HEARING LOSS IN ELDERLY: AN INDIAN PERSPECTIVE

***Nachiketa Rout, ** Bijoyaa Mohapatra, *** Sushmit Mishra**

Abstract

The article aims to analyze audiological findings of 151 geriatric individuals with hearing loss who complained of a progressive reduction in hearing since 10 years. The degree of hearing loss corresponded to moderately severe sensory-neural hearing loss (52%). Cardiovascular diseases including high blood pressure (42%) and diabetes (17%) were the most frequently associated condition while 34% reported no known etiologies of hearing loss. Most common symptoms included difficulties in understanding conversational speech (54%) followed by tinnitus (49%), vertigo (25%) and intolerance to loud sounds (15%). The prevalent audiogram contour corresponded to a steep sloping pattern (45%). Males mostly (52%) had steep sloping high frequency hearing loss as compared to females (60%) who predominantly had a flat audiogram or gradually sloping audiogram (10%). There was a poor follow-up of 14%, most of who came with a complaint of poor benefit from the hearing aid especially in noisy situations.

The causes of hearing loss observed in these individuals are among the well known causes that are responsible for old age hearing loss. Even the audiograms obtained correspond to those of Schuknecht's audiograms. It is found that there is quite much an acceptance to hearing loss in the Indian population and intervention is sought until and unless it is found to reach a degree where it interferes with one's day to day communication.

Key words: Audiogram, speech recognition thresholds, cochlea.

Despite major advances in the ability to prolong life, there have been fewer concomitant advances designed to reduce the illnesses and disabilities attendant upon increased age. Ranking highest among age-related disabilities are those involving communication (Jacobs-Condit, 1984). Hearing loss (HL) which essentially affects oral communication is the third most common chronic condition reported by geriatric population (Lethbridge-Cejku, Schiller & Bernadel, 2002). The geriatric population is defined as population aged 60 years and above (Elango, 1998). HL that is significant enough to interfere with social function affects 25% of persons aged 65 to 74 years and 50% of those age 75 years and older (Marcincuk & Roland, 2002). In spite of the high prevalence and only about 20% of the elderly individuals in America with significant hearing impairment obtain hearing aids ; as many as 30% of the hearing aid owners are dissatisfied (Kochkin & Marke Trak, 2003) and 16% of them never used the aids after obtaining them (Kochkin & Marke Trak 2000). Hearing loss in this population needs to be addressed because of its isolating effects and the increasing geriatric age group. Population projections indicate that individuals over 65 years of age will increase to approximately 22% by the year 2050; by this time 59% of the individuals over 65 years of age will have hearing impairments (Fein, 1983). The geriatric population in India which was 6.3% in 1991 has increased to 7.5% (Census, 2001), 3.4% of this population has both speech and hearing disabilities (National Sample Survey Organization,-2003).

Studies pertaining to HL in the elderly population of India are very few and hardly conclusive. Articles concerning health problem of the geriatric often ignore HL, probably because of its invisibility, non

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acute nature and unawareness amongst both the participants and researchers. The social and medical dynamics of India is rapidly changing. The social problems have been caused by the break-up of the joint family system, housing shortages in urban areas and the increasing participation of women in the workforce. The health care of the pediatric and the especially the geriatric group which were taken care by the family is of concern. Further it's observed that age old traditional of medical systems of India like Ayurveda is losing its effect and the western mode of medication, Allopath is being preferred. Common life styles to maintain hearing prescribed by Ayurveda like putting mustard oil in the ears daily to maintain healthy hearing is strictly being prohibited by the new age doctors. Thus health issues concerned with hearing which was taken care by the traditional wisdom of the family and the traditional healers are slowly becoming the concern of the state. In this regard there is a need to understand the hearing loss and its effects which would facilitate data to address the issues and allocate resources towards them. The present study is an effort in the same direction.

This article aims to answer questions pertaining to HL in the elderly. The issues addressed include, type and degree of HL in this group, the most common symptoms, the pattern of HL, the probable etiological factors which might have precipitated the HL and the amplification device which suited most of them.

