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The Relevance of the Study of the Size and Localization of Perforation of the Tympanic Membrane and its Diagnostic Significance

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Abstract: Chronic Otitis Media is a chronic inflammation of the mucoperiosteal lining of a part or whole of the middle ear cleft characterized by ear discharge and a permanent perforation of TM with or without hearing loss. COM is a major cause of acquired hearing impairment especially in developing countries. Tympanic membrane perforation leads to varying degree of conductive hearing loss. Loss of hearing is a national health problem with significant physical and psychosocial effects. The magnitude of conductive hearing loss in inactive tubotympanic disease is affected by many factors. Size of the tympanic membrane perforation and site of the tympanic membrane perforation are important factors affecting the amount of hearing loss in COM. This study is conducted mainly to correlate the relationship between size of the perforation, site of the perforation and the degree of hearing loss in inactive tubotympanic disease.

Keywords: perforation, tympanic membrane, chronic otitis.

Introduction

Chronic Otitis Media (COM) is an inflammatory process in middle-ear space that results in long-term, more often, permanent changes in the tympanic membrane including atlectasis, dimer formation, perforation, tympanosclerosis, retraction pocket development, or cholesteatoma is a major cause of acquired hearing impairment especially in developing countries. It also gives rise to various extra cranial and intra cranial complications which can be fatal if untreated [1].

In the early centuries, ear infection with complication was a life threatening condition[2]. The introduction of antibiotics and the use of operative microscope in surgical field were revolutionary advances in the control of disease. COM however still remains amajor problem in our country [3, 4].

Tympanic membrane (TM) perforations lead to recurrent ear infections and hearing loss. The effects of TM perforation on middle-ear transmission of sound are not well characterized, largely because ears with perforation typically have additional pathological changes as mentioned above[5]. A better description of perforation effects on middle-ear function is needed so that clinicians know what magnitude and frequency of hearing loss to expect with perforations of various sizes. With such information available, clinicians will be able to assess whether hearing loss is solely the result of a perforation or if additional pathologies are contributing to the hearing loss. This will help the surgeons to be better prepared in the management of cases [6].

The location of perforation was considered to be having effect on hearing loss by some school of thought. Some studies say that hearing loss does not depend on the site of perforation. This cross sectional study aims to correlate the site and size of tympanic membrane perforation with pure conductive hearing loss in patients having inactive tubotympanic chronic otitis media [7].

Experimental part

To evaluate the size and site of the tympanic membrane perforation.

To assess hearing loss in patient with dry tympanic membrane perforation[8].

To correlate the relationship between degree of conductive hearing loss with size and site of the perforation.

Examination under microscope

Aural swab for culture & sensitivity

Tuning fork tests – standard Rinne (256, 512 & 1024 Hz), Weber and Absolute bone conduction tests

Pure tone Audiometry: assesses magnitude of conductive hearing impairment.

The air-bone gap (ABG) depends on - Size of the perforation in the tympanic membrane - Erosion of the ossicular chain, most commonly the long process of incus & sometimes also the stapes suprastructure - Significant granulation tissue around theossicular chain which can reduce its mobility Speech Audiometry[9].

Radiological assessment: Plain x-ray both mastoids, lateral oblique view is useful to see anatomical variation, mastoid air cell system, symmetry of the mastoids, & to see for bony erosions[10].

Eustachian tube function: Assessing the function of the Eustachian tube is difficult.

Conflicting evidence exists in the literature as to the importance of the eustachian tubefunction for the success of tympanic membrane repair[11].

Materials and methods

Study design: Cross sectional study. Place of study Uzbekistan[12]. Bukhara city 150 patients with in the age group 15 – 45 years having inactive tubotympanic disease were included in this study. Based on the surface area of tympanic membrane involved by the perforation, patients were divided in to 4 groups: Group 1: up to 10% involved, Group 2: 11 - 20 % involvement, Group 3: 21 - 40 % involvement and Group4: > 40 % involvement. The patients were divided in to three groups based on the site of perforation: Anterior perforation, Posterior perforation and Combined perforation. The patients were also divided in to 3 groups based on the duration of disease: Group A - < 1 year, Group B - 1-5 years and Group C - > 5 years.

Inclusion criteria

Patients with inactive tubotympanic disease with pure conductive hearing loss.

Patients who gave the consent to participate in this study.

Exclusion criteria

Patients below 14 years and above 45 years of age

Patients with active stage of COM

Patients with tympanosclerosis.

Patients who had undergone myringoplasty.

Patients with mixed or sensory neural hearing loss (SNHL).

Patients with COM attico- antral type.

