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ORIGINAL ARTICLE

An Epidemiological Study of Hearing Loss in a Peripheral Tertiary Care Hospital

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Abstract The estimated prevalence of adult onset hearing deafness in India is 7.6% and childhood onset hearing loss is 2%. But there are very few studies which highlight the prevalence of various types of hearing loss. So a retrospective, cross-sectional study in a peripheral tertiary care hospital was designed to analyze the different types of hearing loss among patients with complaints of hearing disabilities attending and assess the more prevalent type of hearing loss according to severity. Out of total study population of 14,365 patients, Male patients with Mild hearing loss have the maximum correlation coefficient followed by Moderate, Moderately severe, Profound and Severe hearing loss. In the case of female patients Mild Hearing loss has the maximum correlation coefficient. Result of this study may be helpful in planning and management of different programs related to hearing disability prevention. As most of the hearing loss is mild variety and it slowly progress to other form of severe hearing loss, early intervention is very helpful in reducing the severity thus disability.

Keywords Hearing loss · Quality of life · Disability · Deafness · Pure tone audiometry

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Introduction

Hearing is one of the special senses by which human life is blessed to enable contact with fellow humans through language. This makes the human a special social being. Hearing loss causes a great impact on quality of life and emotional problem [1–3]. Under The Rights of Persons With Disabilities (RPWD) Act 2016 [4], in India following disabilities are recognized: Locomotors (20%), Vision (20%), Hearing (20%), Speech (7%), Mental retardation (6%), Mental illness (3%), Others (18%), Multiple (8%). According to WHO report 2001, Hearing loss is the second most common cause of disability in human [5]. In India 6.3% people suffers from significant auditory loss, 4 in every 1000 baby born suffers from severe to profound hearing loss [6]. The estimated prevalence of adult onset hearing deafness in India is 7.6% and childhood onset hearing loss is 2%. But there are very few studies which highlight the prevalence of various types of hearing loss (Conductive, Sensorineural, Mixed). There is also lack of information about severity of hearing loss among these patients. Keeping this background in mind, we conducted this study. The result of this study may be helpful in

different government programs involving hearing disability prevention.

Aims & Objectives

1. To analyze the different types of hearing loss among patients with complaints of hearing disabilities attending Out Patients Department (OPD) in the targeted study area.
2. To assess the more prevalent type of hearing loss according to severity.

Materials & Methods

It is a retrospective, cross-sectional study done in Deben Mahata Government Medical College, Purulia, West Bengal, India. Pure tone audiometry records were collected from Audiovestibular clinic of Otorhinolaryngology department for the period from January 2013 to December 2019 (Total 7 years). The inclusion criteria are: a) Age > 6 years, b) Complaining of hearing loss in one or both ear irrespective of etiology. Exclusion criteria are: a) Non-habilitated profoundly deaf patients b) patients with psychiatric disorder. c) Uncooperative patients. The data collected are tabulated systematically and analyzed with the help of Excel and SPSS 21 software.

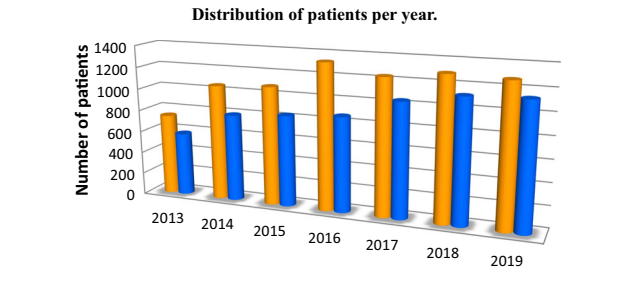
Result & Analysis

A total number of 14,365 patients were considered and corresponding audiogram had been recorded over the study period of 7 years. Average Male patient examined per year is 1141.85 with a standard deviation of 205.45. 910.28 is the average number of Female patients examined per year, with a standard deviation of 201.82 (Fig. 1).