Pathophysiology A few eminent researchers including Gacek & Schuknecht (1969) have identified four sites of aging in the cochlea and divided presbycusis into four types based upon these sites. They are Sensory (cochlear) Presbycusis, Neural Presbycusis, Strial Presbycusis, and Inner ear Conductive (Mechanical, cochlear- conductive) Presbycusis (Figure 1). The histological changes are correlated with symptoms and auditory test results.

Sensory presbycusis: Type 1. Sensory presbycusis refers to the epithelial atrophy with the loss of sensory hair cells and supporting cells in the organ of Corti. This process originates in the basal turn of the cochlea and slowly progresses towards the apex. These changes are correlated with the precipitous drop in the high frequency thresholds, which begins from the middle age. The speech discrimination often is persevered. The process is slow progressive over the time.

Neural presbycusis: Type 2. It refers to atrophy of nerve cells in the cochlea and central neural pathways. Gacek & Schuknecht (1969) estimates that 2100 neurons are lost every decade (of 35,000 in total). This loss begins early in the life and may be genetically predetermined. Effects are not noticeable until old age, because pure tone average is not affected until 90% of the neurons are gone. Atrophy occurs throughout the cochlea. Therefore no precipitous drop in high frequency threshold on audiogram is observed. A disproportionately severe decrease in speech discrimination in clinical testing correlate to neural presbycusis and may be observed because HL is noted as fewer neurons are required to maintain speech threshold than speech discrimination.

Metabolic (strial presbycusis): Type 3. It results from the atrophy of the Stria Vascularis. The Stria Vascularis normally maintains the chemical and bioelectric balance and the metabolic health of the cochlea. Atrophy of the Stria Vascularis results in HL represented by flat hearing curve because the entire cochlea is affected. Speech discrimination is preserved. This process tends to occur in people aged 30 – 60 years. It progresses slowly and may be familial.

Mechanical (cochlear conductive): Type 4.This type of presbycusis results from thickening and secondary stiffening of the basilar membrane of the cochlea. This thickening is more severe in the basal turn of the cochlea where the basilar membrane is narrow. This correlates with a gradually sloping high frequency sensorineural HL that is slow progressive in nature. Speech discrimination correlates with pure tone average.

Presbycusis, referred to as hearing loss due to aging may be the most common cause of diminished hearing in the older population, but it should not be diagnosed until other potential causes of hearing loss have been ruled out (Marcincuk & Roland, 2002). Conditions that may contribute to presbycusis include atherosclerosis, chronic noise exposure, chemical exposure, diet and metabolism, and genetics (Velazuez-Villasensor et al, 2000).

Method

Participant details

The participants of the study included 151 clients, 101 males and 50 females in the age range of 60- 83 years (mean 70 ± SD: 7.2 years). All approached Ali Yavar Jung National Institute for the Hearing Handicapped (AYJNIHH, ERC), an aural rehabilitation centre in eastern India with a complained of progressive reduction in hearing sensitivity and could not attribute any cause to it. Individuals having any type of external and middle ear diseases were not included in the study.

They availed aural rehabilitation as hearing loss had become severe enough to be noticed by family and interfered a lot with day today activities. Some did not know where to go (33.11%) or (11.25%) did not have facilities to come to AYJNIHH, ERC. A few (7.28%) of the participants reported no specific reason for the delay. Twelve (7.94%) of the participants consulted otolaryngeologists for the HL. The physician attributed HL to aging and recommended hearing aid to seven while others were prescribed neuro-vitamins.

