IRSTI 76.29.54 https://doi.org/10.26577/appmed2024v5i25

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AUDIOMETRIC PROFILE AND CLINICAL CHARACTERISTICS OF HEARING IMPAIRMENT IN ADULTS AT NANGARHAR UNIVERSITY TEACHING HOSPITAL

Abstract. Hearing loss (HL) is defined as a partial or total inability to perceive sounds in one or both ears, varying from mild to profound levels. This study aimed to determine the audiometric profile and clinical features of hearing loss among individuals who attended the Ear, Nose, and Throat Department at Nangarhar University Teaching Hospital (NUTH). This cross-sectional study involved 93 patients over a 15-month duration, from September 2023 to the end of November 2024. Adult patients aged 18 and older, presenting symptoms of hearing loss, were included in the study. Participants were divided into three age categories: 18-39 years (11.8%), 40-59 years (34.4%), and 60 years and older (53.8%). Males were 58.06%, and females were 41.93%. Individuals aged 60 and older showed the highest frequency of hearing loss, mostly with sensorineural hearing loss (40.86%), mixed hearing loss (8.60%), and conductive hearing loss (4.30%). Regarding laterality, 25.8% of patients had unilateral impairments, while 74.19% experienced bilateral hearing loss. Diabetes mellitus was present in 30.1% of the population, while hypertension affected 35.48%. Regarding the severity of hearing loss, 30.10% reported mild hearing loss (26-40 dB), whereas moderate hearing loss (41-55 dB) represented 32.25%. Profound hearing loss (91 dB or greater) was uncommon, occurring in 2.15% of cases. Tinnitus was reported by 37.63%, while vertigo was observed in 13.97%, predominantly among individuals with sensorineural hearing loss. The research revealed that hearing loss is prevalent among individuals over 60 years of age, primarily of sensory-neural origin, frequently associated with tinnitus and vertigo. Bilateral hearing loss was more prevalent than unilateral hearing loss, particularly in individuals with comorbidities such as diabetes and hypertension.
Key words: Aging, Audiometry, Hearing loss, Type.

Introduction

The prevalence of hearing loss increases with age; approximately 25% of those aged 60 and above experience disabling hearing loss. By 2050, it is projected that a minimum of 700 million individuals will require hearing rehabilitation, while more than 2.5 billion people will experience some form of hearing loss. Unhealthy listening habits endanger almost 1 billion youth, exposing them to irreparable and preventable hearing damage. Approximately 430 million persons, including over 5% of the global population, including 34 million children, require rehabilitation for the management of their disabling hearing loss[1].Age-related hearing loss is progressive, common, and linked to poor cognitive and physical health outcomes[2]. Hearing impairment frequently receives insufficient attention or may remain undetected; however, given its high prevalence and significant impact on the quality of life for individuals with intellectual disabilities, it is crucial to address this issue[3]. Hearing impairment is a condition that may appear at any age, and the associations between specific risk factors and hearing impairment could develop with older age. The etiology of hearing impairment is complex and diverse; that includes the combined impact of factors such as aging, genetics, epigenetics, environmental factors, health comorbidities, dietary habits, and lifestyle, along with the complex interactions among these elements that may contribute to its development[4]. Despite the considerable frequency of hearing loss, numerous adults fail to find sufficient or early medical attention for their hearing impairments[5].Preventing hearing loss is crucial throughout all life stages, from gestation and the perinatal period to advanced age.Most causes of adult hearing loss, such as excessive noise exposure and ototoxic drugs, are preventable[1].Untreated hearing loss can lead to depression, social isolation, and lower quality of life[6]. To reduce the adverse effects of HL and improve outcomes for those affected, early detection and intervention are essential[7].

Pure-tone audiometry (PTA) over daily listening frequencies can detect hearing loss degrees, config-

urations, and types. The medical team can evaluate the cause, prognosis, and most effective treatment for hearing loss with this understanding[8]. PTA is an effective auditory assessment for finding an individual's hearing threshold levels and for diagnosing the degree, type, and configuration of hearing loss. PTA is a subjective and behavioral assessment of the auditory threshold determined by an individual's response to pure tone stimuli[9].