Among them 7993 were Male and rest Female. Patients are divided into 9 Age groups, viz. Group 1 (Age 6–10 years), Group 2 (11–20 years), Group 3 (21–30 years), Group 4 (31–40 years), Group 5 (41–50 years), Group 6 (51–60 years), Group 7 (61–70 years), Group 8 (71–80 years), Group 9 (> 80 years). The distribution of male patients were as follows: Gr.1 (1107), Gr. 2 (911), Gr. 3 (1399), Gr.4 (1820), Gr. 5 (711), Gr. 6 (577), Gr. 7 (777), Gr. 8 (468), Gr.9 (223).Similarly, in case of female patients, distribution recorded as Gr. 1 (860), Gr. 2 (779), Gr. 3 (754), Gr. 4 (1448), Gr. 5 (761), Gr. 6 (319), Gr. 7 (1061), Gr. 8 (213), Gr. 9 (177) (Fig. 2).

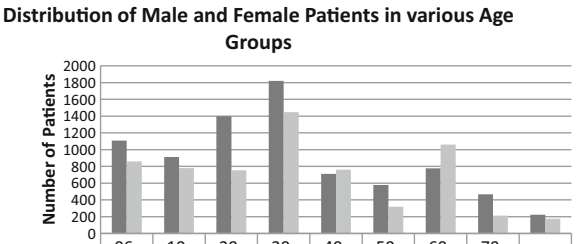
Both sexes of the study population in their respective Age group were analysed for the type of hearing loss i.e. Conductive Hearing Loss, Sensory Neural Hearing Loss and Mixed Hearing Loss. Absolute percentage of patients in each group respective to the type of hearing loss was calculated. In Male patients Conductive Hearing Loss was most prevalent in the age bracket of 10 to 20 years (33%). It fell exponentially as we progressed to the higher age brackets with none of the patients more than 80 years having conductive hearing loss. On contrary 100% patients more than 80 years age had Sensory Neural Hearing Loss. Its prevalence remained high throughout the age range. 59.71% is the minimum prevalence value of Sensory Neural Hearing Loss across the age range of the male population. It is found in the age group of 10 to 20 years. Mixed hearing loss has a high prevalence in age group of 40 to 50 and 50 to 60 years. There are two dips in its prevalence in the preceding and consequent groups (Fig. 3).

In Female patients Conductive Hearing Loss was most prevalent in the age bracket of 20 to 30 years (41.24%). It plateaued in the adjoining age range with an exponential fall as we progressed to the age brackets of more than 60 years. 100% patients more than 70 year age had Sensory Neural Hearing Loss. Its prevalence remained high throughout the age range. 49.33% is the minimum record in



	2013	2014	2015	2016	2017	2018	2019
Male	740	1056	1082	1330	1238	1296	1278
Female	578	795	833	867	1041	1122	1136

Fig. 1 Year wise distribution of the study population



	06-10 Years	10-20 Years	20-30 Years	30-40 Years	40-50 Years	50-60 Years	60-70 Years	70-80 Years	> 80 Years
male patients	1107	911	1399	1820	711	577	777	468	223
female patients	860	779	754	1448	761	319	1061	213	177

Fig. 2 Distribution of male and female patients in various age groups

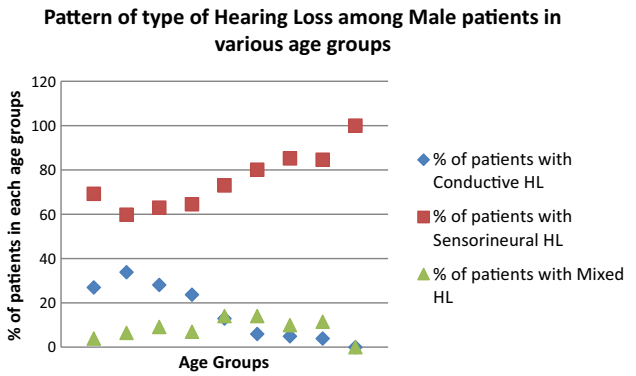


Fig. 3 Pattern of type of hearing loss among male patients in various age groups

the female population, found in the age group of 20 to 30 years. Mixed hearing loss has a low prevalence compared to the other types of Hearing Loss. Highest value of 16.68 is found in age group of 40 to 50 years (Fig. 4).

