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AUDIOGRAM PATTERN IN HEALED CHRONIC OTITIS MEDIA

ABSTRACT

Objective:

The aim of this study was to determine type and degree of hearing loss in healed Chronic Otitis Media (COM) patients.

Materials and methods:

It was a prospective analytical study done over a period of 8 months (1st Jan to 31st August 2018) at Nepalgunj Medical College, Nepalgunj. Patient diagnosed with healed COM underwent audiogram and result was noted in proforma.

Results:

There were 542 ears studied in 386 patients. Most of these patients (35.2%) were 21-40 years of age. Overall 77.8% of ears were part of bilateral COM disease. Major symptoms were hearing loss (71.2%) and tinnitus (58.6%). More than three fourth (76.0%) had past history of ear discharge. Thinned tympanic membrane and myringosclerosis patch were common findings. Out of 352 ears with abnormal audiogram, conductive hearing loss was seen in 59.3% and sensorineural in 21.3%. Low frequency involvement was more seen in younger age group (<40 years) while higher frequency was seen in older age group (>40 years).

Conclusion:

Healed COM is common in middle adulthood stage and mostly associated with COM in other ear. Hearing loss and tinnitus are major complaints and more than three fourth has past history of ear discharge.

Keywords: Chronic Otitis Media, Healed, Hearing loss, Tympanosclerosis

INTRODUCTION

Chronic otitis media (COM) is long borne burden causing hearing impairment especially in developing countries. WHO estimated worldwide prevalence of 466millionhearing impaired,out of which 60% suffer from significant hearing loss.^{1,2} It is estimated that by 2050 over 900 million people – or one in every ten people – will have disabling hearing loss. Two thirds of the global burden of hearing loss is found in the developing countries, where majority have established condition in childhood.² Disabling hearing loss refers to hearing loss greater than 40 decibels (dB) in the better hearing ear in adults and a hearing loss greater than 30 dB in the better hearing ear in children. The majority of people with disabling hearing loss live in low- and middle-income countries. Hearing loss is a public health problem that cut off social interaction and predisposes a

person to aloof state.Apart from functional and economic impact, hearing loss causes impaired speech development in pediatric population and psychosocial problems in adults¹

It was estimated that 13.8–36.2% of hearing impairment in developing countries is due to chronic otitis media.¹The diagnosis of chronic otitis media (COM) entails a permanent abnormality of the pars tensa or flaccida,most likely as a result of earlier acute otitis media, negativemiddle ear pressure or otitis media with effusion. COM can be active COM, where there is inflammation and production of pus, and inactiveCOM, where there is no evident inflammation but has potential to become active at some time. A third clinical entity is healed COM where there are permanent abnormalities of the pars tensa, but the ear does not have the propensity to become active because the pars tensa is intact and there

are no significant retractions of the pars tensa or flaccida.³Otoscope findings in COM healed are local or generalized thinning or opacification of the pars tensa without perforation or retraction. Perforation or retraction pocket is not healed COM. Healed COM can be end result of healing of AOM, OME, COM mucosal or COM squamous. It can also be following successful surgery.

The usual outcome in healed otitis media is a stable ear without accumulation of debris with non progressive hearing impairment. Such ears frequently have myringosclerosis in the tympanic membrane that does not progress or result in any hearing impairment. In few cases, tympanosclerosis affects the ossicular chain, impairing its mobility. About 25% of all cases of COM have tympanosclerosis⁴Sometimes there can be attic tympanosclerosis fixing the ossicular chain.³ Tympanosclerosis of the pars tensa is reported to resolve in some cases, but this is not common.⁵

The hearing in healed otitis media may be normal or mild conductive hearing impairment unless there is ossicular damage or fixation. There may also be an underlying sensorineural hearing impairment as a result of cochlear damage related to previous infection. A healed COM is stable condition and further increase in either conductive or sensorineural hearing impairment is rare but there is no evidence that looks at this issue specifically.³

The majority of adults presenting with COM complain of decreased hearing (~80%) and ear discharge (~70%).^{6,7}Hearing loss is usually conductive type as sound conduction mechanism is impaired and same result is expected in healed COM. In elderly patients, however an incidental finding of COM healed is a possibility when they present with age-related hearing impairment. Some patients give a past history of ear problems often in childhood, but many do not recollect ever having had ear discharge.³

Pure tone audiometry is essential tool to determine degree and type of hearing loss caused by COM. It also shows which particular frequency of sound is affected by the disease. Otitis media will definitely cause some form of conductive hearing loss, however some studies also showed sensorineural hearing loss particularly in higher frequencies which significantly deteriorated with age.^{8,9}

Other causes of hearing loss behind intact drum like congenital middle ear malformations, otosclerosis, and congenital cholesteatoma should be ruled out in unilateral conductive hearing loss with an intact tympanic membrane.¹⁰ In COM healed although there is intact drum like above conditions, but signs of healing in drum helps to establish diagnosis.

