

Figure 1. The age distribution of cases studied.

The present study includes 100 patients of chronic suppurative otitis media. We included all age group patients. In our study minimum age of patient was 6 years and maximum age was 60 years. All 3 patients less than 10 years of age had unsafe CSOM. Maximum patients were between 21 to 40 years (Figure 1).

Table 1. The sex distribution of cases studied

Sex	Safe CSOM n=69 (%)	Unsafe CSOM n=31 (%)	Total
Female	49 (71.0 %)	15 (48.4 %)	64 (64.0 %)
Male	20 (29.0 %)	16 (51.6 %)	36 (36.0 %)
Total	69 (100.0 %)	31 (100.0 %)	100 (100.0 %)

Out of 100 patients 64 were females whereas 36 were males. In safe CSOM 49 (71%) were females and 20 (29%) were males, while in unsafe CSOM 15 (48.4%) were females and 16 (51.6%) were males.
The female to male ratio was 1.77:1 (Table 1, 2).

Table 2. The distribution of cases as per the Ear affected

Ear	Safe CSOM	Unsafe CSOM	Total
Right Ear	31 (44.9 %)	14 (45.2 %)	45 (45.0 %)
Left Ear	38 (55.1 %)	17 (54.8 %)	55 (55.0 %)
Total	69 (100.0 %)	31 (100.0 %)	100 (100.0 %)

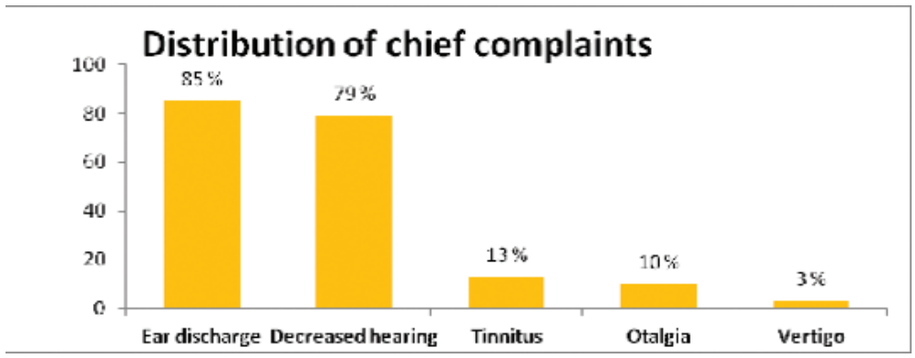

Figure 2. Chief complaints of patients of CSOM.

The primary complaints of the patients were ear discharge, seen in 85 % of the cases and decreased hearing seen in 79 % of the cases.13 % of patients had complaint of tinnitus, otalgia was seen in 10 % of patients and vertigo in 3% of patients (Figure 2) (Table 3).

Table 3. Showing Intra operative findings in patients of CSOM

Intra operative findings	Safe CSOM (n= 69)	Unsafe CSOM (n=31)
Anterior perforation	6 (8.7 %)	0
Posterior perforation	14 (20.2 %)	0
Central perforation	32 (46.4 %)	0
Subtotal perforation	17 (24.6 %)	0
Posterosuperior cholesteatoma	0	21 (67.74 %)
Attic cholesteatoma	0	10 (32.2 %)
Myringosclerosis	8 (11.6 %)	0
Granulations	0	24 (77.41 %)
Ossicles intact	69 (100%)	4 (12.9 %)
Ossicular defect	0	27 (87.1 %)

Table 4. The distribution of average air and bone conduction threshold, average air bone gap in relation to the site of tympanic membrane perforations in Safe CSOM

Site of perforation	No. of Patients	Air conduction thresholds Mean (SD)	Bone conduction thresholds Mean (SD)	Air bone gap Mean (SD)
Anterior Central	6	36.5 (7.0)	13.5 (6.3)	23.0 (2.8)
Posterior Central	14	37.2 (8.1)	11.6 (3.8)	25.6 (10.1)