Hearing Loss was classified according to its severity as Mild, Moderate, Moderately Severe, Severe and Profound Hearing Loss. This was further tabulated with respect to its prevalence in various age groups in both male and female population. In Male population, Mild Hearing loss is most common (2925 patients) followed by Moderate Hearing Loss (1903), Moderately Severe Hearing Loss (1297), Severe Hearing Loss (1157) and Profound Hearing Loss (704). Considering Age wise distribution of the type of hearing loss it is evident that Mild Hearing loss is most prevalent in the age group of 20 to 30 years (40.81). Moderate and Moderately Severe Hearing Loss is prevalent in the age group of 70 to 80 years (31.39) and more than 80 years (30.94) respectively. Severe and Profound Hearing Loss is again more prevalent in 6 to 10 years age group (24.48 and 13.64 respectively) (Fig. 5).

In Female population, Mild Hearing loss is most common (2401 patients) followed by Moderate Hearing Loss

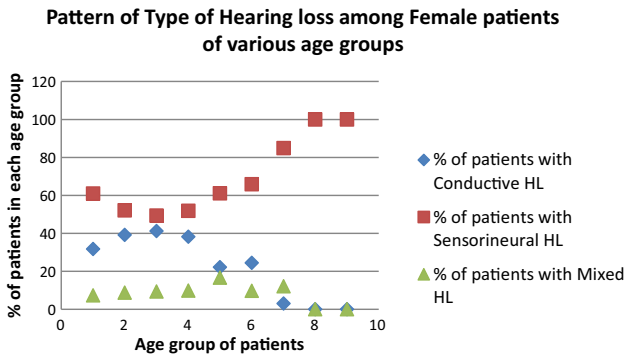


Fig. 4 Pattern of type of hearing loss among female patients of various age groups

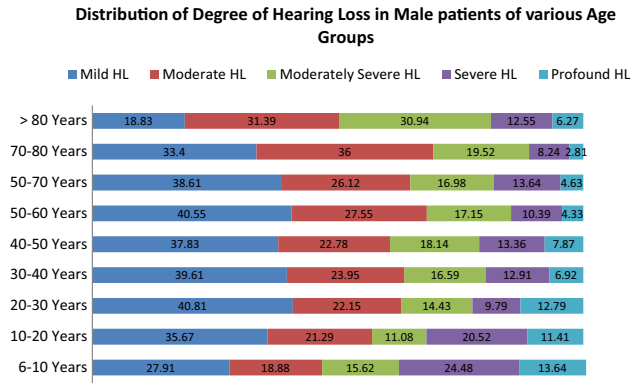


Fig. 5 Distribution of degree of hearing loss in male patients of various age groups

(1682), Moderately Severe Hearing Loss (980), Severe Hearing Loss (860) and Profound Hearing Loss (449). Considering Age wise distribution of the type of hearing loss it is evident that Mild Hearing loss is most prevalent in the age group of 40 to 50 years (46.64%). Moderate and Moderately Severe Hearing Loss is prevalent in the age group of 70 to 80 years (36.61) and more than 80 years (35.59) respectively. Severe and Profound Hearing Loss is again more prevalent in 6 to 10 years age group (25.11) and 10 to 20 years age group (11.68) respectively (Fig. 6).

At the time of considering the severity of hearing loss in case of male patients, it is clearly evident from mean value that maximum number of patients suffers from mild hearing loss (mean value of mild hearing loss in male MILDM = 325.00) and least number of patients suffer from profound hearing loss (mean value of profound hearing loss in male PROFM = 78.22). Similar result is also obtained in case of female patients. Mean value of mild hearing loss in female MILDHLF = 266.78 and profound hearing loss in female PHLF = 49.89. (Table 1, 2).

