International Journal of Otorhinolaryngology and Head and Neck Surgery
Priyadarshini G et al. Int J Otorhinolaryngol Head Neck Surg. 2017 Jul;3(3):671-675
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20173045

Clinical and audiological study of chronic suppurative otitis media tubotympanic type

Priyadarshini G.[1]*, Sowmiya Murali[2], Febin James[1]

[1]Department of ENT, [2]Central Research laboratory and Department of Microbiology, Aarupadai Veedu Medical College and Hospital, Pondicherry, India

Received: 06 April 2017
Revised: 21 May 2017
Accepted: 23 May 2017

***Correspondence:**
Dr. Priyadarshini G.,
E-mail: priyababu12@yahoo.co.in

ABSTRACT

Background: Chronic suppurative otitis media (CSOM), tubotymapanic type, despite a commonly encountered disease in otorhinolaryngology has many controversies involved. This study was aimed at bringing few of these aspects to limelight.
Methods: The study was conducted in Otorhinolaryngology department, Aarupadai Veedu Medical College and Hospital, Pondicherry, India between September 2015 - August 2016. Total of 207 ears of 180 patients with CSOM tubotympanic type were included. Selected patients were subjected to ENT examination and pure tone audiometry after obtaining history.
Results: In this study 35.9% patients belonged to 4th decade and 29.4% to 3rd decade. Among patients with discharge for more than 30 years, 68.8% had moderately-severe hearing impairment and those with discharge for less than 10 years, 60.2% had mild hearing loss. Among patients with large central perforation, 51.4% had moderately-severe hearing loss and those with small central perforation, 68.4% had mild hearing loss. Hearing loss was nearly same in anterior and posterior perforations. On chi square test p value was 0.0874 i.e. >0.05, difference insignificant.
Conclusions: In our study most patients were in 4th decade, incidence is equal in both genders. Hearing loss is directly proportional to disease duration and perforation size. Site of perforation does not influence hearing loss.

Keywords: Chronic suppurative otitis media, Audiometry, Conductive hearing loss, Perforation

INTRODUCTION

Chronic suppurative otitis media (CSOM) has been an important cause of middle ear disease since prehistoric period and it is one of the most common ear diseases in developing countries.[1] CSOM is defined as "a persistent disease, insidious in onset, often capable of causing severe destruction of middle ear structure with irreversible sequelae, which is clinically manifested with deafness and discharge for more than three months".[1] Poor and overcrowded living conditions, poor hygiene and nutrition have been suggested as a basis for the widespread prevalence of chronic suppurative otitis media.

Tubotympanic type of chronic suppurative otitis media is characterized by a perforation of pars tensa; perforations vary in size and site. Tympanic membrane not only performs the conduction of sound waves across the middle ear but also serves a protective function to the middle ear cleft and shields the round window from direct sound waves which is referred to as "round window baffle". This shield is necessary to create a phase differential so that the sound wave does not impact on the oval and round window simultaneously. This would

dampen the flow of sound energy being transmitted in a unilateral direction from the oval window through the perilymph.[2,3] It has been found that the effect of the enhanced ratio of the surface area of the tympanic membrane, to that of the oval window increase the sound pressure by about 26 decibel whereas the lever action of ossicles contribute only about 2 decibel.[2] A perforation on the tympanic membrane reduces the surface area of the membrane available for sound pressure transmission and allows sound to pass directly into the middle ear.[3]

Perforations of the tympanic membrane cause a conductive loss that can range from negligible to 50 decibel (dB).[2] It has been established that the larger the perforation, the greater the decibel loss in sound perception. A total absence of the tympanic membrane would lead to a loss in the transformer action of the middle ear.[3]

The location of the perforations is believed to have significant impact on the magnitude of hearing loss. Posterior quadrant perforations are believed to be worse than the anterior ones because of the direct exposure of the round window to sound waves.[4] This is a subject of controversy as contrary to the old belief that site of perforation influences the hearing loss, the recent hypothesis states that the round window baffle effect which was assumed to happen does not happen exactly as the wavelength of the incident sound is more than the dimensions of middle ear and hence it has less influence on the conduction of sound. [2]

This study was carried out to find out the effect of site and size of tympanic membrane perforation and duration of ear discharge on hearing loss in tubotympanic type of chronic suppurative otitis media.

METHODS

This was a prospective study, carried out in a tertiary care centre, India, from September 2015 - August 2016. A total of 180 patients with 207 ears were included in this study.

Inclusion criteria

Patients aged more than 11 years and less than 50 years of either gender diagnosed with CSOM TT type and Patients with CSOM TT type with dry ear or having minimal mucoid discharge.

Exclusion criteria

Patients with pure sensorineural hearing loss, severe or profound conductive hearing loss to avoid confounding due to ossicular discontinuity, severe or profound mixed hearing loss, cholesteatoma, attic perforation, attic retraction pocket, marginal perforation, Active profuse, mucopurulent discharge, otomycosis, other ear pathologies.

