THE EFFECT OF SENSORINEURAL HEARING LOSS ON BALANCE IN OLDER ADULTS IN THE AGE RANGE OF 50 TO 60 YEARS.

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ABSTRACT: The present study focuses on effect of sensorineural hearing impaired individual's vestibular balance in the age range of 50 and 60 years.100 participants underwent pure tone hearing test to determine whether they had any hearing loss or ear illnesses, and then a videonystagmography was used to assess their vestibular balance. All of the people had the audiological examinations, which included immittance testing, speech audiometry, and pure-tone audiometry. Each participant executed the Dix-Hall pike and VNG for the posturographic assessment. The current study's findings showed that 1) Balance issues were less common in those with normal hearing, while they could occur in healthy adults between the ages of 50 and 60. 2) The presence of vestibular balance difficulties varies with each hearing level. It was concluded that the vestibular balance of healthy people between the ages of 50 and 60 varies depending on the condition of their vestibular system, and that the vestibular balance of people with hearing loss between the ages of 50 and 60 varies depending on the severity of their hearing loss.

Key Words: immittance testing, speech audiometry, pure-tone audiometry, Dix-Hall pike, VNG

I. INTRODUCTION

In order to maintain balance, the vestibular-ocular reflex, vestibule-colic reflex, and vestibule-spinal reflex must work in concert with sensory input from the proprioceptive system, visual system, and vestibular system. It is not surprising that people with sensorineural hearing loss experience some aberrant vestibular symptoms given the close proximity of the cochlea to the vestibular system and the germ layers they share. In children without considerable hearing loss, the prevalence of vertigo and balance issues was reported to be 5.7% and 5.3%, respectively, while in 186 children with hearing loss, 38% had some degree of vestibular loss. Adults most frequently reported having poor coordination (46% of the population), light headedness (35.1%), poor balance (30.9%) and vertigo (29%), as well as frequent falls (25%). It was discovered that the frequency of dizziness symptoms increased with the severity of hearing loss and that dizziness symptoms also increased with ageing. Dizziness and balance issues can result from abnormalities in any vestibular system, vestibulo-spinal, vestibulo-ocular, or vestibulo-collic reflex pathways, which control balance. Otolith organs, semi-circular canals, and the neuronal pathway make up the vestibular system. Audiological tests such as the Rotational Chair Test, Video Head Impulse Test, Electronystagmography (ENG)/Videonystagmography (VNG) test battery, and Vestibular-Evoked Myogenic Potential (VEMP) can be used to evaluate the functioning of the otolith organs (the utricle and the saccule) and semi-circular canals (vHIT). The otolith organ and vestibular nerves are evaluated using the tests cervical vestibular evoked myogenic potential (cVEMP) and ocular vestibular evoked myogenic potential (oVEMP). cVEMP, which was recorded from the sternocleidomastoid (SCM) muscles, provides details on the inferior vestibular nerve and the saccule. Utricle and superior vestibular nerve are revealed by oVEMP data taken from extraocular muscle. Numerous studies have examined the audio-vestibular findings in people with normal hearing and those who have hearing loss, but they have limitations in terms of the study group they took into account. Most frequently, communication and social relationships are considered when examining the effects of hearing and HL on common daily activities. It seems sense that a hearing impairment would have a negative impact on balance if hearing and sound did play a role in balance management. Hearing loss has been linked, in part, to poorer postural control, to self-reported falls (Lin and Ferrucci, 2012) and decreased mobility (Viljanen et al., 2009). The vestibular, visual, auditory, and motor systems, among others, must work in intricate harmony with one another to maintain balance. For maintaining postural balance in the elderly, who use their visual and vestibular systems less effectively, the auditory system is more important. Therefore, the goal of the current study was to explore the relationship between SNHL and postural balance in older people of both sexes. The elderly with and without sensorineural hearing loss are the subject of numerous research to determine posturographic analyses (Daiane 2020). Analysis of the vestibular system in sudden sensorineural hearing loss with vertigo (Jung 2020).