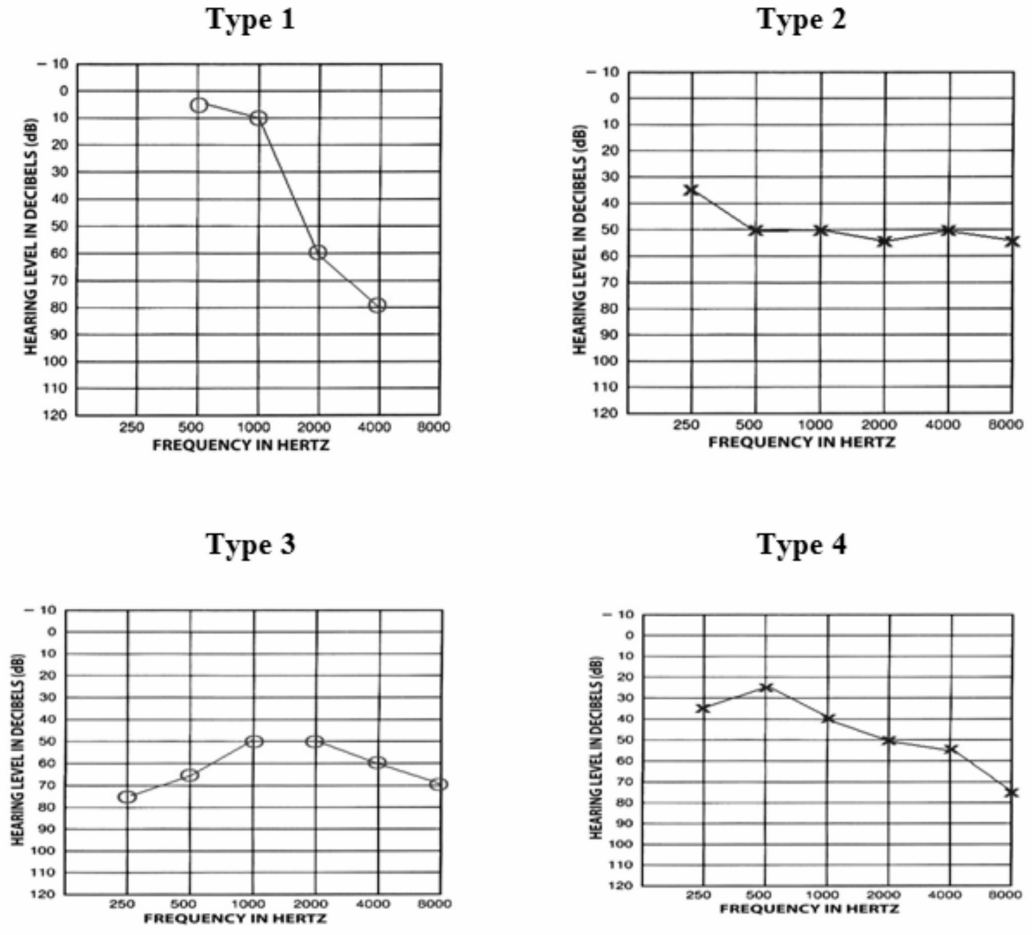

Figure1: Audiogram Type

The participants belonged to poor socio-economic strata with a monthly income below Rupees 6,500/-. The Government of India categorizes this income group as considerably poor, and provides them with free of cost hearing aids. All the participants resided in and around Kolkata, one of the metro cities of India. The symptoms of HL were noticed by the participants 10 years prior to coming to the clinic. When inquired about the reason for the delay, they frequently (48.36%) attributed it to the procrastination.

Procedure

The participants came to AYJNIHH with a complaint of hearing loss. After a detailed case history the clients were referred for an ENT and audiological evaluation. A detailed audiological evaluation protocol included pure tone audiometery along with immittance measures. Most comfortable level (MCL) and Uncomfortable level (UCL) were done for participants who complained of intolerance to loud sounds. The hearing trial followed where ever a

hearing aid was opted and recommended. Audiological evaluations and hearing aid trial was done in acoustically treated rooms with a noise level below 27dBA. The hearing aid prescription followed a counselling session in a one to one setup. The MAICO MA52 audiometer and the GSI 38 Auto-tymp immittance meter were used for the evaluations.

The clinical data, symptoms and auditory test results and were correlated and classified under four types of presbycusis as mentioned by Gacek & Schuknecht (1964). Stastistical Package for Social Sciences (SPSS) for Windows (version 10) was used for descriptive statistical analysis.

Results

During otological evaluation 28% of the participants (28 males and 15 females) had impacted wax in their ear canal which was cleared by syringing the ears before commencement of the audiological evaluations. On immittance audiometry, 92.05% of the participants had 'A' type tympanogram indicative of an apparently mobile and intact middle ear. Seal could not be obtained in three of them and six had 'As' type indicative of a relatively stiff middle ear mechanism. Only three participants had 'B' type tympanogram which is usually suggestive of a minimally mobile middle ear and may be indicative of pathology, though visual otological evaluation did not suggest the presence of any abnormality in them.