The annual investment must be less than US$ 1.40 per person in order to expand aural and hearing care services worldwide. Countries with low or middle incomes are home to nearly 80% of individuals who experience debilitating hearing loss[1]. The prevalence and underlying factors contributing to hearing loss among the adult population in low-to-middle income countries, including Afghanistan, are not well-explored. This study aimed comprehensive descriptive analysis of hearing loss in individuals visiting Nangarhar University Teaching Hospital in Afghanistan. The studyfocused the demographics, audiometric profile, and clinical manifestations of hearing loss within this population.

Aim: This study aimed to determine the audiometric profile and clinical characteristics of hearing loss in individuals attending the ear, nose, and throat department of Nangarhar University Teaching Hospital.

Materials and Method

Study Design

This cross-sectional study involved 93 patients at the Otolaryngology Department of NUTH throughout a 15-month duration, from September 2023 to November 2024. Adult patients aged 18 and older, presenting symptoms of hearing loss, were included in the study. The data collection included complete history, clinical examination, and PTA.

Data Collection

A standardized data-collecting form was used to record demographic and medical information, as well as audiometric data. The variables of interest included age, gender, occupation, and type of hearing loss (conductive, sensorineural, or mixed), as well as related clinical symptoms such as tinnitus or vertigo. Patients who had active otitis media, recent ear trauma, or insufficient clinical data were excluded. The study comprises all patients at the NUTH Audiology Unit who have complaints or confirmed cases of hearing loss. We collected data from the Cello©*Inventis* computer-based audiometer database. Following collection, data were input into Microsoft Excel and analyzed using SPSS 22.

Hearing Assessment

Pure Tone Audiometry was performed in a quiet environment utilizing a calibrated audiometer, following established protocols. Air conduction (AC) and bone conduction (BC) thresholds were assessed at frequencies from 250 Hz to 8 kHz. It has been used to assess auditory thresholds at frequencies of 250Hz, 500Hz, 1000Hz, 2000Hz, 4000Hz, and 8000Hz, in accordance with the guidelines established by the American Speech-Language-Hearing Association (ASHA).(https://www.asha.org)[10]. PTA was conducted in adults and youngsters capable of responding to instructions. Audiograms were utilized to determine the type of hearing loss by measuring the degree of hearing loss in each ear and identifying air-bone gaps (ABG). PTA was conducted just for patients identified with hearing impairment by clinical assessment and tuning fork testing. In this work, we utilized the Cello, a computer-based diagnostic audiometer, to conduct pure tone audiometry (PTA). Hearing loss was categorized according to the World Health Organization (WHO) grading system. The average thresholds for each ear at 500, 1000, and 2000 Hz, known as the pure tone average, have been calculated for audiogram interpretation[9, 11].

Statistical Analysis

The data were analyzed descriptively using means, frequencies, and percentages to summarize the characteristics of hearing loss in the study population. The data was analyzed using SPSS version 22 statistical software. Descriptive statistics were employed to describe demographic variables, clinical characteristics, and audiometric findings. Continuous variables, including age and audiometric thresholds, were expressed as mean ± standard deviation (±SD), whereas categorical variables, such as the type and degree of hearing loss, were represented as frequencies and percentages.

Ethical Considerations

The study adhered to the ethical standards outlined in the Declaration of Helsinki. Participants provided informed consent before participation.

Result

The study comprised 93 participants, divided into three age categories: 18-39 years (11.8%, n=11), 40-59 years (34.4%, n=32), and 60 years and older (53.8%, n=50). The average ages for these groups

were 29.54 ± 4.66, 48.12 ± 3.72, and 66 ± 2.95 years, respectively. Males represented 58.06% (n=54), whereas females comprised 41.93% (n=39).