Patients who had ossicular chain fixation or disruption.

Patients with inactive stage of tubo tympanic COM who had multipleperforations.

Examination of tympanic membrane perforation was carried out by otoendoscopy or under operating microscope with appropriate sedation or local anesthesia. To measurethe size of tympanic membrane perforation, a measuring template was prepared by imprinting a graph grid measuring 1 mm × 1mm square over a transparent OHP sheet and cut in to an oval shape measuring approximately 9 mm × 8 mm pieces and sterilized in formalin chamber. A smaller template of 6 mm × 5 mm was also prepared for narrow ear canal.

The external auditory canal was anaesthetized by applying five drops of 4% xylocaine drops in to the canal and left for half an hour. In patients in whom 4%xylocaine drops was ineffective, EMLA cream was used for anesthesia. Under operating microscope, the sterile measuring template was placed over

the T.M. The number of squares overlying the perforation was directly counted. Half or more of any square within the margins of the perforation was taken as 1 square, less than half of a square within the margins of the perforation was not counted.

In our study age of patients ranged from 15 – 45 years, the mean age of presentation being 30.6 ±7.8 years. Majority of the patients (n = 62) were found to be in the age group of 26 – 35 years. The reason for this may be attributed to the patients becoming more cautious socially about their hearing at this age and because of professional necessities. In a study of bilateral myringoplasty in chronic otitis media by Caye Thomasen et al. on 26 patients, the mean age was 13.3 years.

In our study of 150 patients, 88 patients were male and 62 were female. Male to female ratio was 1.42:1. The presentation of male patients outnumbered the female patients. This could be due to the male gender being more aware of their disease and the incapacity produced because of the disease affecting their daily activities. In the study conducted by Kurian et al.[41] titled „Homologous dura for myringoplasty" on 120 patients,the percentage of male and female were 55% and 45% respectively.

In our study 53 (35%) patients were from urban area and 97 (65%) were from rural area. This difference was thought to be due to illiteracy, poor sanitary conditions, poor personal hygiene and overcrowding in rural population leading to more incidence of disease in rural people. Ramanuj and Anoop [42] in their study „Hearing loss in rural population, the etiology" also observed that most patients with chronic suppurative otitis media were from rural areas.

In our study, it is observed that the average hearing loss increased as the size of the perforation increased. A linear relationship was observed between the hearing loss and the size of tympanic membrane perforation at each frequency. Ahmad and Ramani in their study „Hearing loss in perforations of tympanic membrane" on 70 patients with dry central perforations stated that the hydraulic action arising from the difference in area of TM and of the stapedial footplate is the most important factor in impedance matching. When the effective surface area of the tympanic membrane decreases, there will be a decrease in amplification and hearing loss will be proportionate to size of perforation

Bhusal C L et al. (2011) conducted a study to correlate size of tympanic membrane perforation and hearing loss on 50 cases of pars tensa perforations. In this study, the diameters of the perforations were measured under microscope by placing over them a thin metallic rod of lengths ranging from 4 mm to 10 mm, graduated in ½ mm. steps. The surface area of the perforations were calculated by using a mathematical formula, $A = \pi\ b\ c/4$, where A= area of perforation, b = length of the minor axis, and c = length of the major axis, following which patients divided in to groups based on percent of area involvement. This study showed as the size of the tympanic membrane perforation increased, the hearing loss also increased. In our study we used measuring templates to measure the size of the perforation, which was comparatively a simpler and safer method to directly assess the size of the perforation.

Maharajan M et al. (2009) conducted a study to know about hearing loss in tubo tympanic disease on 100 patients aged between 8 to 60 years with pars-tensa perforations. Clinical examination and history was carried out followed by audiometric evaluation was done in all cases. The study showed that the hearing loss increases as the size of perforation increases. The study also concluded that site of perforation also have significant effect on the magnitude of hearing loss i.e., posterior placed perforations seem to have larger hearing loss when compared to anterior ones. Both the findings in this study are consistent with the findings in our study.

Conclusion

Hearing loss is directly related to the size of perforation. As the size of perforation increases, conductive hearing loss also increases.

Location of perforation also affects amount of hearing loss. Hearing loss is more for posterior quadrant perforations when compared to anterior quadrant perforations of same size.

As the duration of disease process increases, hearing loss also increases.

Male patients were found to be more than female patients. This might be due to male gender being more aware of their disease as it can affect their work performance.

Majority of patients in our study were found to be in the age group of 26 – 35 years.

The disease is found to be more common in rural population than urban population.

The magnitude of hearing loss had no correlation with age or gender factors.

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