All the participants were diagnosed to be having bilateral sensory neural hearing loss mostly (52%) of moderately severe degree. The audiogram patterns of the participants were classified into four types (Type 1-4). Nine audiogram contours did not fit into any category. Majority, 45% of the audiograms corresponded to Type 1 followed by Type 3 (24.5%) and Type 4 (13.2 %), 11.2% had type 2 audiograms. Males mostly (52%) had Type 1 audiogram corresponding to a steep sloping high frequency hearing loss as compared to females (60%) who predominantly had a flat audiogram.

Many (47%) participants did not have any medical records with them. The associated conditions as reported and noted from medical records include, unknown etiology in 34% of the participants, high blood pressure was as frequent as in 42%. History of exposure to noise was reported both males (25%) and females (26%) and 17% of the participants had diabetes. These factors were in present isolation as well as in combination (figure 2). The symptoms which were more frequently reported by the participants included difficulty in understanding speech (54%) followed by tinnitus (49%), vertigo (25%) and intolerance to loud sounds (15%) etc. As reported in 13.2% of the cases, tinnitus was the primary symptoms with HL and in 36% of the cases tinnitus was associated with other symptoms (figure 3).

Most Comfortable Level (MCL) and Uncomfortable Level (UCL) were obtained using Bengali sentences for 15% clients who reported of intolerance to loud sounds. Out of the fifteen eight participants had a narrow dynamic range of 10 dB HL and less. Hearing aid trial for the eight candidates was done at different tone control positions in noisy (70 dB Broad band Noise) and in a relatively quiet room in clinic. All the eight did not complaint of intolerance to conversational speech at 'H' settings of the tone control in a quiet room. All of them preferred using the hearing aid.

A moderate class hearing aid was preferred and fitted to most (79%) of the participants. After a counseling session the participants were asked to pay a follow up visit in 3 months for re-evaluation of their hearing and the hearing aids. Only 14% participants paid a follow up visit in 1-3 months. Most of them came with a complaint of malfunction in the hearing aid or distorted output from the aid. On examination of the hearing aid by the electronic technician, 5 of them were found to be having minor problems like damaged cords or defective switches, 16 of them reported to have minimal benefit from the aid especially in noisy situation like market place or where they were in conversation with more than 2-3 persons at a time.

Discussion

With age the entire physiology of the body changes and so does the auditory system. The outer ear loses its elasticity and strength with increased activity of cerumenous glands rising the likelihood of cerumen impaction (Weinstein, 2002), as in 28% of the participants in the present study. Cerumen can accumulate significantly without any accompanying hearing loss, an occlusion of 95% and more results in significant conductive hearing loss (Roland, Marple & Meyerhoff, 1997). Middle ear was found to be considerably healthy and mobile in majority of the

participants never the less eight percent of the participants had an abnormal tympanogram of 'As' type or 'B' type. With age arthritic changes occur in the middle ear and the tympanic membrane becomes stiff (Roland et al., 1997). Degeneration and stiffening of the middle ear muscles and ossicular ligaments may be reflected as an 'As' type tympanogram although structural changes in middle ear mechanism due to aging have minimal effect on impedance test

of hearing loss and greater hearing loss severity (Agrawal, Platz & Niparko, 2008). The implication is that income and education influence access to healthcare and adequate nutrition, as well as increased exposure to adverse environmental and social conditions, which in turn impact hearing..

In the present study majority of the participants noticed hearing loss at the age of 60 years; approximately 10 years prior to coming to the clinic.