The predominant occupational categories were housewives (29.03%, n=27) and unemployed individuals (22.58%, n=21). Farmers represented 9.67% (n=9), while other professions contributed less, including teachers (6.45%, n=6), shopkeepers (6.45%, n=6), policemen (6.45%, n=6), and drivers (5.37%, n=5). Other occupations, including cleaners, doctors, engineers, nurses, and mechanics, include fewer individuals.

Regarding laterality, 25.8% of patients demonstrated unilateral difficulties, while 74.19% presented with bilateral hearing loss. Diabetes mellitus was observed in 30.1% (n=28) of the population, while hypertension was present in 35.48% (n=33) (see Table 1).

Table 1 – Characteristics of the Studied Population

Study Participants,N= 93		Age Categories							
		18-39 years N= 11 (11.8%)		40-59 years N=32 (34.4%)		60≥ year N=50 (53.8)		Total (%)	
		Frequencies	Percentages	Frequencies	Percentages	Frequencies	Percentages	Frequencies	Percentages
Age (mean ±SD)		29.54± 4.66		48.12 ±3.72		66± 2.95			
Gender	Female	2	2.15	16	17.2	21	22.58	39	41.93
	Male	9	9.67	16	17.2	29	31.18	54	58.06
Occupations	Cleaner	0	0.00	1	1.07	1	1.07	2	2.15
	Doctor	0	0.00	1	1.07	2	2.15	3	3.22
	Driver	3	3.22	1	1.07	1	1.07	5	5.37
	Engineer	1	1.07	1	1.07	0	0.00	2	2.15
	Farmer	0	0.00	1	1.07	8	8.60	9	9.67
	House wife	1	1.07	6	6.45	20	21.5	27	29.03
	Unemployed	0	0.00	8	8.60	13	13.97	21	22.58
	Mechanic	2	2.15	0	0.00	1	1.07	3	3.22
	Nurse	1	1.07	0	0.00	0	0.00	1	1.07
	Officer	1	1.07	2	2.15	3	3.22	6	6.45
	Shopkeeper	0	0.00	6	6.45	0	0.00	6	6.45
	Student	2	2.15	0	0.00	0	0.00	2	2.15
	Teacher	0	0.00	5	5.37	1	1.07	6	6.45
laterality	Unilateral	9	9.67	10	10.75	5	5.37	24	25.8
	Bilateral	2	2.15	22	23.65	45	48.38	69	74.19
Comorbidities	Diabetes Mellitus	5	5.37	9	9.67	14	15.05	28	30.1
	Hypertension	0	0.00	14	15.05	19	20.43	33	(35.48)

The audiometric and clinical characteristics of the study population demonstrated different types of hearing loss across different age groups and severity levels. In the study group of participants aged 18-39 years, 11.82% (n=11) exhibited hearing loss, which includes sensory-neural hearing loss (9.67%, n=9) and conductive hearing loss (2.15%, n=2). No cases of mixed HL were reported in this group. Among individuals aged 40–59, 34.40% (n = 32) exhibited hearing loss, mainly of the sensory-neural type (23.65%, n = 22), followed by conductive (6.45%, n = 6) and mixed hearing loss (4.30%, n = 4) (Table 2).

Individuals aged 60 and older showed the highest prevalence of hearing loss, with 53.76% (n=50) affected. The predominant types were sensory-neural hearing loss (40.86%, n=38), mixed hearing loss (8.60%, n=8), and conductive hearing loss (4.30%, n=4) (Figure 1).