II. REVIEW OF LITERATURE

To explain these correlational findings, several nonexclusive and non-exhaustive ideas have been proposed, particularly in the context of ageing. In 2009, Anne and colleagues published a study on the link between hearing and postural balance. The goal of this study was to see if hearing acuity predicts falls and if the potential link can be explained by postural balance, as well as whether these associations are based on common genetic or environmental factors. Hearing was assessed using a clinical audiometer in 103 monozygotic and 114 dizygotic female twin pairs aged 63 to 76 years as part of the Finnish Twin Study on Aging and postural balance was indicated as a centre of pressure (COP) movement in semi tandem posture. The twin analyses revealed that the link between hearing acuity and postural balance was not explained by genetic characteristics common to both qualities, according to the study. People with poor hearing acuity are more likely to fall, which is explained in part by their lack of postural control. For safe mobility, auditory information about the environment may be useful.

In individuals with idiopathic sudden sensorineural hearing loss, Jia et al. (2017) looked at the relationship between the severity of hearing impairment, vestibular function, and balancing function. 35 individuals in total, including 21 with vertigo, were enrolled. Audiometry, a sensory organisation test, a caloric test, a cervical vestibular-evoked myogenic potential test, and an ocular vestibular-evoked myogenic potential test were all performed on each patient. In both patients with and without vertigo, the aberrant rate of the oVEMP test was the highest, followed by the abnormal rates of the caloric and cVEMP tests. .

Vitkovic, Lee, and Clark (2016) published a study on the effects of hearing and hearing loss on balance control. The concept that a hearing map of the surroundings is employed to maintain balance control was tested in this study. They used centre of pressure analysis to explore the effects of sound on postural sway in 50 patients with normal hearing, 28 with hearing loss, and 19 with vestibular dysfunction. Sound cues were either present or absent in the acoustic situations. Auditory cues were discovered to be used by subjects with normal hearing to improve postural sway. The ability to utilize sound for postural control is diminished when there is a hearing loss, but this appears to be overcome by the use of a hearing aid. Patients with more vestibular impairments use auditory cues to a greater extent, implying that sensory weighting to improve auditory cue utilisation could be used when sensory redundancy is reduced.

Sensorineural hearing loss, is a severe public health issue. There is some evidence that there is a link between sensorineural hearing loss and balance issues. Rubens and colleagues (2020) published Posturographic Analysis in the Elderly with and without Sensorineural Hearing Loss. The researchers wanted to see if there was a link between SNHL and postural balance in older people of both genders. A total of 247 physically independent senior people (166 women) were included in the study .The anamnesis and pure tone audiometry were employed for hearing loss, and a force platform based on assessments of centre of pressure area and sway velocity in the anteroposterior and mediolateral directions was utilised for balance. And the result revealed that elderly individuals with SNHL exhibited more instability on the postural balance, and elderly men presented worse results in the test.

Jia Liu Et al. released a study (2017) called Assessment of balance and vestibular functions in individuals with idiopathic sudden sensorineural hearing loss. The severity of hearing impairment, vestibular function, and balance function in patients with idiopathic abrupt sensorineural hearing loss were studied in this study. A total of 35 idiopathic abrupt sensorineural hearing loss patients were included, with 21 of them having vertigo. Audiometry, sensory organisation test, caloric test, cervical vestibular-evoked myogenic potential test, and ocular vestibular-evoked myogenic potential test were all performed on all of the patients. There was a significant correlation between vertigo and hearing loss grade, as well as between sensory organisation test VEST grade and hearing loss grade. The oVEMP test had the highest abnormal rate, followed by the caloric and cVEMP tests, not just in individuals with vertigo but also in those who did not have vertigo. In patients with vertigo, the vestibular end organs were more vulnerable to injury compared with patients without vertigo. There was a link between the presence of vertigo and the SOT VEST grade. Patients with vertigo may have more severe cochlear and vestibular damage than those who do not. The dysfunction of the vestibular end organs does not always cause vertigo.

