Original Research Article

Audiometric analysis of different causes of hearing loss in patients attending a tertiary level hospital in India

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Abstract

Background: We sought to understand the audiometric profile of various causes of hearing loss in our patients. Patients were classified as conductive and sensorineural hearing loss along with their specific etiopathological causes.
Materials and methods: After approval of the ethics committee, we enrolled patients from our outpatient clinic that presented with complaints of hearing loss. All patients underwent general and systemic examination to ascertain the etiopathological cause of their hearing loss, followed by audiometric analysis. The data was analysed using appropriate statistical methods.
Results: 100 patients were included in our study, of which 16 had mild, 36 moderate, 28 severe and 15 had profound hearing loss. Chronic suppurative otitis media was the commonest cause of conductive hearing loss, with majority having moderate level hearing loss. Congenital causes were the commonest in sensorineural hearing loss, of which 12 had profound hearing loss.
Conclusion: Audiometric analysis helps in determining the prognostic evaluation of the patients. This study calls for similar research in different geographical locations.

Key words

Audiometric analysis, Hearing loss, Chronic suppurative otitis media, Sensorineural hearing loss.

Introduction

Hearing loss is a common problem that everyone experiences from time to time. Most commonly it occurs when flying or traveling up a mountain, and a full sensation develops in the ears, leading to the feeling of wanting to pop the ears open in order to hear better. Diminished hearing may also occur during an ear infection. These causes of hearing loss are usually short-lived. The other extreme is the permanent sensorineural hearing loss that occurs with aging, which we will all experience to some degree [1]. Hearing loss is a common chronic impairment, particularly for older adults. In the Beaver Dam cohort in the United States, the prevalence of hearing loss, defined by audiometry, increased steadily with age [2]. While evaluating the causes of hearing loss in a patient, it is important to examine the patient generally, systemically and perform audiometric analysis.

We undertook this research to study the audiometeric analysis of various pathologies which resulted in conductive and sensorineural hearing loss in our patients. The aim of this study was to study etiopathological causes of hearing loss and do audiological assessment of hearing loss due to various causes.

Materials and methods

The present study was carried out in the department of Otorhinolaryngology and Head-Neck Surgery of N.S.C.B. Medical College and Hospital, Jabalpur during a period of August 2012 to August 2013 after obtaining approval of the institutional ethics committee.

Selection of cases

The cases for this study were patients of all age group, both sexes, different religions, varying socioeconomic status, who all attended (OPD/ in patient) Department of ENT of N.S.C.B. Medical College, Jabalpur.

Method of examination and data collection

We used the following equipment for the study: bull's eye lamp, head mirror, ear speculums, tuning forks of 256, 512, 1024 Htz, Jobson Horn's Probe, Otoscope, suction apparatus, pure tone audiometer, ear cleaning swab stick and sterilized cotton, boric spirit and rectified spirit, tongue depressor, laryngeal mirrors of various size, eustachian catheter, gloves, post nasal mirror, Barany noise box, warm water, autoclaved test tube, 4% Xylocaine, Siegel's speculum, nasal speculums and wax curette. Detailed history of the patient was taken as under the various headings mentioned in the proforma. Past history, personal history, family history and other relevant history was taken. General examination included the patients' general constitution and carried out according to the various heads mentioned in the proforma. Systemic Examination: included examination of various systems of body. Local examination included the detailed examination of ear, nose and throat as under the proforma. For pathological examination the following investigations were carried out mainly, aural swab (Culture and Sensitivity), throat Swab (Culture and Sensitivity), Blood Sugar, Blood Urea, Urine (Routine and microscopy), Hemoglobin, total leucocyte count, erythrocyte sedimentation rate and coagulation profile. To know the hearing status of patient whisper test and tuning fork test were carried out. In the tuning fork test Rinne test was done with 256, 512, 1024 Hertz. Weber test was done with 512 Hertz to know the side of more damaged conductive mechanism. Absolute bone conduction was done to know the state of inner ear (512 Hertz), Gelle's test was done, as and when required. Audiometric evaluation: It was carried out in all patients, by using ELKON clinical audiometer model EDA 3N3 plus calibrated to ISO standard. Normal limit for all frequencies 0-20 dB.