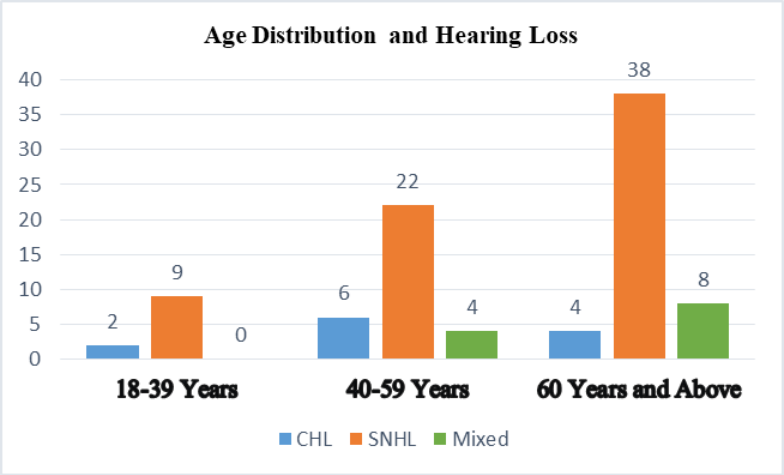

Figure 1 – Hearing loss among different age groups

In terms of hearing loss severity, 30.10% (n=28) exhibited mild hearing loss (26-40 dB), while moderate hearing loss (41-55 dB) included 32.25% (n=30). Moderate to severe hearing loss (56-70 dB) was observed in 24.73% (n=23) of cases, while severe hearing loss (71-90 dB) was noted in 10.75% (n=10). Profound hearing loss (91 dB or higher) was uncommon, observed in 2.15% (see Table 2).

Tinnitus was reported by 37.63% (n=35) of the population, with sensory-neural hearing loss showing the highest prevalence at 29.03% (n=27).

Vertigo was observed in 13.97% of cases, predominantly among patients with sensorineural hearing loss (8.60%), followed by those with mixed hearing loss (3.22%) and conductive hearing loss (2.15%) (table 2).

Sensory-neural hearing loss was the predominant type observed, particularly among older individuals, indicating that hearing loss advances with age. Tinnitus was the most common associated symptom, with the majority of cases classified as mild to moderate hearing loss.

Table 2 – Audiometric Profile and Clinical Characteristics

Study Participants, N= 93		Type of Hearing loss (HL)						Total (%)
		Conductive HL N=12 (12.9%)		Sensory Neural HL N=69 (74.2%)		Mixed HL N= 12 (12.9%)		
		N	%	N	%	N	%	
Age (mean±SD)	18-39 years (29.54± 4.66)	2	2.15	9	9.67	0	0.00	11(11.82)
	40-59 years (48.12 ±3.72)	6	6.45	22	23.65	4	4.30	32(34.40)
	60≥ years (66± 2.95)	4	4.30	38	40.86	8	8.60	50(53.76)
Hearing Loss Degree	Mild HL (26-40dB)	4	4.30	18	19.35	6	6.45	28(30.10)
	Moderate HL(41-55dB)	3	3.22	27	29.03	0	0.00	30(32.25)
	Moderate to Severe HL (56-70dB)	3	3.22	17	18.27	3	3.22	23(24.73)
	Severe HL (71-90dB)	1	1.07	6	6.45	3	3.22	10(10.75)
	profound HL(91 dB and above)	1	1.07	1	1.07	0	0.00	2(2.15)
Complaints	Vertigo	2	2.15	8	8.60	3	3.22	13(13.97)
	Tinnitus	5	5.37	27	29.03	3	3.22	35(37.63)

Discussion

The age distribution of participants in this study was significant, with a notable 53.8% aged 60 and older, highlighting the higher frequency of age-related hearing loss. Presbycusis, or age-related hearing loss, can appear in the fourth decade of life and becomes more common with older age[12].The increased proportion of older persons in our study lines up with the expected demographic distribution of age related hearingloss, as the prevalence of hearing loss increases with age[13]. This age distribution shows the relevance of age in hearing health research and clinical practice.

Males were 58.06% of the study's population with hearing loss, while females were 41.93%. This gender distribution differs from particular findings reported in the other studies. Ude *et al.*reported that among newly diagnosed adults, the male-to-female ratio was 1:1.83, suggesting a greater prevalence of hearing loss in females[14]. Anwar *et al.* similarly found that males were more prone to hearing impairment than females, with a male-to-female ratio of 2.54:1[15]. On the other hand, Shin and Hwang (2017) found that the correlation between mental health issues and hearing impairment varies based on age and gender. Older males with hearing loss showed a higher likelihood of depressive symptoms, while older females with hearing loss revealed a greater likelihood of suicidal thoughts [16]. However, the recent study found a higher frequency among men. These variations point out the need for additional research to better understand the link between gender and hearing loss.