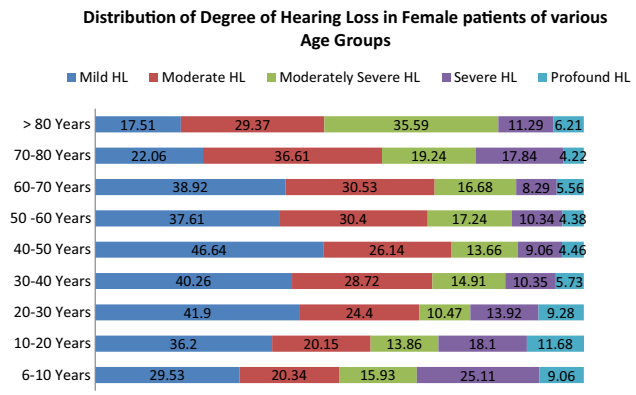


Fig. 6 Distribution of degree of hearing loss in female patients of various age groups

Table 1 Descriptive statistics for MALE individuals based on degree of hearing loss

Statistic	Total patients male (TPM)	Mild hearing loss male (MILDM)	Moderate hearing loss male(MODEM)	Moderately severe hearing loss male (MODESEVM)	Severe hearing loss male (SEVM)	Profound hearing loss male (PROFM)
Mean	887.33	325.00	211.44	144.11	128.56	78.22
Std. Error of mean	164.281	68.613	34.931	24.139	28.808	21.045
Median	777.00	300.00	194.00	129.00	106.00	56.00
Mode	223a	42a	203	69a	28a	13a
Std. Deviation	492.843	205.840	104.793	72.416	86.425	63.134
Variance	242,894.500	42,370.000	10,981.528	5244.111	7469.278	3985.944

Table 2 Descriptive statistics for FEMALE individuals based on degree of hearing loss

Statistic	TPF	MILDHLF	MODEHLF	MODESEVHLF	SEVHLF	PHLF
Mean	708.00	266.78	186.89	108.89	95.56	49.89
Std. Error of mean	138.623	59.793	39.196	19.522	21.513	11.048
Median	761.00	282.00	175.00	104.00	88.00	59.00
Mode	177a	31a	52a	41a	20a	9a
Std. Deviation	415.870	179.379	117.587	58.565	64.539	33.145
Variance	172,948.250	32,176.944	13,826.611	3429.861	4165.278	1098.611

Discussion

In our study, sensorineural hearing loss is the most common type hearing loss. Study by Dalton DS et al. also shows that the sensorineural hearing loss is more common than conductive type of hearing loss in both male and female [2].

Below 6 years age conductive hearing loss is the most common type of hearing loss [7]. This may be due the fact that most of the children suffer from recurrent attack of upper respiratory infection. This lead to frequent attack of Acute Otitis Media (AOM) and Otitis Media with Effusion (OME), Chronic Otitis Media (COM) which are responsible for more cases of conductive hearing loss in below 5 years of age group. Children of age group more than 6 years to 10 years less like to suffer from upper respiratory tract infection than lower age group. So, conductive hearing loss is less common in this age group. This leads to relative preponderance of sensorineural hearing loss.

In patients of age group 50 years and above, irrespective of male and female the proportion of sensorineural hearing loss is more compared to conductive hearing loss. This can be easily explained by age related cochlear hair cell loss.

Hearing loss prevalence in a community is difficult to obtain in country like India because lack of population based survey. In India 18% of population with hearing loss is above 50 years of age and prevalence of hearing loss in this age group is around 70% [8]. Age wise classification shows 83%, 85%, 86% of hearing losses are sensorineural type in the age group of 30 years plus, 40 years plus, and 50 years plus respectively. In our study also we found that sensorineural type of hearing loss is the most common type.

In our study it is found that most of the patients are clustered around 11–20 years, 21–30 years, 31–40 years age group contrary to the findings in developed countries where more number of patients are clusters above 50 years of age. It may be due to majority of Indian population is relatively young and less number of older population living in the society. In developed countries majority of the population with hearing loss is found in the older age group most probably due to higher life expectancy [9, 10]. In USA deafness is 8 times more common in older age group than younger population [11].