Patients are bothered for treatment when they have pain and discharge in ear. Hearing loss especially unilateral usually goes unnoticed. In active stage of COM, hearing usually becomes worse due to inflammation hindering proper sound transmission. So hearing assessment in inactive stage refers to actual hearing loss. Evaluation of hearing in such patient helps us to know the change in conductive and sensorineural status. Most of the studies from Nepal have taken hearing status in COM mucosal or squamous; but this will be first study of its kind to incorporate COM healed. The aim of this study is to determine type and degree of hearing loss in healed chronic otitis media patients.

MATERIALS AND METHODS

It was a prospective analytical study with purposive sampling which was taken over a period of 8 months (1st Jan to 31st August 2018). All patients of healed chronic otitis media presenting in OPD or emergency of Nepalgunj medical college at Nepalgunj were asked to undergo pure tone audiometry. The patient history, examination finding and audiogram were entered into proforma sheet. Approval was obtained from institutional review committee (IRC) of the Nepalgunj medical college. Patients were not deprived of standard treatment and no active intervention was done in patients. .

Both sex and all age group patients diagnosed with COM healed were included in the study. Patients who had perforation, retraction pocket, discharge, granulation tissue, cholesteatoma were excluded. Patients who couldn't undergo pure tone audiometry (small children, mentally retarded) or those who denied further investigation or to be part of study were excluded.

Comparison was done between types of complaints and age group. Age was categorized into 4 groups with each group of 20 years span separating children/adolescents, young adults, middle aged adults and elderly into different

groups. Severity of symptom was assessed into 3 grades with first grade having no symptoms, second grade with mild symptoms not bothering daily life and third grade with major concern or affecting daily life. Comparison was done with examination finding and audiogram report. Audiogram configurations were categorized as up-sloping (hearing loss affecting 250, 500 Hz more), flat (less than 20 dB difference between the highest and the lowest threshold), down-sloping (hearing loss affecting 4,000, 8,000 Hz more) and profound (thresholds of 90 dB or more in each test frequency) hearing loss.¹¹

Data was analyzed using SPSS 26 software. Descriptive statistics was presented including mean, frequency and percentage.

RESULTS

There were 386 patients who were enrolled after following inclusion and exclusion criteria. Bilateral disease was present in 156 patients (40.4%) and total ear studied were 542. Most of these patients (35.2%) were in 21-40 years age group (Table 1). In patients with unilateral disease majority were having disease in right side (58.2%). Out of 542 ears studied, 290 were having disease in right side and 252 were in left side. Contralateral ear having other forms of COM was found in 50.7% of patients with right COM healed and 43.75% of patients with left COM healed. Hence, overall 77.8% of ears were part of bilateral COM disease.

Table 1. Number of patients and ears in different age groups

| Age group (yrs) | No. of Patients | Right side | Left side | Bilateral | Total ears |
|-----------------|-----------------|------------|-----------|-----------|------------|
| <20 | 47 | 16 | 12 | 19 | 66 |
| 21-40 | 136 | 52 | 29 | 55 | 191 |
| 41-60 | 116 | 40 | 29 | 47 | 163 |
| >60 | 87 | 26 | 26 | 35 | 122 |
| Total | 386 | 134 | 96 | 156 | 542 |

Different symptoms with their severity (graded as 1, 2 and 3) in right and left ears is shown in Table 2. Most of the patients (71.2%) did appreciate hearing loss but was not of much concern. Similarly 58.6% patients complained of tinnitus but it was

not severe enough to disturb their routine life. Most of the patients didn't complain of earache while only 5.1% had troublesome earache. Out of 386 patients 210 didn't complain of dizziness while 26(6.7%) had dizziness as major concern. More than three fourth of ears (76.0%) had history of discharge in past. Mild ear itching was one of the complaints in 310 ears (57.2%).