According to the current knowledge about age-related hearing loss, individuals aged 60 and above showed the highest prevalence of hearing impairment, predominantly because of sensory-neural hearing loss. Presbycusis, often known as age-related hearing loss, is a common condition marked by a gradual decline in auditory function due to aging [17]. Various factors, including the cumulative effects of noise exposure, age-related alterations in the inner ear, and additional medical conditions, have been proposed to account for this issue[18]. The frequency of sensory-neural hearing loss in this older age group aligns with the typical pattern of age-related hearing loss, mostly affecting the auditory nerve or inner ear. This study highlights the prevalence of hearing loss in older individuals; however, further research is necessary to delineate the specific subtypes of sensorineural hearing loss and their underlying causes within this demographic [19]. The particular requirements of older individuals with hearing loss can be addressed by utilizing this understanding to inform the development of management strategies and interventions. Moreover, research on the impact of HL on the cognitive capacities and overall quality of life of older individuals is essential for developing complete treatment options [18].

The distribution of hearing loss severity in this study demonstrated that moderate hearing loss was prevalent in the sample, accounting for 32.25%. A significant percentage of individuals (30.10%) reported mild hearing loss (26–40 dB). Kapoor et al. (2023) address a range of issues resulting from different levels of hearing loss, highlighting the importance of appropriate treatments and support services. The overall distribution of hearing loss severity in the population aligns with the slightly lower prevalence of profound hearing loss [20].

The literature showed an important connection between tinnitus and sensorineural hearing loss (SNHL), evidenced by the high prevalence of SNHL among individuals with tinnitus (29.03%). Multiple studies have demonstrated a correlation between sensorineural hearing loss and tinnitus. Tinnitus was identified as a prevalent symptom in individuals with auditory neuropathy spectrum disorder in a study conducted by Muthukumar *et al*[21]. Similarly, research on patients with chronic suppurative otitis media (CSOM) demonstrated a significant correlation between high-frequency hearing loss and tinnitus, even in individuals demonstrating normal cochlear function as per conventional audiometry[22]. This study reveals that tinnitus is less prevalent than in other studies. A South Korean study found that 92.1% of persons with mild hearing loss experienced annoying tinnitus[6]. Heterogeneous study populations, tinnitus criteria, and cultural difficulties in symptom reporting may explore this variation.

The prevalence of diabetes mellitus and hypertension among those who have hearing loss was found to be approximately 30.1% and 35.48 %, respectively, according to the findings of the study. These findings raise significant questions regarding the probable links between these two conditions. A large number of studies have been conducted to investigate the relationship between diabetes and hearing loss, and the findings indicate that those who have diabetes are more likely to experience hearing loss[23].The neurological and microvascular effects of diabetes,

which could damage the vulnerable structures of the inner ear, may explain this relationship[24].It is probable that hypertension and diabetes, might cause vascular damage in the inner ear, resulting in hearing loss; however, the exact cause of this link is not known[25]. Future research should concentrate on assessing the impact of diabetes, hypertension, and additional cardiovascular risk factors on hearing loss. This will assist researchers in understanding the complex connections that exist among different medical diseases and hearing loss.

Conclusion

The study revealed that hearing loss is more common in those over the age of 60, and it is primarily sensory-neural in nature, often accompanied by tinnitus and vertigo. Bilateral hearing loss was more common than unilateral hearing loss, as were coexisting conditions such as diabetes and hypertension. The majority of patients had moderate HL, highlighting the need for comprehensive hearing healthcare services and specific treatment for this population.

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Date of receipt of the article: December 3, 2024.
Accepted: December 20, 2024