Central perforation	32	45.4 (11.1)	12.6 (6.9)	32.8 (9.2)
Subtotal	17	47.5 (10.2)	13.3 (7.5)	34.2 (8.7)
Comparison		P-values (Between Sites Comparison)		
Anterior Central v/s Posterior Central		0.999 (Non-Significant)	0.936 (Non-Significant)	0.935 (Non-Significant)
Anterior Central v/s Central perforation		0.201 (Non-Significant)	0.989 (Non-Significant)	0.073 (Non-Significant)
Anterior Central v/s Subtotal		0.110 (Non-Significant)	0.999 (Non-Significant)	0.051 (Non-Significant)
Posterior Central v/s Central perforation		0.062 (Non-Significant)	0.968 (Non-Significant)	0.063 (Non-Significant)
Posterior Central v/s Subtotal		0.031 (Significant)	0.895 (Non-Significant)	0.046 (Significant)
Central perforation v/s Subtotal		0.907 (Non-Significant)	0.984(Non-Significant)	0.959 (Non-Significant)

P-values are obtained using one-way analysis of variance (ANOVA) with Tukey's correction for multiple group comparisons. P-value<0.05 is considered to be statistically significant.

4.1 Comments

4.1.1 Air Conduction Threshold

a. The average air conduction threshold differs significantly between posterior central and subtotal sites in safe CSOM.
b. The average air conduction threshold did not differ significantly between all other sites in safe CSOM (Table 4, 5).

4.1.2 Bone Conduction Threshold

a. The average bone conduction threshold did not differ significantly between all the sites in safe CSOM.

4.1.3 Air Bone Gap

a. The average air bone gap differs significantly between posterior central and subtotal sites in safe CSOM.
b. The average air bone gap did not differ significantly between all other sites in safe CSOM.

Table 5. The distribution of average air and bone conduction threshold, average air-bone gap in relation to the size of tympanic membrane perforation in safe CSOM

Size of perforation	No. of patients	Air conduction thresholds Mean (SD)	Bone conduction thresholds Mean (SD)	Average Air-Bone Gap Mean (SD)
Small	6	32.3 (5.1)	11.5 (4.9)	20.8 (6.1)
Medium	27	41.8 (8.6)	11.2 (3.8)	30.6 (8.9)
Large	19	45.9 (12.7)	14.6 (8.3)	31.3 (10.6)
Subtotal	17	47.5 (10.2)	13.3 (7.5)	34.2 (8.7)
Comparison		P-values (Between Sizes Comparison)		
Small v/s Medium		0.173 (Non-Significant)	0.999 (Non-Significant)	0.094 (Non-Significant)
Small v/s Large		0.028 (Significant)	0.729 (Non-Significant)	0.079 (Non-Significant)
Small v/s Subtotal		0.013 (Significant)	0.933 (Non-Significant)	0.016 (Significant)
Medium v/s Large		0.528 (Non-Significant)	0.280 (Non-Significant)	0.994 (Non-Significant)
Medium v/s Subtotal		0.273 (Non-Significant)	0.695 (Non-Significant)	0.598 (Non-Significant)
Large v/s Subtotal		0.966 (Non-Significant)	0.930 (Non-Significant)	0.786 (Non-Significant)

P-values are obtained using one-way analysis of variance (ANOVA) with Tukey's correction for multiple group comparisons. P-value<0.05 is considered to be statistically significant.

4.2 Comments

4.2.1 Air Conduction Threshold

a. The average air conduction threshold differs significantly between small and large sizes of perforation in safe CSOM.
b. The average air conduction threshold differs significantly between small and subtotal sizes of perforation in safe CSOM.

4.2.2 Bone Conduction Threshold

a. The average bone conduction threshold did not differ significantly between across all the sizes of perforation in safe CSOM.

4.2.3 Air Bone Gap

a. The average air bone gap differs significantly between small and subtotal sizes of perforation in safe CSOM.
b. The average air bone gap did not differ significantly across all other sizes of perforation in safe CSOM.

Table 6. The distribution of average air and bone conduction threshold and average air-bone gap in relation to cholesteatoma in unsafe CSOM

Cholesteatoma	Number	Air conduction thresholds Mean (SD)	Bone conduction thresholds Mean (SD)	Average Air-Bone Gap Mean (SD)
Posterosuperior cholesteatoma	21	47.9 (12.1)	15.4 (8.4)	32.5 (7.6)
Attic cholesteatoma	10	45.7 (7.6)	12.1 (4.5)	33.6 (9.4)
Comparison		P-values (Between Type of Cholesteatoma Comparison)		
Posterosuperior v/s Attic cholesteatoma		0.595 (Non-Significant)	0.251 (Non-Significant)	0.735 (Non-Significant)

P-values are obtained using independent sample t test. P-value<0.05 is considered to be statistically significant.