Considering gender wise distribution, the study by Guleria et al. [12] show male patient is slightly more than female patient (M: F = 0.93: 1). Study by Dawes et al. on hearing health of middle age population (40–69 years) in United Kingdom by unaided better ear speech reception threshold shows that male population in this age group have higher risk of hearing impairment than female [13]. In our study male has slight preponderance over female (M; F = 1.125: 1). This can be explained by Indian population demographic characteristics where male population

outnumbers the female population. No significant association between male and female was found by Alimohammad Asghari et al. [14]. A study conducted by Kalpana et al. [15] found that hearing loss is greater in male population than female. Even in USA, it is found that male population is more commonly affected with hearing impairment than female population. Goldman AM et al. in their study also showed that male suffer more in hearing loss than female [16].

Among the three types of hearing loss (conductive, sensorineural, mixed), the sensorineural hearing loss is the most common type of hearing loss found in the study conducted by Guleria et al [12]. In our study, from statistical calculation while calculating distribution of both male and female individuals based on type of hearing loss, it is clearly evident that maximum numbers of patient suffer from sensorineural hearing loss and least from mixed type of deafness. This may be due to gradual diminution of hearing loss due to infective etiology. Due to improvement of literacy rate, patients are taking medical help in the early stage of disease and those common offending diseases are being corrected by medical and surgical treatment. These are greatly reducing the incidence of conductive hearing loss. With rapid industrialization and lack of protective devices and strict legislation to prevent hearing loss due to industrial noise, the cochlear hair cells are being damaged progressively. This leads to progressive increase in sensorineural hearing loss. Again, uses of ototoxic drugs, sound producing musical instruments, prolonged headphone use, mobile phone use etc. are contributing to the sensorineural hearing loss. Overall result is gradual increase in sensorineural hearing loss and decrease of conductive and mixed hearing loss.

In the study by Kalpana et al. [15], conductive hearing loss is more common than other two types of hearing loss. This difference can be explained by the fact that Kalpana et al. included only the school going children only in their study. In this group conductive hearing loss is relatively common than other two types of hearing loss. Study by Bist RS et al. also showed that sensorineural hearing loss is the most common type of hearing loss [17]. Another study by Chakraborty et al. showed that sensorineural hearing loss is more prevalent than conductive and mixed type of hearing loss [18]. Study by Guleria et al. shows mild hearing loss is the most common type of hearing loss [12], whereas the study done by Bisht RS et al. shows that moderately severe hearing loss is the commonest variety of hearing loss according to severity [17]. In our study when we analyze both male and female patients in terms of severity of hearing loss, we found mild hearing loss is the most common. In older population (Age $>$ 80 years) moderate and moderately severe type of hearing loss is more common than other form of severity of hearing loss. This can be explained by the fact that in developing countries like India, majority of population are children and younger age group who mostly suffer from mild type hearing loss.

A survey on Prevalence of Minimal hearing loss in South Korea based on Korean National Health and Nutritional Examination Survey in population over 12 years of age showed minimal hearing loss to be a common problem [19]. It leads to subjective hearing loss, tinnitus and poor quality of life. WHO in their literature of global burden of disease 2019 showed 74% of hearing loss patients have mild hearing loss and 26% patients suffer from moderate to complete hearing loss in their better ear [7].

Although mild, these hearing loss can cause difficulties depending on its nature and individuals hearing needs. Goldman AM et al. in their study showed hearing loss directly affects 23% of Americans aged 12 years or older. The majority of individuals have mild hearing loss; however moderate hearing loss is more prevalent than mild hearing loss among individuals aged 80 years or older [16].

Conclusion

From our study we can conclude that (a) the most common type of hearing loss is sensorineural hearing loss and (b) mild degree of hearing loss is more common than other form of severity of hearing loss. Result of this study may be helpful in planning and management of different programs related to hearing disability prevention. As sensorineural hearing loss is the commonest and major cause of this is sound pollution, strict rules need to be implemented for preventing noise pollution. As most of the hearing loss is mild variety and it slowly progress to other form of severe hearing loss, early intervention is very helpful in reducing the severity thus disability. "So we should not be deaf for the deaf."

Author Contributions The authors assert that all the procedures contributing to this work comply with the international ethical standard guidelines as per Helsinki Declaration of 1975, as revised in 2008.

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Declarations

Conflict of interest All authors declare that there is no conflict of interest.

Ethical Approval Institutional Ethical Committee clearance was obtained for the study.

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