

Correlation of site of tympanic membrane perforation & and malleolar involvement with degree of hearing loss and its improvement following tympanoplasty

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Abstract:

Introduction: The tympanic membrane (TM) is as a key component of the tympano-ossicular system. Chronic otitis media causes mild to moderate conductive hearing loss.

Material & Methods: The study was conducted on 50 patients of either sex in age group of 15-50 years having chronic inactive (mucosal) otitis media after. Pure tone audiogram was done to confirm the degree, type of hearing loss. TM perforations were divided into Group A (anterior), B (central), C (posterior) according to site of perforation. **RESULTS:** Average Hearing loss in Group A, B, & C was 33.53, 45.53 & 35.31 dB respectively. Mean Hearing gain following tympanoplasty in Group A, B, & C was 13.68, 16.39 & 14.21 dB respectively.

CONCLUSION: Hearing threshold levels does depend on whether perforation is central involving the malleus or non-central i.e. whether malleolar or non-malleolar. However, it does not depend on whether the perforation is involving anterior or posterior half of the tympanic membrane and the amount of hearing gain does not depend on the site of the perforation.

Introduction

Chronic suppurative otitis media represents one of the most common infections of the ear. It is a worldwide health problem which is still prevalent in the modern antibiotic era.¹ Chronic otitis media equates with the classic term chronic suppurative otitis media which is no longer advocated, as chronic otitis media is not necessarily a result of the 'gathering of pus'. It can be classified in five types:

1. Healed chronic otitis media - thinning and local or generalized opacification of the pars tensa without perforation or retraction.
2. Inactive (mucosal) chronic otitis media – permanent perforation of pars tensa but the middle ear mucosa is not inflamed.
3. Active (mucosal) chronic otitis media – permanent defect of the pars tensa with an inflamed middle ear mucosa which produces mucopus that may discharge.
4. Inactive (squamous) chronic otitis media – retraction of the pars flaccid or pars tensa (usually postero-superior) which has the potential to become active with retained debris.
5. Active (squamous) chronic otitis media – Retraction of the pars flaccida or tensa with retained squamous epithelial debris and is associated with inflammation and the production of pus, often from the adjacent mucosa.²

Tympanic membrane perforations are a common phenomenon and usually the result of infection, ventilation tube insertion or trauma. The size and site of TM perforations are variable. Accurate evaluation of TM perforation is an important guide for informed management of this problem.

In view of high incidence of chronic suppurative otitis media in our country and lack of studies on correlation of site of tympanic membrane perforation and malleolar involvement with hearing threshold, we have undertaken a prospective study to assess these parameters.

AIMS AND OBJECTIVES

1. To study the correlation of site of tympanic membrane perforation with hearing loss.
2. To study the post-operative site specific hearing gain.

MATERIAL AND METHODS

The study was conducted on 50 patients of either sex in age group of 15-50 years having chronic inactive (mucosal) otitis media with dry ear over a period of at least 4 weeks after obtaining their consent. All patients underwent a detailed evaluation based on history, general physical examination as well as complete ear, nose and throat examination. Tuning fork test and pure tone audiogram were done for preoperative assessment and to confirm the degree and type of hearing loss.

INCLUSION CRITERIA

Patients in the age group of 15-50 years, uncomplicated perforation of pars tensa, that has remained dry for at least 4 weeks prior to surgery, good cochlear reserve and air bone gap more than 25 db on pure tone audiogram were included in the study.

EXCLUSION CRITERIA

Patients with history of ear surgery in the past, age <15 years and >50 years, patients with hearing loss >60dB, actively discharging ear, presence of cholesteatoma, tortuous or narrow external auditory canal, marked deviated nasal septum and active sinus disease were excluded from the study.

All selected patients (n=50) underwent underlay tympanoplasty with temporalis fascia graft. Patients were taken up for surgery after the routine investigations were reported normal. All patients underwent pre-anaesthetic checkup. All cases were operated under monitored anaesthesia care with use of ivdexmetomidine.

MEASUREMENT OF SIZE OF PERFORATION

In the present study, the site of the perforation was noted intraoperatively under microscopic examination.

Depending on site of the perforations, cases were divided into 3 groups.

GROUP A: Anterior perforation

GROUP B: Central perforation

GROUP C: Posterior perforation

Final result was assessed at 6 months and following assessment were made:

- A. Graft taken up or rejected.
- B. Pure tone audiogram.

The data was entered in Microsoft excel spreadsheet and later cleaned for possible errors. The data was analysed using SPSS software for Windows version 20.0

For quantitative data involving two groups, independent sample t-test was applied. For paired data, paired t-test was applied. For normally distributed three or more groups, ANOVA test was applied.