Table 2. Different symptoms with their severity

| Symptom | Right side | | | Left side | | |
|--------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | Grade 1 (No Complaints) | Grade 2 (Slight effect) | Grade 3 (Major concern) | Grade 1 (No Complaints) | Grade 2 (Slight effect) | Grade 3 (Major concern) |
| Hearing loss | 86 | 152 | 52 | 70 | 132 | 50 |
| Tinnitus | 96 | 154 | 40 | 74 | 164 | 52 |
| Earache | 191 | 87 | 12 | 140 | 96 | 16 |
| Itching | 82 | 168 | 40 | 62 | 142 | 48 |

On examination of studied 542 ears, majority (73.0%) had both thinned tympanic membrane and myringosclerosis patch. Only myringosclerosis was seen in 14.7% and rest (12.2%) had only thinned tympanic membrane.

Pure tone audiometry showed normal threshold in 190 ears(35.0%). Out of 352 ears with abnormal audiogram, conductive hearing loss was seen in 209 (59.3%); sensorineural in 75 (21.3%) and mixed in 68 (19.3%) ears. Even normal threshold ears did have some abnormal patterns involving certain frequencies. The different audiogram patterns in 542 ears is shown in Figure 1. Up-sloping pattern with involvement of low frequency was more seen in younger age group (<40 years) while down-sloping curve involving higher frequency was seen in older age group (>40 years). Flat curve was seen in approx one fourth cases. Apart from flat, down sloping and upsloping curve, there were few curves with "V" shape, inverted "V" shape and non specific ones categorized under "other" pattern.

Pure tone average or threshold of hearing was compared in different age groups in Figure II.

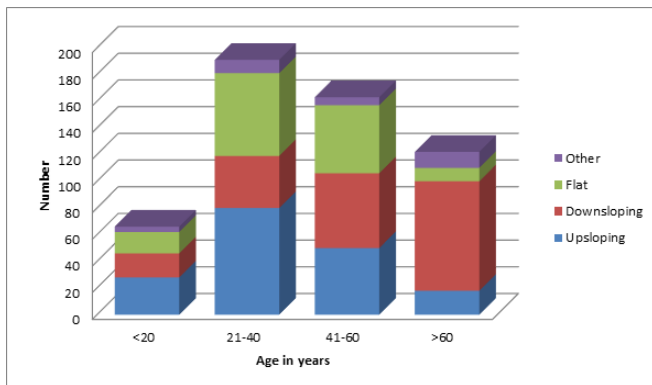


Figure I. Audiogram patterns in different age groups

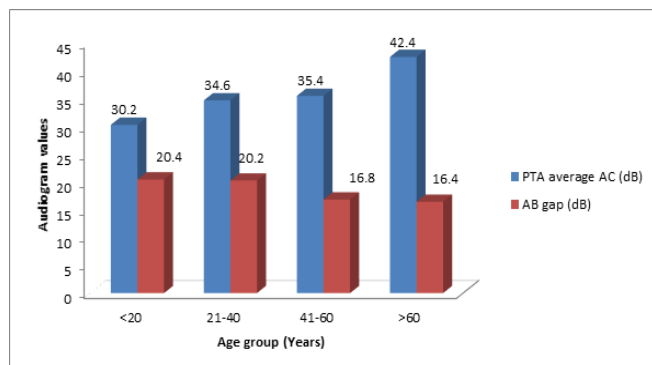


Figure II. Audiogram values (Average of AC and AB gap) in different age groups

It shows increase threshold with age, i.e: worse hearing as age increases. . Average threshold in 542 ears studied was 36.0dB. This was inversely related with Air Bone Gap (ABG). With increasing age, the gap decreased. The average ABG was 18.3%.

DISCUSSION

UK National Study of Hearing found overall prevalence of healed, inactive and active COM was 11.9%, 2.6% and 1.5% respectively.¹² There is no recent study in prevalence of COM in Nepal, but the prevalence of deafness was 16.6% of the general population in a study of over fifteen thousand people.¹³ It showed 7.2% had COM mucosal and also showed that one third of preventable deafness was due to COM. Although the classification was not as in UK study, but we can presume bulk of those COM induced deafness was due to healed COM. Other studies have also supported its strong association with permanent hearing loss and considered it as an important cause of preventable hearing loss in developing countries^{7,14,15} Ironically such a public burden and preventable disease can be easily diagnosed with otomicroscopy¹⁶ which can be

easily trained in paramedical staffs.