4.3 Comments

4.3.1 Air Conduction Threshold

a. The average air conduction threshold did not differ significantly between posterosuperior cholesteatoma and attic cholesteatoma in unsafe CSOM (Table 6).

4.3.2 Bone Conduction Threshold

a. The average bone conduction threshold did not differ significantly between posterosuperior cholesteatoma and attic cholesteatoma in unsafe CSOM.

4.3.3 Air Bone Gap

a. The average air bone gap did not differ significantly between posterosuperior cholesteatoma and attic cholesteatoma in unsafe CSOM.

Table 7. Status of ossicles in patients of CSOM

Ossicles Status	Total	Safe CSOM (n=69)	Unsafe CSOM (n=31)	P-value (Safe vs Unsafe)
Malleus intact	87	69 (100.0 %)	18 (58.1 %)	0.001
Malleus erosion	10	0	10 (32.3 %)	
Malleus absent	3	0	3 (9.6 %)	
Incus intact	73	69 (100.0 %)	4 (12.9 %)	0.001
Incus erosion	22	0	22 (70.9 %)	
Incus absent	5	0	5 (16.2 %)	
Stapes intact	94	69 (100.0 %)	25 (80.6 %)	0.001
Stapes suprastructure erosion	2	0	2 (6.5 %)	
Stapes suprastructure absent	4	0	4 (12.9 %)	

Values are n (%). P-values are obtained using Chi-Square test. P-value<0.05 is considered to be statistically significant.

4.4 Comments

1. The incidence of ossicular defect involving malleus only differs significantly between safe and unsafe CSOM (p=0.001).
2. The incidence of ossicular defect involving incus only differs significantly between safe and unsafe CSOM (p= 0.001) (Table 7, 8).
3. The incidence of ossicular defect involving stapes only differs significantly between safe and unsafe CSOM (p= 0.001) (Table 9).

Table 8. The distribution of average air and bone conduction threshold and average air-bone gap according to the number of ossicular defect in unsafe CSOM

Ossicular defect (n)	Air conduction thresholds Mean (SD)	Bone conduction thresholds Mean (SD)	Air- Bone gap Mean(SD)
No defect (n=4)	43.3 (3.9)	15.8 (5.0)	27.5 (5.9)
Single defect (n=10)	43.1 (12.4)	12.7 (8.7)	30.4 (7.4)
Any two defects (n=15)	51.1 (10.3)	14.9 (7.7)	36.1 (8.4)
All three defects (n=2)	47.0 (11.3)	15.5 (4.9)	31.5 (6.4)
Comparison	P-values (Between Ossicular defects Comparison)		
No defect v/s Single defect	0.999 (Non-Significant)	0.909 (Non-Significant)	0.921 (Non-Significant)
No defect v/s Any two defects	0.563 (Non-Significant)	0.998 (Non-Significant)	0.220 (Non-Significant)
No defect v/s All three defects	0.976 (Non-Significant)	0.999 (Non-Significant)	0.932 (Non-Significant)
Single defect v/s Any two defects	0.276 (Non-Significant)	0.894 (Non-Significant)	0.290 (Non-Significant)
Single defect v/s All three defects	0.964 (Non-Significant)	0.966 (Non-Significant)	0.856 (Non-Significant)
Any two defects v/s All three defects	0.956 (Non-Significant)	0.999(Non-Significant)	0.959 (Non-Significant)

P-values are obtained using one-way analysis of variance (ANOVA) with Tukey's correction for multiple group comparisons. P-value<0.05 is considered to be statistically significant.

4.5 Comments

1. The average air conduction threshold did not differ significantly across different groups of ossicular defects in unsafe CSOM.
2. The average bone conduction threshold did not differ significantly across different groups of ossicular defects in unsafe CSOM.
3. The average air bone gap did not differ significantly across different groups of ossicular defects in unsafe CSOM.

Table 9. Degree of hearing loss based on air conduction thresholds according to WHO classification in patients of CSOM

Degree of hearing loss Air conduction thresholds	Safe CSOM (n=69)	Unsafe CSOM (n=31)	P-value (Safe vs Unsafe)
0-25 dB (normal hearing level)	0	0	0.028 (Significant)
26-40 dB (mild)	33 (47.8 %)	9 (29.0 %)	
41-55 dB (moderate)	22 (31.9 %)	16 (51.6 %)	
56-70 dB (moderately severe)	14 (20.3 %)	4 (12.9 %)	
71-90 dB (severe)	0	2 (6.5 %)	
>90 dB (profound)	0	0	

Values are n (%). P-values are obtained using Chi-Square test. P-value<0.05 is considered to be statistically significant.
Comments: The degree of hearing loss differs significantly between safe and unsafe CSOMS.