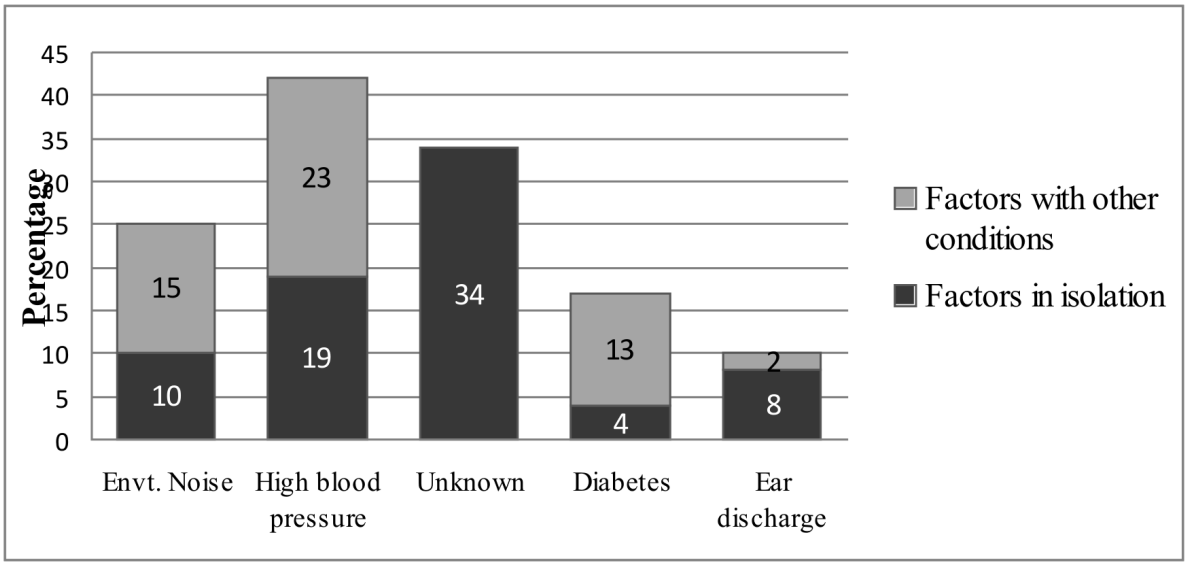

Figure 2: Distribution of associated conditions/probable etiologies.

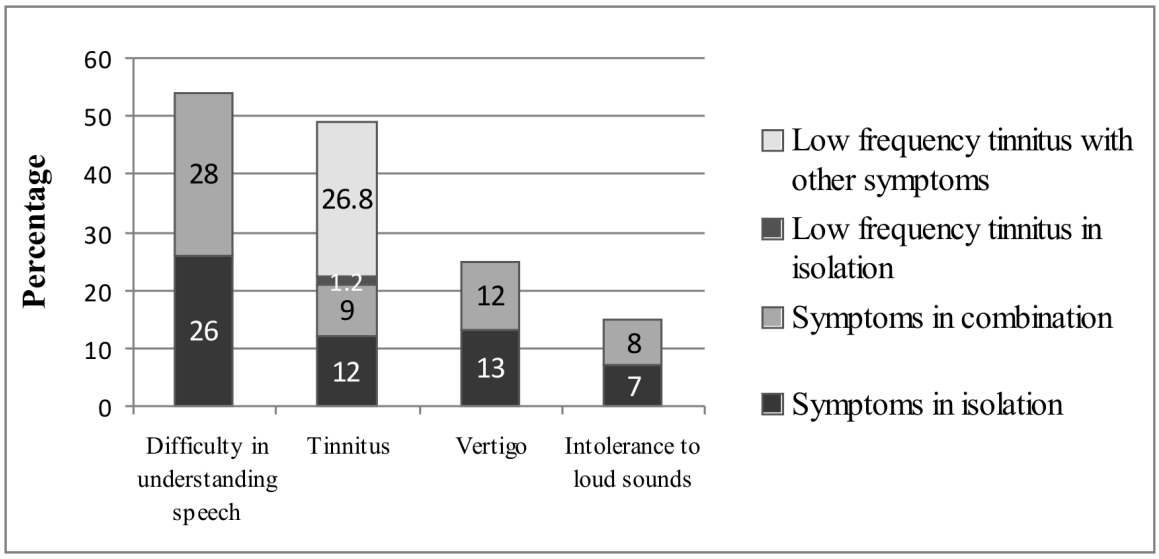

Figure 3: Distribution of symptoms

(Weinstein, 2002)

