ORIGINAL RESEARCH PAPER

Otorhinolaryngology

DEGREE OF HEARING LOSS IN INACTIVE MUCOSAL CHRONIC OTITIS MEDIA AND ITS CORRELATION WITH SITE AND SIZE OF TYMPANIC MEMBRANE PERFORATION- AN OBSERVATIONAL STUDY

KEY WORDS: Perforation; Tympanic membrane, Infection, Hearing loss; Kashmir

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ABSTRACT

Background: Studies have persistently associated the site and size of the tympanic membrane (TM) with the magnitude of hearing loss; however, the results are mixed and inconclusive on the effect of the site of the perforation on the hearing loss. Therefore, we conducted the present study to investigate the relationship between the size and site of TM perforation and hearing loss in inactive mucosal chronic otitis media. **Methods:** We conducted a hospital-based observational, prospective study in the Postgraduate Department of Otorhinolaryngology, Head and Neck Surgery, Government Medical College Srinagar, and recruited 94 patients diagnosed to have inactive mucosal chronic otitis media with dry tympanic membrane perforation. In addition to the site and size of TM perforation, the magnitude of hearing loss was also estimated. **Results:** We recruited 94 subjects presenting acute otitis media with TP perforation. The mean age (±SD) of cases was 36.3(±4) and males showed a marginal over-representation over females (male to female ratio: 1.2:1). We observed a positive correlation of the size of TM perforation with the average hearing loss. Moreover, subjects having perforations in the posterior ear reported higher average hearing loss. **Conclusion:** We report a positive correlation of the size of TM perforation with the average hearing loss and subjects having perforations in the posterior ear reported higher average hearing loss. However, more replicative studies with a larger sample size are warranted to substantiate our findings.

INTRODUCTION

Tympanic membrane (TM), a layer of fibrous connective tissue, that separates the external auditory canal from the middle ear and ossicles aids in hearing by creating and transmitting sound vibrations to the inner ear. The TM perforation refers to ruptures, producing a hole between the external and middle ear [1], impeding the transmission of vibrational patterns produced by sound, leading to hearing loss. These perforations are more common in men than women and can occur at any age. The TM perforations are characterised by sudden pain followed by relief associated with otorrhea, tinnitus, and vertigo. These TM perforations tend to heal on their own and have a good prognosis and low risk of complications [2].

The global incidence of TM perforation is largely unknown. However, hearing impairment is one of the leading disabilities, with over 5% of the global population that suffer from debilitating hearing loss [3]. The perforation in TM is reported to have multiple origins including barotrauma from explosions, sudden negative pressure, scuba diving, or air travel, head trauma, noise trauma, foreign body insertion into the ear, iatrogenic from foreign body removal attempt, or infection-induced complications [4]. One of the most common causes of TM is perforations caused by trauma or acute otitis media [5].

Otitis media (OM) refers to a multitude of different inflammatory conditions that affect the middle ear that might be with or without perforation in the TM. A perforated tympanic membrane may be associated with acute or chronic otitis media. Studies have persistently reported hearing impairment associated in 50-100% of otitis media cases in low- and middle-income countries[6-9]. The OM-associated hearing impairment is usually mild but can lead to distorted speech and sound intelligibility depending upon the level of hearing loss and the varying nature of the middle-ear fluid. Moreover, in the presence of background noise, auditory processing, its localization, and hearing ability may be unfavourably impacted in the patients [10-12].

The site and size of the size of tympanic membrane perforation have been persistently associated with the degree of hearing loss in various presentations of otitis media[13-16]. However, the results on the correlation of site of perforation are mixed and inconclusive [15]. Moreover, studies on both in vivo models—[17] and human subjects have investigated and linked genetic contributions in modulating the pathophysiology of recurrent acute otitis [18-20]. Kashmir valley, a north Indian state represents an ethnically distinct population with a conserved genetic pool offers a unique setting for corelating, site and size of TM perforation with degree of hearing loss in inactive mucosal chronic otitis media. Given these observations, the present study was conducted to evaluate if the findings from the other ethnic populations hold true for Kashmiri population as well.

METHODS

The current hospital-based observational, a prospective study was conducted in the Postgraduate Department of Otorhinolaryngology, Head and Neck Surgery, Government Medical College Srinagar from July 2019 to December 2021. A total of 94 patients between the age of 20 to 70 years diagnosed to have inactive mucosal chronic otitis media with dry tympanic membrane perforation were enrolled in the study. While as the patients suffering from discharging ear, cholesteatoma, tympanosclerosis, or any malignancy were excluded from the study. In addition to a detailed medical history, all the subjects underwent a detailed clinical and ENT examination. We performed otoscopy in all patients to check the extent of perforation and the regions of TM involved. We divided the perforations into small, medium, and large. Their classification was based on the total area of ear drum that was lost. Perforations with less than 25% surface area lost were labelled small, 25-50% surface area lost as medium, more than 50% surface area lost as large perforations. The perforation site was defined with respect to an imaginary line drawn across the TM the level of manubrium. An audiometer (pure tone audiometry), calibrated to ISO standard settings, was used to evaluate the hearing loss in a sound treated room. The hearing level was defined as mean air conduction threshold at 500, 1000, and 2000Hz and average of these frequencies was calculated to measure the hearing level. The

study was reviewed by the Institutional ethics committee and informed consent from the patient was also obtained.

Data analysis.

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to the data editor of SPSS Version 25.0 (SPSS Inc., Chicago, Illinois, USA). The data was summarized as frequencies and percentages.