Pure tone air conduction threshold: Hughson and Westlake technique "up 5-down 10" method of threshold exploration was used. Similar method was used for bone conduction threshold measurements. The better ear i.e. better cochlear reserve (as indicated by Weber test) was tested first. Cases were divided according to the degree of impairment as mild- 20-30 dB, moderate- 30-

45 dB and severe- 45-60 dB. Hearing loss of more than 90dB was considered as profound.

Data analysis

Data obtained from hospitals was codified and entered into Microsoft excel sheets. Data were then analyzed using the Statistical Package for Social Sciences (SPSS) version 21. From the software we calculated the age and gender distribution, then were able to categorise cases into conductive and sensorineural hearing loss, and calculate frequencies of those cases.

Results

This study was conducted from August 2012 to August 2013 in Department of Otorhinolaryngology and Head-Neck Surgery of NSCB Medical College, Jabalpur. During the study period 100 patients were enrolled in the study who fulfilled our inclusion/exclusion criteria. Patients were both, inpatients admitted to E.N.T. ward and those who attended ENT O.P.D. These patients underwent routine and special investigations available in the institution, wherever indicated. These cases are tabulated hare as regard to their incidence, sex distribution age of presentation and hearing loss in various ear diseases. The majority of cases i.e. 62% had conductive hearing loss while 33% had sensorineural hearing loss (**Table - 1**). 5% cases had mixed hearing loss. On audiometric analysis 16 patients had mild hearing loss of which 12 had conductive and 4 had sensorineural hearing loss. 36 had moderate hearing loss, 31 being conductive and 5 being sensorineural, 28 had severe hearing loss, 19 had conductive and 9 had sensorineural and 15 had profound hearing loss, all of which were sensorineural hearing loss (**Table - 1**). Majority of the patients (34) of conductive hearing loss were suffering from chronic suppurative otitis media (safe), 20 of which had moderate hearing loss. Another common reason of conductive hearing loss was chronic suppurative otitis media (unsafe), 11 of them had severe forms of hearing loss (**Table - 2**). None of the patients with conductive hearing loss had profound hearing loss. Similarly most common cause of sensorineural hearing loss was congenital conditions (16) of which 12 had profound hearing loss.

Table - 1: Characteristics of subjects included in the study.

Total number of patients = 100 Conductive hearing loss = 62 Sensorineural hearing loss = 33 Mixed hearing loss = 5 Males = 57		
Hearing loss	**Conductive**	**Sensory**
Mild	12	4
Moderate	31	5
Severe	19	9
Profound	0	15

Discussion

Out of 62 cases there were 3 cases of otosclerosis, 2 with severe conductive hearing loss and 1 with moderate conductive hearing loss. All cases were females who came with complaints of diminished hearing from both ears between age of 30 to 40 years. Cawthorne [3] reported that 70% of patients with clinical otosclerosis first noticed their hearing loss between the ages of 11 and 30 years. By audiometric study, it was found that average conductive loss varies from 25 to 60 dB depending upon lesion.

Among the 52 cases of CSOM studied 2 were associated with postauricular fistula / sinus. Among 52 cases 34 were of safe type and 18 were of unsafe type. Most of them belonged to lower socioeconomic status. Ear discharge and diminished hearing were main complaints in all the patients. There were associated hypertrophied tonsils in 42 cases and blocked Eustachian tube in 20 cases. Mainly moderate type of conductive hearing loss was present in cases of CSOM safe type and in unsafe type it was severe in nature. Due to lower socioeconomic conditions the incidence of CSOM is definitely higher in India and is one of the most common condition causing conductive hearing loss.

Table - 2: Causes of hearing loss in our patients.

Hearing loss	**Mild**	**Moderate**	**Severe**	**Profound**
Causes of conductive hearing loss				
CSOM safe	8	20	6	0
CSOM unsafe	0	7	11	0
ASOM	1	1	0	0
Otosclerosis	0	1	2	0
Otitis media externa	1	0	0	0
Adhesive Otitis media	0	2	0	0
Trauma	1	0	0	0
Tympanosclerosis	1	0	0	0
	12	31	19	0
Causes of sensorineural hearing loss				
Congenital	0	0	4	12
Presbycusis	0	2	5	3
CSOM unsafe	2	1	0	0
Otosclerosis	0	1	0	0
Ototoxic drugs	0	1	0	0
Post infectious	1	0	0	0
Noise induced	1	0	0	0
	4	5	9	15

(CSOM: Chronic suppurative otitis media, ASOM: Acute suppurative otitis media)