Michelle and colleagues conducted research on asymmetrical hearing loss and vestibular dysfunction in the Korean National Health and Nutrition Survey in 2019. The goal of this study was to see if asymmetric hearing loss had an impact on vestibular function. The researchers examined data from the 2010 Korean National Health and Nutrition Survey for people aged 40 and up. The modified Romberg test was used, as well as pure-tone audiometry. Adults with asymmetric hearing loss should be regularly examined since low-frequency asymmetric hearing thresholds often combine with vestibular impairment.

A study on the otolithic organs' hidden malfunction in people with profound sensorineural hearing loss was conducted by Xin Et. al (2015). The study included 20 healthy individuals and 29 patients with profound sensorineural hearing loss. Medical records for the patients were gathered and examined. We evaluated and studied the ACS-evoked oVEMPs, cVEMPs, and caloric test. When compared to healthy volunteers, who both had 100% oVEMP and cVEMP response rates, individuals with profound sensorineural hearing loss had response rates of 38.9% and 44.4%, respectively. Both oVEMPs and cVEMPs exhibit the utricular and saccular dysfunction that can be hidden in patients with significant sensorineural hearing loss. In the identification and management of profound sensorineural hearing loss, otolithic function should be taken into consideration. For the detection of concealed otolithic organ dysfunctions in patients with significant sensorineural hearing loss, VEMPs are particularly valuable.

III. METHOD

The present study focuses on effect of age on sensorineural hearing impaired individual's vestibular balance. This cross-sectional experimental study is adopted to investigate the influence of hearing loss on postural parameters and balance measures across 50-60 age range. All the participants selected for the study gave their consent to take part in the study.

Objectives of the study

1. To compare the vestibular balance of normal individuals in the age range of 50 to 60 years.
2. To compare the vestibular balance of hearing impaired individuals in the age range of 50 to 60 years.

Participants

Participants in this study were recruited for a single group study in the Indian population. A total of 100 people were included in the study's sample, with 20 having normal hearing and 80 having sensorineural hearing loss in the age range of 50 to 60 years. All the adults in the sensorineural hearing loss group had minimal to profound hearing loss with varied etiology of hearing loss (hereditary, acquired and unknown). A detailed case history was taken from all the participants and the caregivers regarding their auditory, neurological and otological problems. The audiological tests including pure-tone audiometry, speech audiometry and immittance evaluation were administered on all the adults.

Inclusion criteria

Individuals with a history of balance disorders or complains of imbalance and/or clinical signs related to vestibular disorders, individuals with traumas or individuals taking medications that could alter postural parameters or the central nervous system, or individuals with chronic muscular-skeletal pathologies were exclude from investigation. Additionally, individuals with recent surgical history was also be excluded from the study. Participants with sudden hearing loss was also exclude from investigation.

Data collection and Analysis

The participants were to undergo a hearing examination to address the presence of hearing impairments or diseases of the ear and subsequently, vestibular perception through a videonystagmography. All recordings were carried out in a quiet environment. All hearing examinations were administered by the same audiologist.

Audiometric assessment

Pure-tone air- and bone-conduction average thresholds were measured for the frequencies 0.25–0.5–1–2–4–8 kHz for both left ear and right ear and the air measures was used to classify hearing loss degree. The assessment was undertake in a sound-isolated booth. All patients should be free of otologic diseases. All recordings were carried out in a quiet environment with the participants seated in a comfortable supine position.