Detailed history was obtained and complete ENT examination was done. The ears were examined by Heinz LED otoscope initially, subsequently by a Carl Ziess microscope and the site and size of perforation was noted down by a single examiner. Pure tone audiometry with appropriate masking was done at frequencies 250 kHz, 500 kHz, 1000 kHz, 2000 kHz, 4000 kHz and 8000 kHz in a sound proof room, in all the patients to find out the hearing status.

The hearing loss was classified based on the WHO grades of hearing impairment, which is as follows:[11]

- Normal hearing - 10 to 25 dB
- Mild hearing loss - 26 to 45 dB
- Moderate hearing loss - 46 to 55 dB
- Moderately-severe Hearing Loss - 56 to 70 dB
- Severe hearing loss - 71 to 90 dB
- Profound hearing loss - 91 dB and more

Size of tympanic membrane was categorized based on the following criteria: small –area of the perforation is equal to or less than that of one quadrant; medium - area of the perforation is more than one but less than or equal to that of two quadrants; large –area of the perforation is more than that of 2 quadrants.

The tympanic membrane was divided into 4 quadrants based on an imaginary line passing along the axis of handle of malleus and a line drawn perpendicular to it through umbo. Hearing loss in 56 anterior and 43 posterior moderate central perforations was compared and chi square test was applied. The results were statistically analyzed using Epi Info software.

RESULTS

Age distribution

The study was carried out in a tertiary care center and the maximum number of patients belonged to the age group between 31-40 years which included 35.6% patients, the next common age group was 21-30 years with 29.4% patients. Further, 21.4% patients belonged to the age group between 41-50 years and 13.6% patients were in the age group between 11-20 years. Age wise Distribution of CSOM Tubotympanic type is shown in Figure 1.

Gender distribution

In the present study the disease was observed to be slightly more common in females i.e., in 53.9% patients and rest 46.1% were males. Gender distribution of patients with CSOM Tubotympanic type is shown in Figure 2.

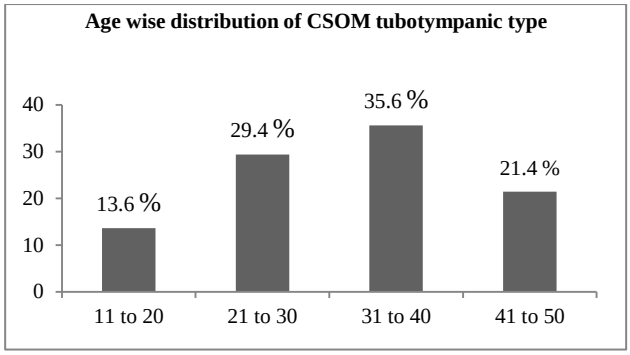

Figure 1: Age distribution of patients with CSOM tubotympanic type.

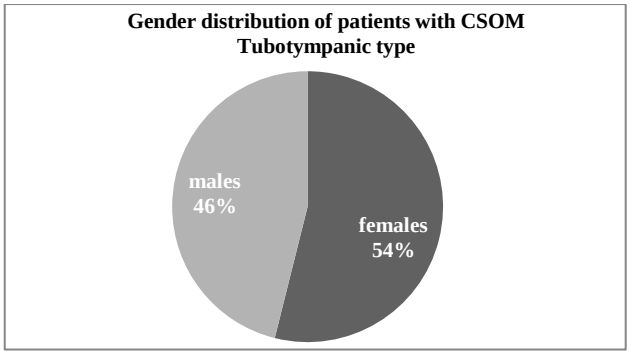

Figure 2: Gender distribution of patients with CSOM tubotympanic type.

Table 1: Hearing loss in relation to duration of discharge.

Duration	Hearing loss in dB				Total no. of ears
	Normal	Mild	Moderate	Moderately Severe	
<10 years	11 (14.1%)	47 (60.3%)	20 (25.6%)	0	78
10-20 years	0	32 (48.5%)	29 (43.9)	5 (7.6%)	66
20-30 years	0	13 (27.7%)	27 (57.4%)	7 (14.9%)	47
>30 years	0	0	5(31.2%)	11 (68.8%)	16

Table 2: Hearing loss in relation to the size of perforation.

Size of perforation	Hearing loss in dB				Total no. of ears
	Normal	Mild	Moderate	Moderately-severe	
Small	9 (23.7%)	26 (68.4%)	3 (7.9%)	0	38
Medium	2 (2.0%)	48 (48.5%)	42 (42.4%)	7 (7.1%)	99
Large	0	18 (25.7%)	36 (51.4%)	16 (22.9%)	70

Table 3: Hearing loss in relation to site of perforation.