Jensen et al¹⁷ observed almost 40% of spontaneous healing rate in a population-based cohort study in Greenlanders. The commonest finding of those healed ears was circular atrophy indicating a healed perforation. By 18 years of age, many of the tympanic membrane abnormalities had completely resolved with exception of tympanosclerosis following ventilation tubes¹⁸ Tympanosclerosis develops in the lamina propria between the epidermis and mucosal epithelium. It consists of hyaline deposits of acellular material visible as white plaques and white nodular deposits.

COM healed and some inactive COM might undergo unnoticed especially if unilateral and in young age. With advancing age, minor contributions from these diseases add up to presbycusis and symptomatically patient becomes aware of hearing loss. Inactive COM might cause other symptoms besides hearing loss; hence COM healed is the usual silent culprit. As prevalence studies suggest COM healed being major contributor of hearing loss and there was no dedicated study in this group, COM healed was taken for study.

Age group categorization was done to segregate different groups of people with different common etiologies of hearing loss and their possible role in outcome of hearing. More than three fourth of total ears were part of bilateral COM which favors in the theory of COM being bilateral disease. COM was less common in <20 years age which is usually age of active infection and body needs some time to heal the sequel of acute or chronic infection. So COM healed is disease in young and mid adulthood stage as suggested in other studies.¹⁹

Our result of more than 70% complaining of some form of hearing loss was comparable with other studies which showed around 80% of COM has hearing loss.^{6,7} Tinnitus like hearing impairment was a common symptom, while significant earache is not the usual issue in COM healed. Although there was considerable number of patients with past history of ear discharge, we believe the proportion must be higher as some patients forget episodes of ear infection in early childhood. Healing signs of tympanosclerosis and thinned drum usually co-existed which suggests the common pathway of development of both these pathologies.

Although 65% of patients had abnormal threshold in audiometry but almost all ears have some form of abnormalities in audiogram pattern. Lower frequency was usually involved in younger people while it was higher in older age group possibly due to effect of age related hearing impairment. Similarly mean threshold was higher in advanced age while AB gap was decreasing with increasing age, all suggesting development of high frequency sensorineural loss in older age group. The proportion of sensorineural hearing loss (20.3%) is similar with study done by Yang et al in 2014 (22%).²⁰ Conductive hearing loss is caused by tympanic membrane perforation, ossicular fixation or ossicular erosion, and can be improved by surgical treatment. By contrast, SNHL is permanent, attenuated only through the use of a hearing aid. There are contrasting studies indicating both positive and negative association between COM and SNHL. Relation with duration of disease was however not defined in such studies, as duration of disease is difficult to establish due to COM healed being incidental in many instances.

WHO definition only accounts better ear result, but both ears with mild or moderate impairment affects patients' quality of life with considerable extent. The definition and grading only accounts pure tone average, hence unilateral, high-frequency or low frequency hearing losses are not considered in hearing disability. The threshold level at 25 dBHL used by the WHO also excludes slight hearing loss (15 dBHL- 25 dBHL) that can have a negative impact on school performance. Thus, in the developed part of the world 15 dBHL is commonly considered the threshold for normal hearing among children.²¹

Sometimes inflammatory processes in chronic otitis media (COM) can damage the inner ear, resulting in sensorineural hearing loss.^{8, 20} Sensory cells processing higher frequencies are more seriously damaged due to their proximity to middle ear.^{19,20, 22, 23,24} The probable cause of this may be passage of toxins through round window membrane that causes biological changes in perilymph and endolymph.²⁵ Older age increases this vulnerability.²⁶ But is this deterioration in hearing related with age or is it related with duration of disease has not been fully explained by different studies. Again, is it the effect of ototoxic ear drop patient use in active

stage is also not well explained. Few authors also pointed that this may be due to Carhart's effect and not due to disease damaging inner ear.¹ Mean value of bone conduction thresholds are significantly higher in COM ears than in healthy ears. So treatment should be considered as early as possible for patients with COM.^{1, 27, 28}

CONCLUSION

This study is first of its kind in Nepal assessing hearing impairment in COM healed. It shows that COM healed is common in middle adulthood stage and mostly associated with COM in other ear. Hearing loss and tinnitus is major complaint and more than three fourth has past history of ear discharge. Thinned drum and myringosclerosis are common pathology. Conductive hearing loss accounts to about 60% of hearing loss. Low frequency loss is common in less than 40 years and high frequency in more than 40 years. Sensorineural hearing loss is more common in older age group. The studies doesn't rule out co existing other causes of hearing loss in COM healed like otosclerosis, 8th nerve disease or middle ear mass, the evaluation of which needs further investigations.

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