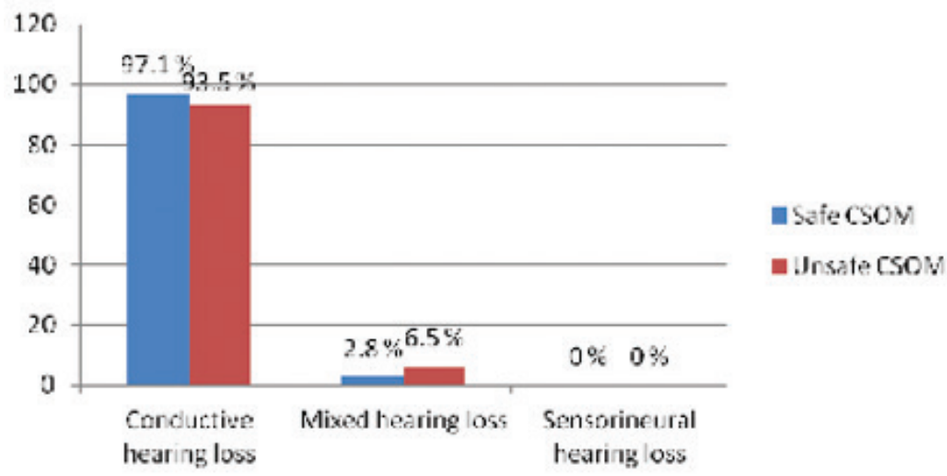

Figure 3. Evaluation of preoperative hearing loss type in patients of CSOM.

4.6 Comments

1. In patients of Safe CSOM 97.1 % had conductive hearing loss and 2.8 % had mixed hearing loss while sensorineural hearing loss was not seen in any patient.
2. In patients of Unsafe CSOM 93.5 % had conductive hearing loss and 6.5 % had mixed hearing loss (Figure 3) while sensorineural hearing loss was not seen in any patient.

5. Discussion

The present study was conducted from August 2011 to August 2013 during which 100 cases of chronic suppurative otitis media of tubotympanic type and attico-antral type were included. All patients of Safe CSOM underwent tympanoplasty surgery and Unsafe CSOM patients underwent Modified radical mastoidectomy surgery.

Among 100 patients, 69 patients were of Safe CSOM and 31 patients were of Unsafe CSOM.

The present study involved patients of all the age range. The minimum age of patient was 6 years and maximum age was 60 years. All 3 patients less than 10 years of age had unsafe CSOM. Maximum patients (33 %) were of the age group 21 to 30 years and next group was 31 to 40 years (29 %). The reason could be that this age group is socially active and health conscious.

The findings were in fair agreement with those reported earlier by others.Alam J, Udaipurwala IH et al.[2], Salman A A et al. [3], in their study observed the most common age group was 21-30 years.

In our study females outnumber the males in a ratio of 1.77:1. Alireza Karimi-Yazdi et al in their study observed, male: female ratio as 1:2[4].

In patients of safe CSOM who underwent tympanoplasty surgery (n= 69), 6 patients (8.7 %) had anterior central perforation, 14 patients (20.2 %) had posterior central perforation, 32 patients (46.4 %) had central perforation, and 17 patients (24.6 %) had subtotal perforation. 8 patients (11.6 %) had myringosclerosis affecting the tympanic membrane. In all 69 patients of safe CSOM ossicles were intact and mobile. No ossicular defect was found intraoperatively.

S. Gurumani in his study showed that incus was most commonly affected ossicle and was most commonly seen in patients with subtotal perforation of tympanic membrane[5] But in our study all patients with tubotympanic type of CSOM had intact and mobile ossicular chain.

In patients of Unsafe CSOM (n = 31) who underwent modified radical mastoidectomy surgery, cholesteatoma was present in all 31 patients. 21 patients (67.7 %) had posterosuperior cholesteatoma, 10 patients (32.2 %) had attic cholesteatoma. 24 patients (77.4 %) had granulations. Ossicular defect was seen in majority of patients. 27 patients (87.1 %) had ossicular defect. 4 patients (12.9 %) had all three ossicles (malleus, incus, and stapes) intact.