Site of perforation	Hearing loss in dB				Total no of ears
	Normal	Mild	Moderate	Moderately-severe	
Anterior	2 (3.6%)	27 (48.2%)	23 (41.1%)	4 (7.1%)	56
Posterior	0	21 (48.8%)	19 (44.2%)	3 (7%)	43

Side of perforation

Right sided tympanic membrane perforation was observed in 48.9% patients, left sided perforation in 36.11% and bilateral perforation in 15% patients.

Duration of discharge

Among the patients who had longer duration of discharge i.e, more than 30 years, 68.8% of them had moderately severe hearing loss. It was further observed that among the patients having shorter duration of discharge i.e., less than 10 years, 60.2% of them had mild hearing loss were shown in Table 1.

Size of perforation

In the group of patients who had large central perforation, 51.4% of them had Moderately-severe hearing loss and among those who had small central perforation, 68.4% had mild hearing loss, as the size of the perforation increases the degree of hearing loss also found to increase were shown in Table 2.

Site of perforation

Comparing the hearing loss based on the site of perforation it was observed that be it anterior or posterior perforation the hearing loss was nearly same. On applying the chi square test the p value was 0.0874 i.e. >0.05 and the difference was found insignificant which implies that the site of perforation does not influence the hearing loss were shown in Table 3.

DISCUSSION

In the present study the commonest age group of patients with CSOM tubotympanic type was found to be 31-40

years, whereas in the study conducted by Nagle et al and Singh et al, the commonest age group was 21-30 years.[5,6] This difference in age group may be due to the fact that our institute being a tertiary care centre, most of the patients reported late. Slight female preponderance of the disease with M:F ratio 1:1.17 in our study is comparable to the results of the study by Nagle et al with M:F 1:1.22, singh et al, with M:F 1:1.34 and Fadl et al, with M:F 1:1.42.[5-7]

In the present study, among the patients who had discharge for less than 10 years, 60.2% had mild hearing loss and among the patients having discharge for more than 30yrs 68.8% had Moderately-severe hearing loss. This is comparable to the observation of Maharjan et al, wherein only 18% of patient with discharge for less than 10 years had moderate hearing loss and 34% of patients having discharge for more than 10 years had moderate hearing loss.[8] In the study done by Sakagami et al, all 87 ears included in his study showed gradual deterioration of hearing on long term observation.[9] Hearing deterioration was 0.13 dB/year in the control side and 0.61 dB/year in the CSOM side. The hearing deterioration in long standing CSOM may be due to the ossicular resorption happening in longstanding disease, sclerosis of mastoids leading to reduction in the volume of mastoid and diffusion of toxins through the round window membrane imparting a sensorineural component to the existing conductive hearing loss.

In the present study among the patients with small central perforation 68.4% had mild hearing loss and it was further observed that among the patients having large central perforation, 51.4% had moderate hearing loss. This observation is comparable to the study performed by Maharjan et al, where 62.5% patients with large central perforation had moderately severe hearing loss and Bhusal et al, where maximum hearing loss of 43.8dB was observed in group D (above 40% of surface area of TM) perforations, whereas 30.8 dB was observed in group A (less than 10% surface area of TM) perforations.[1,8] The fact that the hearing loss is more in a larger perforation is obvious and is due to the reduction in the effective vibrating area of the tympanic membrane and the phase difference offered by shielding of the round window membrane by intact tympanic membrane is reduced due to the tympanic membrane perforation.

In the present study no significant differences was noted in the hearing loss between anterior and posterior perforations. This is comparable to the study conducted by Mehta et al, where he found no significant difference in A-B Gap at any frequency for perforation in anterior and posterior quadrants.[10] Whereas, according to Maharjan et al, perforations involving posterosuperior and posteroinferior quadrant were found to have more hearing loss as compared to perforations involving anteroinferior or anterosuperior quadrant.[8] This is a subject of controversy as contrary to the old belief that site of perforation influences the hearing loss, the recent hypothesis states that the round window baffle effect which was assumed to happen does not happen exactly as the wavelength of the incident sound is more than the dimensions of middle ear and hence it has less influence on the conduction of sound.[2] More than the site of perforation the middle ear volume tends to influences the hearing loss.[2]

CONCLUSION

In the present study most of the patients reported to our tertiary care centre late i.e., in the 4th decade. Incidence is almost equal in males and females with a slight female preponderance. As the duration of disease increases the hearing loss also increases. Larger the perforation more is the hearing loss and site of perforation does not influence the hearing loss.

Though we conclude that the site of perforation does not influence the hearing loss, the fact is to be confirmed by performing the study in a larger group of patients and with adequate facilities to measure the middle ear volume and other factors influencing the hearing loss in patients with CSOM tubotympanic type.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Priyadarshini G, Murali S, James F. Clinical and audiological study of chronic suppurative otitis media tubotympanic type. Int J Otorhinolaryngol Head Neck Surg 2017;3:671-5.