Postural assessment

For the posturographic assessment, each participant performed the Dix-Hall pike. A dizziness screening test must be completed prior to performing the Dix Hall pike. The procedures conducted before balance performance assessment was explained orally to the normal individuals and for those with hearing loss, by the researcher. The subjects were asked to pay close attention to the researcher's instructions regarding how balance performance would be assessed and the nature of their participation. After the instructions given, the subjects were asked if they understood how to take part in the assessment and tests. When there is any doubt, the instructions would be repeated and the assessment was initiated once there are no further questions. The Dix-Hall pike test was the gold-standard test for the diagnosis of BPPV involving the posterior semi-circular canal (PC-BPPV). While seated on the examination table, the subject's head was turned 45° toward the side to be tested. The subject was then moved en bloc to a supine position, ending with the head hanging 20° -30° below the examination table. The Dix-Hall pike test should be performed with caution in patients with a history of neck surgery, cervical radiculopathy, and vascular dissection syndrome, since it requires rotation and extension of the neck during the positioning. The examiner observed the body movement and balance. This completed the first stage. Next, the researcher will be asked to close their eyes and stand for 30 seconds. The examiner will check the body movement and balance. This completed the second stage. The subject of the VNG test sat in a dim examination room while putting a unique pair of goggles. On a TV screen, the subject was directed to observe lights move, or the subject was instructed to move their body and head in specific ways. The eye movements in reaction to various actions were recorded by the goggles.

The researcher recorded all the findings for the 20 normal participants as well as in individuals with sensorineural hearing loss (SNHL) for further investigations. The data was then subjected to statistical analysis using Statistical Package for Social Sciences vs.20.

IV. RESULT AND DISCUSSION

The present study displays the descriptive statistics frequencies, percentages and graphs were obtained for participants with normal hearing and sensorineural hearing loss with various degrees for left and right ears, including selected parameters on the VNG reports. The cross tabulations (Contingency tables) with frequencies and percentages were obtained between degree of hearing loss and VNG report. The whole statistical analysis was carried out using SPSS version 20. The present study focuses on effect of age on hearing impaired individual's vestibular balance. The objectives of the study were to compare the vestibular balance of normal individuals among 50- 60 age groups, to compare the vestibular balance of hearing impaired individuals among 50-60 age group and to compare the effect of hearing loss on vestibular balance.

4.1. *Descriptive statistics of left ear and VNG.*

Table 4.1.1: Left ear - Degree of hearing loss with respect to VNG report

Variables	Normal VNG	Left lateral canal BPPV	Left posterior canal BPPV	Right lateral canal BPPV	Right posterior canal BPPV	Total
Normal hearing	10(50.0%)	1(5.0%)	2(10.0%)	1(5.0%)	6(30.0%)	20
Minimal	3(12.5%)	4(16.7%)	4(16.7%)	7(29.2%)	6(25.0%)	24
Mild	5(21.7%)	5(21.7%)	3(13.0%)	5(21.7%)	5(21.7.0%)	23
Moderate	5(31.3%)	3(18.8%)	0	2(12.5%)	6(37.5%)	16
Moderately severe	0	4(57.1%)	0	0	3(42.9%)	7
Severe	1(16.7%)	1(16.7.0%)	3(50.0%)	0	1(16.7%)	6
Profound	2(2.0%)	0	1(25.0%)	1(25.0%)	0	4
Total	26(26.0%)	18(18.0%)	13(13.0%)	16(16.0%)	27(27.0%)	100

According to this statistical analysis which is shown in Table 4.1.1, 50 percent of the 20 normal subjects had normal VNG. This suggests that those with normal hearing were less likely to experience balance problems. So this was supported by a findings in a study conducted by Lin and Ferrucci (2012), who examined data from the National Health and Nutritional Examination Survey and found that people with hearing loss had a markedly increased likelihood of recently experiencing a fall. From Table 4.1.1 it also evident that two subjects had left lateral canal BBPV and right lateral BBPV, respectively, which may have been caused by their frequent morning dizziness. Six out of 20 subjects had right posterior canal BPPV, while two persons displayed left posterior canal BPPV. This suggested that individuals with normal hearing might be at risk of developing BPPV, but there were no significant research to confirm this conclusion.

Three participants had normal VNG in the case of minimal hearing loss, whereas four subjects experienced left lateral canal BPPV and left posterior canal BPPV. According to statistical analysis, right lateral canal BPPV was more common in patients with minimal hearing loss which is evident in Table 4.1.1.