Quantitative data was presented as mean and standard data. Chi-square test was applied for quantitative and qualitative data was presented as proportions.

RESULTS:

1. Age & Sex Distribution: (TABLE 1)

Out of 50 patients, there were 27 male (54%) and 23 female (46%). Patients ranged from 15 years to 50 years. Maximum patients belonged to age group 15-25 i.e. 32 cases (64%). (Graph 1)

TABLE 1
AGE AND SEX DISTRIBUTION:

	15-25 years	26-35 years	36-50 years	Total	%age
Male	20	06	01	27	54
Female	12	08	03	23	46
Total	12	05	03	20	100

On applying chi-square test, value is 2.98 with degree of freedom value 2. The p value is 0.225.

2. Duration of discharge:

Patients complaining of ear discharge for 0-3 years, 4-6 years and 7-9 years were 27 (54%), 11 (22%) and 12 (24%) respectively. (Graph 2)

TABLE 2

DURATION OF EAR DISCHARGE

DURATION (YEARS)	Number of patients	%age
< 3 years	20	40
4-6 years	16	32
7-9 years	14	28
Total	50	100

On applying chi-square test, value is 1.12 with degree of freedom 2. The p value comes out to be 0.571 which is statistically non significant.

3. Involvement of ear.

Most of the cases were having unilateral involvement of ear. (Graph 3)

TABLE 3
EAR INVOLVEMENT

EAR INVOLVED	Number of patients	%age
UNILATERAL R	28	56
L	19	38
BILATERAL	03	06
Total	50	100

4) Site of perforation (Table 4)**Table 4****DISTRIBUTION OF PATIENTS ACCORDING TO SITE GROUPS**

SITE	Number of cases	%age
Group A	08	16
Group B	26	52
Group C	16	32
Total	50	100

5) Condition Of Handle Of Malleus (Table 5)

Out of 50, 02 (04%) cases had medially retracted handle of malleus. In rest 48 (96%) cases handle of malleus was normal.

TABLE 5(Graph 4)**CONDITION OF HANDLE OF MALLEUS**

Condition	Number of cases	%age
Retracted Medially	02	04
Necrosis partially	00	00
Normal	48	96
Total	50	100

6) AudiologicalAssesment (Table 6)

Based on the pure tone audiogram, hearing loss was classified as mild (25-40 dB), moderate (41-55dB), moderately severe (56-70dB), severe (71-90dB) or profound (>90 dB). The average of hearing levels of frequencies 500 Hz, 1 KHz, 2 KHz and 4 KHz was taken.

Out of 50, 29 (58%) of the patients were having conductive hearing loss in the range of 25-40 dB. 20 (40%) of patients were having hearing loss in the range of 41-55 dB while 01 (02%) patients were having hearing loss of 56-70 dB. (Graph 5)

TABLE 6**AUDIOLOGICAL ASSESMENT****(On the Mean of four frequencies from 500 hz to 4 khz)**

Degree of Hearing Loss	Hearing Loss in dB	Number of patients	%age
Mild	25-40 dB	29	58
Moderate	41-55 dB	20	40
Moderately Severe	56-70 dB	01	02
Severe	71-90 dB	00	00
Profound	>90 Db	00	00
Total		50	100

7) Site Of Perforation And Hearing Threshold Levels: (Table 7)

On comparing the hearing thresholds levels between Group A, B & C (as per Table 7); it was observed that the overall p-value was statistically very significant (p-value <0.001) on comparison between Groups A, B & C. However on Intergroup comparison, it was observed that p-value was statistically very significant (p-value <0.001) on comparison between Groups A& B and between Group B & C., but it was statistically insignificant on

comparison between Group A & C (p-value=0.331). It indicates that hearing threshold levels does depend on whether perforation is central involving the malleus or non-central i.e. whether malleolar or non-malleolar. However, it does not depend on whether the perforation is involving anterior or posterior half of the tympanic membrane.

TABLE 7.
SITE OF PERFORATION AND HEARING THRESHOLD LEVELS

Group	SITE OF PERFORATION	Mean±SD	Intergroup p-value
A	Anterior	33.53±1.61	A-B=<0.001
B	Central	45.53±5.39	B-C=<0.001
C	Posterior	35.31±2.30	C-A=0.331
		p-value<0.001	

8) Relationship Between Graft Take Up And Site Of Perforation (Table 8)

On comparing graft uptake rates with 3 sites, it was observed that the p-value is statistically insignificant (p-value 0.229). It indicates that the site of the perforation does not affect the graft take-up rate. Grafttake-uprate was 100% for anterior and posterior perforation, while it was 88.46% for Central perforation.