The participants in the study belonged to the lower socio economic strata and had a lower educational level. Prior studies have related low income and educational levels to a higher prevalence

During case history when it was asked "What do you mean by noticeable HL?" 83% replied, when they could not effortlessly participate in regular conversation. It seemed others mumbled and friends and family members started complaining about he/

she not being able to understand verbal commands especially when spoken from behind and name called from the other room. Most of the participants with mild to moderate degree of hearing loss presented complaint of tinnitus or vertigo rather than hearing loss. Some (3%) with mild degree of hearing loss in one ear and moderate to moderately severe degree of hearing loss in the other reported of hearing loss only in the poorer ear and perceived the better ear to be normal. The Articulation Index theory predicts the intensity of average conversational speech to be 60 dB sound pressure level (SPL) (American National Standards Institute, 1969). The low frequency vowels and diphthongs, which have an intensity of 65- 70 dB SPL (Fletcher, 1953) contributes importantly to performance on sentence material. Vital audiometric frequency region for correctly identifying sentence material is around 750 Hz and a person with high frequency hearing loss will typically experience little problems with sentence identification tasks (Hall & Mueiler, 1997). The performance of individual in social communication and linguistic skills improve with age and hence older adults tend to fill in the missing linguistic input better (Pichora-Fuller and Singh, 2006). Thus till the hearing loss progresses up to 60-65 decibels (moderately severe degree) the person does not considerably appreciate the hearing loss which is in progress since a few years. Further elderly people usually do not experience problems understanding speech in ideal listening conditions that include quiet environments and familiar talkers, as long as the speech level permits audibility of high frequency information (Dubno, Dirks & Morgan, 1984). A few, 9% of the participants had history of ear discharge in childhood but no middle ear disease was detected by the otologist. Eastern India especially the coastal belt is a hot and humid, many people living in villages still take bath in ponds. This makes them prone to middle ear infections especially during childhood.

In addition to age related degeneration, excessive exposure to occupational or recreational noise, genetic factors, eighth nerve tumor, trauma, metabolic diseases, vascular diseases, infection, ingestion of ototoxic agents (aminoglycosides, ethaerynic acid salicylates) and cardiovascular diseases (CVD) contribute to hearing loss (Weinstein, 2002). CVD has been identified as a risk factor for hearing loss in older adults (Brant et al., 1996; Susmano & Rosenbush, 1988). CVD-related potential risk factors include heart disease, hypertension, diabetes mellitus, smoking history and white blood cell count. Majority of the participants (69%) in the study had either diabetes or high blood pressure along with HL. Conversely, many researchers have not found an association between hearing loss and CVD risk factors or combinations of risk factors (Bunch, 1931, Karamitsos et al., 1996). In a recent study (Pratt & Geriatric Research Education and Clinical Center, 2009) contrary to expectations; CVD histories did not appear to influence hearing thresholds in this group of elders, suggesting that characteristics intrinsic or strongly tied to the groups in this study disposed them or made them resistant to hearing loss.

The fact that persons with diabetes have hearing impairment is a relatively recent discovery especially after diabetes induced animal studies of micro vascular changes in the inner ear including in circulation flow, narrowing capillaries and loss of outer hair cells that amplify sound energy entering the cochlea, an overall atrophy of the ganglion cells are also seen in persons with diabetes (Salvinelli et al, 2004). There is no recent research that has directly evaluated the association between CVD and cochlear function in older adults (Torre III., Cruickshanks, Barbara, Ronald & David, 2005). To date, researchers have used animal models to investigate the restriction of cochlear blood flow and its effect on DPOAEs (Distortion product otoacoustic emission) (Mom, Telischi, Martin & Lonsbury-Martin, 1999). Once the blood flow was restored, DPOAE levels returned to pre compromise levels.

In this study hearing loss in 34.34% of the participants could not be attributed to any known etiology. Brant et al, (1996) found a relationship between a large sample of older adults who were free of noise induced HL and other etiologies causing hearing related disorders. There are many physiological factors which trigger hearing loss. Conclusions of a study by Frisina (2002) signify the reduced levels of aldosterone, with age contributed to the hearing loss. Aldosterone is a hormone which is important for regulation of sodium and potassium ions in the inner ear and has protective functions. Auditory efferent feedback system starts declining in middle age in both humans and mice.