Out of 23 participants with mild hearing loss, 5 each had Normal VNG, Left Lateral Canal BPPV, Right Lateral Canal BPPV, and Right Posterior Canal BPPV. The results were in line with a study conducted by Karthik and Ahalya (2020), which found that

patients with mild hearing loss had benign paroxysmal positional vertigo in the left posterior canal and complained of feeling heavy and dizzy. It is also apparent from Table 4.1.1 that three individuals experienced BPPV in the left posterior canal. These findings are supported by a study conducted by Uneri and Turkdogan, who assessed the vestibular functions of 34 subjects who had experienced vertigo attacks. They reported that four of the patients had mild sensory neural hearing loss (SNHL) in the frequencies of 250, 500, and 1000 Hz. Two had BPPV diagnoses, while two had vestibulopathy diagnoses. In a study on the relationship between hearing and postural balance, Anne and colleagues discovered that patients with poor hearing acuity are more prone to fall, which might be partly attributed to their lack of postural control (2009).

According to Table 4.1.1, five individuals with moderate sensorineural hearing loss had normal VNG, thus there is a potential that individuals might not experience balance problems. Three persons, who each experienced a left lateral canal BPPV, showed that those with moderate sensorineural hearing loss may be at risk for developing BPPV. This is possibly due to ageing. There were no participants with left posterior canal BPPV. Right posterior canal BPPV affected 6 persons while right lateral canal BPPV affected 2 people, which might be due to Meniere's disease. The results carried out by Ewan et.al (2018) supported the hypothesis that hearing loss negatively impacts postural control, which affects the anterior-posterior sway, although it does not appear that hearing loss has an impact on the neck's activation methods or range of motion. Erik et.al (2022) also lends credence to the findings; they discovered that even a moderate SNHL may be connected to an abnormal vestibular response.

None of the individuals with moderately severe hearing loss had normal VNG, indicating that these people had balance problems. Four of the seven patients had BPPV in the left lateral canal, and three had it in the right posterior canal.

According to Table 4.1.1, three of the six participants who had left posterior canal BPPV showed signs of severe hearing loss and were therefore more likely to experience balance problems. Out of the four participants who had profound hearing loss, two had normal VNG which is also evident in Table 4.1.1. It is apparent from Table 4.1.1 that the VNG responses were 25% for both the right lateral canal BPPV and left posterior canal BPPV, indicating that those with profound sensorineural hearing loss may experience vestibular balance difficulties. The percentage of semi-circular canal dysfunction in patients with profound sensorineural hearing loss was significantly higher than that in healthy volunteers, according to Xu et.al (2016) study, which provided support for the findings. According to Hong et al. (2008), the incidence of saccule involvement rises with the severity of hearing loss. They discovered that 26.9% of adult patients with profound sensorineural hearing loss exhibit aberrant responses.

The statistical analysis across the types of hearing loss revealed that respondents with mild to severe hearing loss experienced higher balance problems than subjects in other categories. Chuan et.al (2018) from Journal of Preventative Medicine suggests that there is an association between hearing loss and the risk of falls in both children and adults.