TABLE 8
RELATIONSHIP BETWEEN GRAFT TAKE UP AND SITE OF PERFORATION

SITE OF PERFORATION	No. of cases with Graft Takeup	No. of cases with Graft failure	Total
Anterior	08	0	08
Central	23	03	26
Posterior	16	0	16
Total	47	3	50

Chi-square- 2.94, p-value= 0.229

All patients presented themselves for regular follow up. Discharge was noted in four patients which resolved by change of antibiotic and three patients had graft rejection with residual perforation.

9) Hearing Gain (Table 9)

Hearing levels were assessed at 6 months

A) Average Hearing Gain At 4 Frequencies (500 HZ, 1 KHZ, 2 KHZ & 4 KHZ).

The average preoperative hearing level was 40.34 dB while the average postoperative hearing level was 25.08 dB, giving an average postoperative gain of 15.26 dB.

TABLE 9

AVERAGE POSTOPERATIVE GAIN

Average Post-Op Hearing Gain	Number of patients
0-10 Db	04 (08%)
11-20 Db	41(82%)
21-30 Db	05 (10%)
31-40 Db	-

Majority of patients 41 (82%) had a gain in the range of 11-20 dB. 5(10%) patients had a gain of 21-30 dB. 4 (08%) patients had gain of 0-10 dB, this group comprised of three cases with graft rejection. Mean pre-operative hearing level was 40.34 dB with standard deviation of ± 6.84 . Mean post-operative hearing level was 25.08 with standard deviation of ± 6.80 . The average gain in hearing level was 15.26 dB. On applying t-test p value was <0.001 which was statistically highly significant.

TABLE 10
MEAN PRE AND POST-OP HL

	Mean \pm SD (AVG OF 4 frequencies)
Pre	40.34 \pm 6.84
Post	25.07 \pm 6.80
P value	<0.001

B) Relation Between Site Of The Perforation With The Hearing Gain: Table 11

When the mean hearing gain was studied between size groups (as per Table 7), it was found that the difference in hearing gain between Group A, B & C was not statistically significant (p-value 0.305). It indicates that the amount of hearing gain does not depend on the site of the perforation.

TABLE 11
HEARING GAIN IN DIFFERENT SITE GROUPS

Groups	SITE	Mean \pm SD	Intergroup p-value
A	Anterior	13.68 \pm 1.64	A-B=0.220
B	Central	16.39 \pm 7.17	B-C=0.210
C	Posterior	14.21 \pm 1.92	C-A=0.821
		p-value 0.305	

DISCUSSION

Maximum number of patients i.e. 64% were in the age group of 15-25 years, 28% of patients were in age group of 26-35 years and rest 08 % were in age group of 36-50.

In the present study maximum no of patients, i.e. 58% were having hearing threshold in the range of 25-40 dB and 20(40 %) were in the range of 41-55dB. The average of hearing levels of frequencies 500 Hz, 1 KHz, 2 KHz and 4 KHz was taken.

On comparing hearing loss in different site groups (Group A, B & C), p-value was statistically very significant (p-value <0.001) on comparison between Groups A & B and between Group B & C, but it was statistically insignificant on comparison between Group A & C (as per Table12). It indicates that hearing threshold levels does depend on whether perforation is central involving the malleus or non-central & not involving malleus i.e. whether malleolar or non-malleolar. However, it does not depend on whether the perforation is involving anterior or posterior half of the tympanic membrane. These findings are in accordance with studies done by Ahmad and Ramni³, Mehta RP et al⁴ and Bhusal et al⁵. These findings contradicts the observations made by Anthony and Harrison⁶, Nahata V et al⁷ and Vaidya S⁸.

In our study, the average preoperative hearing level was 40.34 dB while the average postoperative hearing level was 25.08 dB, giving an average postoperative gain of 15.26 dB. On applying t-test, p value was <0.001 which was statistically highly significant.

In our study, it was found that the difference in hearing gain between Group A, B & C was not statistically significant (p-value 0.305). It indicates that the amount of hearing gain does not depend on the site of the perforation.

Hearing threshold level depends on whether the TM perforation is central with involvement of malleus or not involving the handle of malleus. However, it does not depend on whether the TM perforation is anterior or posterior.

Hearing improvement does not depend on site of TM perforation.

Conclusion: The involvement of malleus in tympanic membrane perforation is an important factor in determining degree of hearing threshold. Perforations involving malleus causes significantly greater hearing loss than perforations not involving malleus. Hearing thresholds doesnot depend upon whether perforation is anterior or posterios. Hearing improvement following tympanoplasty also doesnotdepend on site of TM perforation.

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