Rajendra Kumar PV [4], Kapur Y, et al. [5], found 69.7% cases of chronic suppurative otitis media in their study. The audiometric study revealed variable hearing loss depending upon the lesion. Kerrison Philip D stated that to some extent hearing is impaired in almost every case of chronic suppurative otitis media [6]. Simpson Hall found hearing loss of 45 dB to 60 dB in cases of chronic suppurative otitis media with cholesteatoma [7]. Simpson Hall stated that generally more marked the deafness, the greater are destructive changes within the middle ear. The converse must not be assumed however, as a mass of cholesteatoma may take on the function of an absent or eroded ossicle and transmit vibrations to the stapes, so that a false sense of security is conveyed. A loss of 45 dB or more where suppuration of ear is present, suggests loss of continuity in the ossicular chain.

Fredric J Pollock stated that chronic suppurative otitis media can cause hearing loss of any degree [8]. Chronic suppurative otitis media with cholesteatoma produces more hearing loss than chronic suppurative otitis media with central type of perforation. This result of Fredric J Pollock resembles the present study. In the present study in cases of chronic suppurative otitis media with central perforation, the hearing loss was mainly moderate in nature and in chronic suppurative otitis media with cholesteoma the average loss was mostly of severe type.

Kobrak [9] and Pick [10] also found that hearing loss with ossicular damage was around 60 dB. It has been noted that perforation is more common in pars tensa than in pars flaccid [11]. Central or marginal perforation of the part tensa may result in great variety of sound conduction defects. As long as the ossicular chain is not involved, hearing loss is moderate, but following interruption of ossicular chain the defect can reach upto 60 dB or more. In the present study hearing loss of severe variety was found in marginal perforation. Ballantyne, Robin and Simpson also found that posterosuperior

marginal perforation produces hearing loss of 40 to 60 dB [12]. Study conducted by Mishra et al in 103 cases of total and sub-total perforation tympanic membrane showed hearing loss ranging from 15 to 60 dB and in the present study hearing loss in cases of total perforation was 60 dB [13].

In the present study, 33 cases were of sensorineural hearing loss, out of which 16 cases were of congenital deafness. But due to lack of adequate facilities like chromosomal analysis, viral marker studies, an exact etiology could not be assigned to them. Widespread poverty and ignorance to health problems has made it difficult to elicit relevant history during pregnancy period. None of the cases had positive family history in our study.

In general clinical practice, the commonest cause of acquired bilateral sensorineural deafness is presbyacusis. Presbyacusis is the term used to describe the bilaterally symmetric deterioration of auditory function that appears to have no basis other than the general ageing process of the cellular elements of the cochlea. Presbyacusis manifests during middle age and beyond but the causative degenerative process may begin as early as the second or third decades of life. In the present study, presbyacusis accounted for about 30% cases of sensorineural deafness, next only to congenital deafness. In the present study 3 cases were of CSOM and all had unsafe disease. All had cholesteatoma on otoscopy and 33% had granulation tissue. 67% cases had severe sensorineural loss and 33% had moderate SNHL.

Sensorineural deafness is frequently associated with the conductive hearing loss of otosclerosis, but there is still argument about the exact mechanism by which it occurs. There is controversy about the concept of 'Cochlear otosclerosis'. Causse 220 reported that cochlear otosclerosis results from the release of enzymes from the otosclerotic foci which damage the inner ear [14]. It is seen more often in women than men and a sex ratio of 2:1, with an age of onset between 20 and 30 years. In our study, there was one case with advanced otosclerosis (3%), a female aged 38 year with bilateral moderate SNHL and tinnitus.

Repeated exposure to high levels of noise is a major cause of deafness, particularly in certain industrial occupations and in places of public or private entertainment where there is over amplification of sound. Industrial workers who are exposed to 85 or more decibels for 5 hours a day in about 25% of their working life have a higher chance of developing noise induced deafness. In this study we had one case of noise induced hearing loss, a male aged 55 years, who developed bilateral mild sensorineural hearing loss following exposure to machinery noise.

Conclusion

The incidence of chronic suppurative otitis media as a cause of conductive hearing loss was highest. Hearing loss of mainly moderate type was present in cases of safe type of chronic suppurative otitis media and in unsafe type it was mainly of severe type in nature. There was no case of profound hearing loss in patients with conductive hearing loss. The findings of this study calls for future research in similar patients in other geographic settings.

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