RESULTS

In the current prospective study, we recruited a total of 94 patients in the age group of 20 to 70 years diagnosed to have inactive mucosal chronic otitis media with dry tympanic membrane perforation. The mean age (±SD) of cases was 36.3(±4) and males showed a marginal over-representation over females (male to female ratio: 1.2:1). On stratification of the subjects by age categories, we observed a linear decrease in the number of prevalent cases in both genders with the increase in age. More number of cases were in the age group of 20 to 30 years (38.3%) followed by 31-40 years (29.8%) Table 1. On evaluating the degree of hearing loss of the subject recruited in the present study we found that a greater number of subjects (38.3%) had moderate hearing loss (41-60 dBs), while as only 7 subjects presented with severe hearing loss. A sizable number of subjects had a perforation size of <25% while as ~27% had a perforation size of >50%. However, the average hearing loss (in dBs) reported had a positive correlation with perforation size (Table 2). While a greater number of subjects (~51%) reported central perforation (multiple quadrants involved) with an average hearing loss of ~39dB, on assessing the correlation of site of perforation with hearing loss we observed that compared to anterior ear, subjects having perforations in posterior ear reported higher average hearing loss (42.3dB). (Table 2).

DISCUSSION

In the current observational study, we recruited 94 subjects presenting inactive mucosal chronic otitis media with TM perforation at a tertiary care hospital in the Kashmir valley. We found a male predominance over females and observed a positive correlation between the size of TM perforation with the average hearing loss. Moreover, subjects having perforations in the posterior quadrants of TM reported higher average hearing loss.

The distinct male predominance in TM perforations with or without otitis has been widely reported in many earlier studies from diverse ethnicities [21, 22]. Despite such a strong predominance, no convincing or pathophysiological mechanism has been put forward so far. The confinement of females to their homes and subsequent late presentation to the tertiary health care facilities in our population cannot be entirely ignored [23]. Moreover, it has been reported that compared to males, females possess a strong innate immunity [24], and the effect of the latter cannot be ruled out for precluding females from developing TM perforation associate otitis media. However further mechanistic studies are warranted to understand the gender-based differences in the susceptibility of TM perforation.

Most of the cases in our study belonged to the age group of 20 to 40 years. Similar observations have been reported in the earlier literature as well. Sood *et al.* [25] reported that 79% of patients were less than 40 years of age in their study. While as Ediale *et al.* [26], Bhusal *et al.* [27], and Rana *et. al.*[28] observed in their respective studies that a high proportion of study subjects were within the age group of 10–39. The presentation of TM perforations in younger age can be attributed to the extensive environmental exposure during this age category.

The TM aids in hearing by creating and transmitting sound vibrations to the inner ear that are then transferred to the brain for further decoding. Expectedly, thresholds for hearing and the size of TM perforation have a positive correlation [29]. Similar to earlier reports [5], in the present study, we found a positive correlation between average hearing loss and the size of TM perforation. Ediale et al. [8] have attributed the increase in the average loss of hearing to the reduction in the physiologically vibrating TM surface area that functions as an amplifier of sound waves in the ear [26]. However, the marginal differences reported in different studies in numbers and percentages are possibly due to different methods employed for calculating the size of perforations.

One school of thought propounds that the site of TM perforation has a significant impact on the extent of hearing loss[30]. These researchers advocate that because of the direct exposure of the round window to sound waves, posterior quadrant perforations are worse than the anterior ones. Similarly, perforations in or juxtaposed with TM attachment to manubrium are more severe than those of similar size at different sites [30]. Unlike this school of thought, other workers did not find any link between the site of the perforation with the intensity of hearing loss[15,31].

Ibekwe et. al.in their study on 62 patients reported that the location of perforation on the tympanic membrane (TM) has no effect on the magnitude of hearing loss in acute TM perforations but impacts in chronic ones [15]. While as another study by Priya *et. al.*, in their cross-sectional prospective observational study on 88 subjects reported that the location of perforation on the TM affects the magnitude of hearing loss. It has a significant impact on chronic suppurative otitis media [32]. The heterogeneity in the results can be attributed to the differences in study designs especially the small sample size in these studies. Given these varied results, more replicative studies are warranted for conclusive investigation of the relationship between the site of TM perforation and the extent of conductive hearing loss.

CONCLUSION:

We report a positive correlation between the size of TM perforation with the average hearing loss and subjects having perforations in the posterior ear reported higher average hearing loss. However, larger data sets are required to corroborate our findings.

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Table 1. The age and gender distribution of subjects presenting inactive mucosal chronic otitis media with dry tympanic membrane perforation

Age (years)	Total N (100)	Male N (%age)	Female N (%age)
Total (20-70)	94 (100)	51 (54.3)	43 (45.7)
Age categories (years)			
20-30	36 (38.3)	21 (41.2)	15 (34.9)
31-40	28 (29.8)	16 (31.4)	12 (27.9)
41-50	21 (22.3)	10 (19.6)	11 (25.6)
51-60	3 (3.2)	2 (3.9)	4 (9.3)
61-70	6 (6.4)	2 (3.9)	1 (2.3)

Table 2: The degree of hearing loss (in dBs) and its correlation with size and site of perforation in subjects presenting inactive mucosal chronic otitis media with dry tympanic membrane perforation.

	Hearing loss (in dB)	N (%)
Degree of Hearing loss		
Mild	25-40	34 (36.2)
Moderate	41-60	36 (38.3)
Moderately severe	61-75	17 (18.1)
Severe	>76	7 (7.4)

Size of perforation (%)		
<25% (small)	32.3	37 (39.4)
25-50% (medium)	42.5	32 (34)
>50% (large)	58.6	25 (26.6)
Site of perforation		
Anterior	33.6	19 (20.2)
Posterior	42.3	27 (28.7)
Central (Multiple quadrants)	39.2	48 (51.1)

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