D Shrestha et al in their study on 100 patients of CSOM of attico-antral type observed that cholesteatoma was present in 61 cases and granulation tissue was present in 27 cases[6] In a similar study done by D.K.Banskota et al. cholesteatoma was found in 87.28 % cases and granulation tissue in 12.71 % cases[7].

In our study we found that hearing loss was more in subtotal perforation than posterior central perforation and difference between these two sites was statistically significant (p= 0.031).

The average air conduction threshold did not differ significantly between all other sites in safe CSOM. The average bone conduction threshold remained relatively stable.

Air bone gap was more in subtotal perforation than posterior central perforation and difference between these two sites was statistically significant (p= 0.031).

The average air bone gap did not differ significantly between all other sites in safe CSOM.

The location of perforation is believed to have significant effect on the magnitude of hearing loss. Posterior quadrant perforations are believed to be worse than anterior ones because of direct exposure of the round window to sound waves.

Shaheen Malik et al observed that posteriorly placed perforations have greater degree of loss as compared to anteriorly based perforations[8]. Mohammed Shafiqul Islam et al observed that hearing loss was more in posterior central perforation (51.5 dB) than anterior central perforation (33.64 dB) and the difference between these two sites was statistically significant[9].

The hearing loss increases as the perforation size increases and also air bone gap is less in small size (involving single quadrant) perforation as compared to subtotal size perforation. It is consistent with other studies. We observed that the larger the perforation on the tympanic membrane the greater the decibel loss in sound perception.

Maharjan M et al observed that patients having larger perforations (involving all four quadrants) showed greater hearing loss with large air bone gap. Smaller perforations involving single quadrant showed lesser loss. They found significant relationship between hearing loss and size of perforation, with strong trend for hearing loss to increase as the perforation size increases[10].

Ossicular defect was found intra operatively in Unsafe CSOM patients, malleus eroded in 10 cases (32.3 %), and malleus absent in 3 cases (9.6 %). Incus was eroded in 22 cases (70.9 %) and absent in 5 cases (16.2 %). Stapes suprastructure was eroded in 2 cases (6.5 %) and absent in 4 cases (12.9 %). Stapes footplate was intact in all cases.

The characteristic bony changes that occur in Unsafe CSOM are due to cholesteatoma and granulation tissue. Number of theories such as pressure necrosis, chronic inflammation which leads to cytokine release and osteoclast activation, hyperaemic decalcification, enzymatic, responsible for lytic effect on the bone have been postulated explaining the mechanism of bone erosion by cholesteatoma[11–13]. The incus is the most commonly eroded ossicle in cholesteatoma. The reason is due to its delicate structure and location rather than its tenuous blood supply[14].

The average air conduction threshold & air bone gap did not differ significantly across different groups of ossicular defects in unsafe CSOM.

Fuh-CherngJeng et al in their study demonstrated that the ABG was larger in ears with ossicular discontinuity than in those without ossicular discontinuity, whether with cholesteatoma or not. According to them the ABG was not a good parameter for predicting ossicular discontinuity because the cholesteatoma and granulation tissue might serve as transmission bridges for acoustic energy and reduced the ABG[14].

The air bone gap in patients affected by chronic otitis media has been related to ossicular chain condition, narrow ABG would suggest ossiclar integrity, whereas wide ABG would predict ossicular erosion[15]. However, it is widely known that pathological tissue can transmit sounds replacing the damaged ossicles; therefore puretone audiometry does not always show the real state of the ear transmission system[16]. In our study the air conduction threshold and air bone gap were worse in patients with two or three ossicular defect as compared to no ossicular defect or single ossicular defect. But the difference was not significant statistically. These shows that neither average air conduction threshold nor air bone gap are reliable parameters on which to base the diagnostic process and predict ossicular condition. Functional integrity of the ossicular chain, even in the presence of bone erosion, allows a hearing function similar to that found in case of cholesteatoma without chain involvement[17].

In patients of Safe CSOM (n=69) majority of patients had mild hearing loss 47.8 %. Moderate hearing loss was seen in 31.9 % of patients and moderately severe hearing loss seen in 20.3 % of patients. Severe and profound hearing loss was not present in any patient.

In patients of Unsafe CSOM (n=31), 29 % patients had mild hearing loss, 51.6 % patients had moderate hearing loss, 12.9 % had moderately severe hearing loss and 6.5 % had severe hearing loss. Profound hearing loss was not seen in any patient. The degree of hearing loss differs significantly between safe and unsafe CSOMS (p= 0.028). According to WHO estimates CSOM causes a mild to moderate conductive hearing loss of 30-60 dB in more than 50 % of cases[18].

