

Relation of site and size of Tympanic membrane perforation on Hearing loss with help of PTA

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Abstract

Tympanic membrane (TM) perforation is common condition worldwide especially in developing countries. TM perforation size and site is noted. The hearing loss is directly related to the size of the perforation and hearing loss is more when in posterior quadrant than anterior quadrant considering eustachian tube is normal. This study is done find the relation of site and size of Tympanic membrane perforation with Hearing loss in individual with normal eustachian tube function, with Respect to Pure Tone Audiometry (PTA).

Keywords: Pure tone audiometry, Eustachian tube, Tympanic membrane.

Introduction

Otitis media is prevalent disease worldwide. Thus, TM perforation is prevalent globally especially in developing countries with poor environmental hygiene. It is general view and have been recognized that the degree of hearing loss increases with size of perforation. The hearing loss is less in small perforation than larger perforation and less in perforation of anterior quadrant than those of posterior quadrant perforation which is physiological requirement of healthy middle ear.

Aim and Objectives

1. To assess relation between site and size of TM perforation with respect to degree of hearing loss.
2. To study the hearing loss in relation with frequency loss based on site and size of TM perforation.

Inclusion criteria

1. Patients with tympanic membrane perforation Tubotympanic type with normally functioning eustachian tube.
2. Patients of age group 15 to 60 years and both sexes.

Exclusion criteria

1. Patient not willing to give written informed consent for study.
2. Patients with sensory neural hearing loss, presbycusis or any hearing impairment.
3. Patients with unsafe type of CSOM.
4. Perforation with active discharge
5. Infection of external ear.
6. Patients with co-morbid conditions.

Materials and Methods

This is a prospective study in Department of ENT. The subjects selected for the study were patients with safe type of CSOM (Tubotympanic type) with normal Eustachian tube functionally. In this study 50 patients were selected, among the age group 15 to 55 years. The patients underwent detailed History taking, general physical examination with examination of Ear, Nose and Throat. The important relevant details were noted and if required the patients were subjected to required blood investigations. All the patients underwent Tuning fork tests, endoscopic examination of the ear and Pure Tone Audiometry.

Observations

This study was carried out in 50 patients, 26 were males and 24 were females. Patients with unilateral or

Bilateral perforation of TM were considered for the study and the study was conducted for a period of one year. All patients considered were having Tubotympanic type of CSOM with normally functioning eustachian tube. Majority of the subjects were among the age group 18 to 30 years with a slight male predominance.

Table 1: Percentage of patients based on site of TM perforation

Site of TM Perforation	%	N = 82
AI	6.09	5
PI	6.09	5
AS+AI	13.4	11
PS+PI	8.5	7
AI+PI	12.19	10
AS+AI+PI	19.51	16
AS+AI+PS+PI	34.14	28

AI- Anteroinferior, PI- Posteroinferior, AS- Anterosuperior, PS- Posterosuperior

The causes of TM perforation among the patients were most commonly infectious etiology. Among study subjects, 3 patients, 1 female and 2 male patient had traumatic perforation. The most common and initial symptom was ear discharge followed by hearing impairment and tinnitus. In Traumatic perforation initial symptom was sudden hearing impairment with tinnitus followed by ear discharge. The patients with ear discharge were treated conservatively with antibiotics, Antihistamines and Decongestants, once the ear was dry, ear examination with PTA was performed.

On ear Examination, 32 patients had Bilateral perforation, 10 left ear perforation and 8 right ear perforation. Total of 82 ears.

Table 2: Distribution of patients based on size of the TM perforation

Size of TM Perforation	No. of ears N=82	%
Small (involving 1 quadrant)	10	12.19%
Moderate (involving 2 quadrant)	28	34.14%
Large (involving 3 quadrant)	16	19.51%
Subtotal/ Total perforation (involving all quadrant)	28	34.14%

Degrees of hearing loss on PTA

1. Normal hearing: (0-25 dB)
2. Mild hearing loss: (26-40 dB): Patients with this hearing loss may not hear soft speech.
3. Moderate hearing loss: (41-55 dB): Patients with this hearing loss have trouble hearing little conversational speech.
4. Moderate-severe hearing loss: (56-70 dB): Patients with this hearing loss do not hear most conversational-level speech.
5. Severe hearing loss: (71-90 dB): Severe hearing loss can affect speech quality.
6. Profound hearing loss: (>90 dB): With profound hearing loss (deafness), speech and language deteriorate.

Table 3: Hearing impairment based on the size of TM perforation

Size of TM perforation	Average dB hearing loss on PTA	Degree of hearing loss
Small	28 Db	Mild
Moderate	34 Db	Mild
Large	39 dB	Mild
Subtotal/ Total	45 dB	Moderate

Table 4: Hearing Impairment based on site of TM perforation.