The effect of noise on hearing occurs primarily in the high frequencies above 1000 Hz. The effect of noise and hearing are difficult to separate from presbycusis since noise also causes hair cell damage and has a similar audiometric configuration (Stach, 1990). For whatsoever reason, beyond a certain age no differentiation can be made between the two. As a result, the problem of hazardous noise exposure becomes less and less important and maintenance of reasonable hygiene of the ear becomes more and more routine (Davis & Silverman, 1970).

The extent to which an individual recognizes this disability may influence his or her motivation to seek assistance through amplification or aural rehabilitation. Age related differences are observed on measures of perceived hearing disability. In a study with adults and elderly Americans with mild to moderate HL, elderly adults (65-76years) report less social and emotional impact of hearing impairment in their daily life (Gordon-Salant, Labtz, Fitzgibbons, 1994). In a large scale study of 2150 adults in Japan, there were significant age differences in self perceived hearing problems. Elderly subjects (60-79years) reported less hearing disability than middle aged subjects (40-59 years) (Uchida, Nakashima, Ando, Niino & Shimokata, 2003). These analogous studies conducted in United States and Japan has similar findings and underscores the universality of the phenomenon. In the present study during the case history interview process when the patients were inquired about their problem, some of them replied there was no problem per se; it's just that they had reduced hearing sensitivity which is usually associated with old age. Seven participants remarked (in Hindi) "ye to prakritik den hae" which means it's "by the *grace* of nature". This reflects a laid-back attitude of the elderly towards their HL and an accepted deterioration of sensory function in old age. A few of the elderly in the study reported hearing loss to be advantageous especially in some situations which they want to avoid.

The symptoms which was most frequently reported was difficulty in understanding speech (54.30%), Van Rooij, Plomp and Orlebeke, 1989 report the proportion of persons with problems in perceiving speech doubles per decade, from 16% at age 60 to 32% at age 70, to 64% at age 80. However, there are large individual differences in understanding speech in individuals over 60 years of age (Weinstein, 2002). Investigators have attempted to isolate several factors that contribute to this variability. Several hypotheses have been posited to explain the mechanism underlying speech understanding problems experienced by the older adults including the peripheral hypothesis, the central auditory hypothesis, and the cognitive hypothesis (Humes, 1996).

Vertigo and tinnitus were frequently reported symptoms. The sense of balance is largely regulated by the inner ear structures called the vestibular system. American Speech-Language-Hearing Association (1999) reports that the elderly between ages 65 and 75 who do not present any major health problem or acute balance disorder, at least 25–35% complained a significant fall annually. As many as 25% of the participants reported of vertigo and were prescribed medications for the same. Most of them recover by symptomatic treatment (Igarashi, 1984).

The principal treatment of age related HL at present is with suitable amplification (Gordon-Slant, 1994). Despite the documented benefit of amplification for elderly hearing impaired individuals (Stark and Hickson, 2004), market trend as reported by some private practitioners in West Bengal show that only 20- 25% of the population who come for hearing evaluation purchase hearing aids. Factors reported by elderly people who do not adhere to recommendations to purchase a hearing aid are cost and relatively low value placed on effective communication (Garstecki & Erler, 1999). Some who do not wear aids report the main reasons for not wearing hearing aid to be poor benefit, particularly in noise, restaurants and large group (Kochkin, 2000). The hearing aids provided by the government of India are conventional body level aids. Conventional hearing aids have relatively few options (*e.g.,* gain, output, frequency response) and few controls (*e.g.,* on/off, volume, tone) that could be adjusted by the user according to his or her situation-specific listening preferences.

In this study although all had opted for hearing aids, most of them did not follow up for re-evaluation in spite of the recommendations. Follow up is expected after a period of 3-4 months as the mostly stops functioning due to damage of cords. The drop out of patients may be attributed to various factors

like lack of use of hearing aids, lack of facilities to follow up at AYJNIHH due to distance as well as the cost of travel or on health grounds.

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