In our study in cases of Safe CSOM (n=69); 97.1 % of patients had conductive hearing loss and 2.8 % of patients had mixed hearing loss, whereas only sensorineural hearing loss was not present in any patient.

In our study in cases of Unsafe CSOM (n=31); 93.5 % of

patients had conductive hearing loss and 6.5 % of patients had mixed hearing loss, whereas only sensorineural hearing loss was not present in any patient.

6. Summary and Conclusion

1. Out of 100 patients studied 69 % of patients had Tubo-Tympanic type of CSOM, 31 % of patients had Attico-antral type of CSOM.

2. In patients of Safe CSOM; Central perforation was seen in maximum cases 46.4 % cases, anterior central perforations was seen in 8.7 % cases posterior central perforations seen in 20.2 % cases and subtotal perforations seen in 24.63 % cases.

3. The average air conduction threshold differs significantly between posterior central perforation and subtotal perforation sites in safe CSOM. The average air bone gap differs significantly between posterior central and subtotal sites in safe CSOM.
   No statistically significant difference was seen in average air conduction threshold and average air bone gap in anterior central perforation versus posterior central perforation.
   These findings show us that hearing loss does not depend on the site of perforation. The main mechanism of hearing loss at audiometric frequencies from a perforation is a reduction in driving pressure across the tympanic membrane. Such a mechanism is expected to be independent of location of the perforation.

4. The average air conduction threshold differs significantly between small and large size of perforation in safe CSOM.
   The average air conduction threshold differs significantly between small and subtotal sizes of perforation in safe CSOM.
   The average air bone gap differs significantly between small and subtotal sizes of perforation in safe CSOM.
   These findings show us that hearing loss depends on size of perforation. Hearing loss increases as the size of perforation increases.

5. In patients of Unsafe CSOM posterosuperior cholesteatoma was seen in maximum cases 67.74 % cases, and attic cholesteatoma was seen in 32.2 % cases.
   Ossicular defect was seen in both cases leading to raised air conduction threshold and air bone gap. But the average air conduction threshold and average air bone gap did not differ significantly between posterosuperior cholesteatoma and attic cholesteatoma in unsafe CSOM cases.

6. In Safe CSOM all 69 cases had intact and mobile ossicular chain, while in Unsafe CSOM 12.9 % cases had intact and mobile ossicular chain. 87.1 % cases had ossicular defect in Unsafe CSOM cases. This results show us the destructive characteristic of cholesteatoma.

7. In Unsafe CSOM cases most commonly eroded ossicle was incus (70.9 %), also incus was mostly seen totally absent ossicle (16.2 %). Second most commonly seen eroded ossicle was malleus (32.3 %) and absent in 16.2 %.Stapes was found as the most functional ossicle (80.6 %) in patients with unsafe CSOM, suprastructure eroded in 6.5 % cases and absent in 12.9 %. Stapes footplate was intact in all cases.

8. The average air conduction threshold and average air bone gap did not differ significantly across different groups of ossicular defects in unsafe CSOM cases. These shows that neither average air conduction threshold nor air bone gap are reliable parameters on which to base the diagnostic process and predict ossicular condition. Functional integrity of the ossicular chain, even in the presence of bone erosion, allows a hearing function similar to that found in case of cholesteatoma without chain involvement.

9. In patients of Safe CSOM (n=69) majority of patients had mild hearing loss (47.8 %). Moderate hearing loss was seen in 31.9 % of patients and moderately severe hearing loss seen in 20.3 % of patients, severe and profound hearing loss was not seen in any case.
   In patients of Unsafe CSOM (n=31), 29 % of patients had mild hearing loss, 51.6 % had moderate hearing loss, 12.9 % had moderately severe hearing loss and 6.5 % had severe hearing loss, profound hearing loss was not seen in any case.
   The degree of hearing loss differs significantly between safe and unsafe CSOMS.

10. In patients of Safe CSOM (n=69) 97.1 % of patients had conductive hearing loss and 2.8 % of patients had mixed hearing loss, whereas only sensorineural hearing loss was not present in any patient.

In patients of Unsafe CSOM (n=31) 93.5 % of patients had conductive hearing loss and 6.5 % of patients had mixed hearing loss, whereas only sensorineural hearing loss was not present in any patient.

These finding show us that most of the patients in our study had conductive hearing loss.

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