Site of TM perforation	Average Hearing loss in dB on PTA	Degree of hearing loss
AI	25 dB	Normal
PI	28 dB	Mild
AS+AI	30 dB	Mild
PS+PI	35 dB	Mild
AI+PI	38 dB	Mild
AS+AI+PI	39 dB	Mild
AS+AI+PS+PI	45 dB	Moderate

On assessing the hearing impairment on Pure Tone Audiometry, 77 (93.9%) had hearing loss, among them 49(59.7%) had mild hearing loss and 28 (34.1%) had moderate hearing loss. In our study, majority had mild conductive hearing loss. None of the patients had pure sensorineural hearing loss. In our study, the hearing loss was more in Subtotal/ Total perforation 28 ears (34.1%) when all 4 quadrants of the TM are involved followed by 16 ears (19.51%) when 3 quadrants of TM were involved.

Discussion

Tympanic membrane (TM) plays an important role in sound transmission to the middle ear. TM perforation is a relatively common problem which predisposes to varying degree of hearing loss and is usually less than 50dB. In our study, 50 patients were considered, 82 ears with Tubotympanic type of CSOM. 32 patients had bilateral TM perforations (64%) and 10 had left ear involvement and 8 ears had right ear involvement. In a study by Mehta RV et al, Bilateral ear involvement was more. In our study, majority of the patients were of aged 18 to 35 years and both genders were almost equally affected with slight male predominance. In a study by Kumar N et al, the maximum number of patients were of the age group 21 to 30 years.¹ The most common history given by the patients were ear discharge followed by hearing loss with tinnitus.

On Examination most of the patients had subtotal/total perforation 28 (34.14%) and 2 quadrant moderate perforation 28 (34.14%). On PTA examination, most of the patients hearing loss, 77 (93.9%) patients had hearing loss, among them 49 (59.7%) had mild hearing loss and 28 (34.1%) had moderate hearing loss.

In our study, patients with large (average 39 dB) or subtotal/total perforation (average 45 dB) had greater hearing loss compared to moderate (average 34dB) to small perforation (average 28dB). In our study, size of the perforation is directly related to degree of hearing loss. In a study by Kumar et al, also stated that the hearing loss increase with size of the perforation.¹

On assessing, hearing loss was more in total/subtotal perforation. On comparing to anterior and posterior quadrant, perforation of the posterior quadrant had comparatively more hearing loss than anterior quadrant. Mehta et al in their study, stated hearing loss did not vary with site of the perforation and any variation was negligible.² In a study by Ibekwe TS et al, stated that the location of Tympanic membrane perforation has no effect on the magnitude of hearing loss in acute Tm perforation and significant in chronic ones.³ In a study by Pannu KK et al, stated that average hearing loss increased as the perforation size increases, the site of TM perforation was not related to hearing loss and the mean hearing loss at all

frequencies increased as the duration of the disease increases.⁴ In a study by Maharajan M et al, stated that larger the perforation, greater will be the decibel loss in sound perception and the location of perforation on TM and duration of ear discharge have significant effect on magnitude of hearing loss.⁵ In a study by Park H, stated that hearing loss in Tympanic Membrane perforation depends on size of perforation and the degree of middle ear and mastoid pneumatization when the mucosa of the middle ear cavity and ossicles are normal.⁶ This is due to the fact that the posterior perforations were small and confined to posteroinferior quadrant and round window is located deep within a niche, hence posterior perforation of TM doesn't protect the round window, hence round window baffling effect is lost.

Table 5:

Anterior Quadrant	AI	25 dB
	AS+AI	30 dB
Posterior Quadrant	PI	28 dB
	PS+PI	35 dB

All the patients with hearing loss, low frequencies were affected. In a study by Mehta RP et al, posterior quadrant perforation had no air-bone gap at any frequency, anterior perforation had air-bone gap, which were smaller by 1 to 8 dB at lower frequencies.² In a study by Dawood MR et al, stated that hearing loss is proportionally related with the size of the perforation, posterior site had greater impact than anterior site and hearing loss was detected to be worst at lower frequencies as 500Hz, than those of 1000-2000Hz.⁷ In our study, none of the patients had pure sensorineural hearing loss, this can occur once the bacterial toxin crosses the cochlea via round window.

Conclusion

Safe type (Tubotympanic) of CSOM, is most commonly seen in low socioeconomic class among adolescents and mid-aged group people. Bilateral ear involvement was more common than unilateral ear involvement in our study. On examination of Dry TM perforation with PTA, average degree of hearing loss was in the range 25 to 45 dB, most of them had conductive type, low frequency hearing loss. Hearing

loss is directly related to the size of TM perforation, as the size increases hearing loss increases. Posterior quadrant TM perforation have more hearing loss compared to Anterior quadrant perforations at the Pars Tensa of TM.

Source of Funding

None.

Conflict of Interest

None.

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