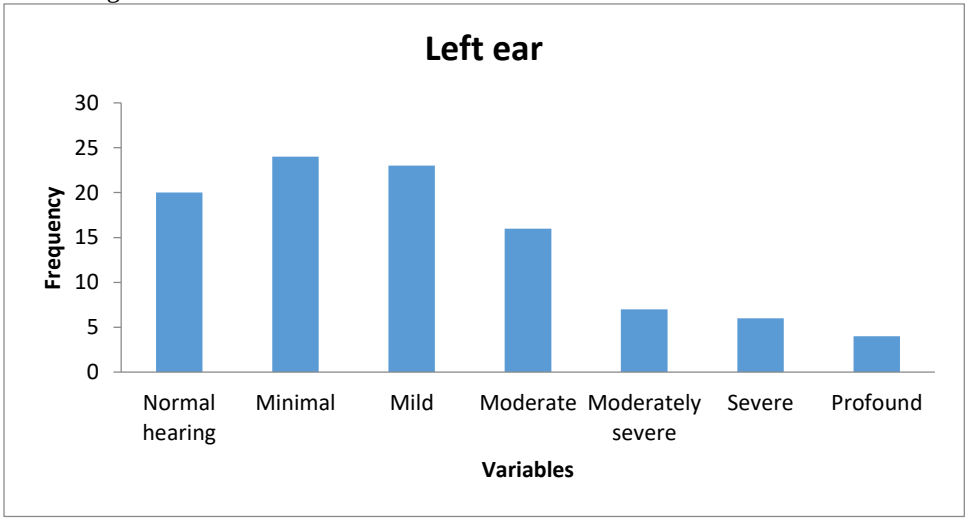

Figure.4.1.1. Descriptive statistics, the Comparison between the left ear and VNG

According to the statistical analysis of fig 4.1.1, those with minimal sensorineural hearing loss had a greater presence of BPPV (25%), which suggests that they experienced more balance problems than those with other losses in the left ear. Additionally, as seen in fig 4.1.1, those with profound sensorineural hearing loss experienced fewer BPPV (4%) cases which indicates that they experienced less balance issues.

4.2. *Descriptive statistics of left ear and VNG*

Table 4.2.1: Right ear - Degree of hearing loss with respect to VNG report

Variables	Normal VNG	Left lateral canal BPPV	Left posterior canal BPPV	Right lateral canal BPPV	Right posterior canal BPPV	Total
Normal hearing	10(50.0%)	1(5.0%)	2(10.0%)	1(5.0%)	6(0.0%)	20
Minimal	2(8.3%)	5(20.8%)	4(16.7%)	7(29.2%)	6(25.0%)	24
Mild	4(28.6%)	3(21.4%)	1(7.1%)	4(28.6%)	2(14.3%)	14
Moderate	5(23.8%)	5(23.8%)	2(9.5%)	1(4.8%)	8(38.1%)	21
Moderately severe	0	4(44.4%)	0	1(11.1%)	4(44.4%)	9

Severe	3(37.5%)	0	3(37.5%)	1 (12.5%)	1(12.5%)	8
Profound	2(50.0%)	0	1(25.0%)	1(25.0%)	0	4
Total	26(26.0%)	18(18.0%)	13(13.0%)	16(16.0%)	27(27.0%)	100

Participants' results on the degree of sensorineural hearing loss for the right ear in relation to the VNG report are discussed in the sections below. In the case of right ear out of 20 patients, 50% people had normal VNG, as shown in Table 4.2.1, suggesting that those with normal hearing have fewer balance problems. The individuals had higher right lateral canal BPPV (29.2%) when their right ear had only a minimal hearing loss. Four of the 14 patients with mild hearing loss had normal VNG and right lateral canal BPPV which might due to age factor. In Table 4.2.1, it is clear that 23.8% of the reports for moderate sensorineural hearing loss in the right ear were normal. Only five of the 21 patients with severe hearing loss had normal VNG and left lateral canal BPPV, however Table 4.2.1 shows that more patients had right posterior canal BPPV. Four individuals with moderately severe hearing loss each had BPPV in the left lateral and right posterior canals. Out of all participants, 37.5% exhibited normal VNG and BPPV in the left posterior canal but had severe sensorineural hearing loss. BPPV is less frequent (12.5%) in cases with severe sensorineural hearing loss. According to Table 4.2.1, two of the four participants with profound hearing loss had normal VNG, one had left posterior canal BPPV (25%) and the other had right lateral canal BPPV. There are contradictory research that support these findings. According to Homa et.al (2020), patients with profound sensorineural hearing loss frequently experience otolithic dysfunction, which is often undiagnosed. Another study which was given by Xu et.al (2016) found that utricular and saccular dysfunctions can be concealed in patients with profound sensorineural hearing loss.

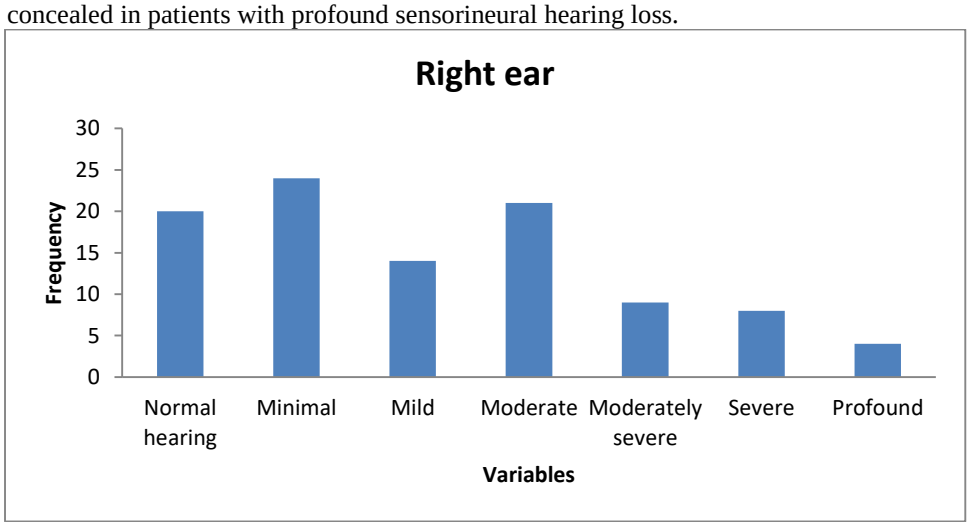

Figure.4.2.1. Descriptive statistics, Comparison between the right ear and VNG

The statistical analysis of fig 4.2.1 shows that those with minimal sensorineural hearing loss had a greater presence of BPPV (24%) in the right ear, suggesting that they had more balance issues than those with other losses. Those with moderate hearing loss also had a greater presence of BPPV (20%) in the right ear. Furthermore, as shown in fig 4.2.1, people with profound sensorineural hearing loss had less episodes of BPPV (4%) in their right ear, which may suggest that the participants did have histories of balance problems. Michelle and colleagues (2019) conducted research on asymmetrical hearing loss and vestibular dysfunction in the Korean National Health and Nutrition Survey and it concluded that adults with asymmetric hearing loss should be regularly examined since low-frequency asymmetric hearing thresholds often combine with vestibular impairment.

4.3: ***Descriptive statistics of hearing loss and VNG***

Table 4.3.1: Left ear - Types of hearing loss with respect to VNG report

Variables	Normal VNG	Left lateral canal BPPV	Left posterior canal BPPV	Right lateral canal BPPV	Right posterior canal BPPV	Total
Sensorineural hearing loss	16(20.0%)	17(21.3%)	11(13.8%)	15(18.8%)	21(26.3%)	80
NA	10(50.0%)	1(5.0%)	2(10.0%)	1(5.0%)	6(30.0%)	20
Total	26(26.0%)	18(18.0%)	13(13.0%)	16(16.0%)	27(27.0%)	100

Table 4.3.2: Right ear - Types of hearing loss with respect to VNG report

Variables	Normal VNG	Left lateral canal BPPV	Left posterior canal BPPV	Right lateral canal BPPV	Right posterior canal BPPV	Total
Sensorineural hearing loss	16(20.0%)	17(21.3%)	11(13.8%)	15(18.8%)	21(26.3%)	80
NA	10(50.0%)	1(5.0%)	2(10.0%)	1(5.0%)	6(30.0%)	20

Total	26(26.0%)	18(18.0%)	13(13.0%)	16(16.0%)	27(27.0%)	100

Participants with sensorineural hearing loss demonstrated a higher right posterior canal BPPV (26.3%) in both ears compared to those with normal hearing, as shown in Tables 4.3.1 and 4.3.2. Additionally, Table 4.3.1 and Table 4.3.2 show that participants with sensorineural hearing loss (50%) have higher normal VNG reports in both ears than subjects with normal hearing (20%), indicating that those with sensorineural hearing loss are more likely to have balance issues. Hong et al. (2008) found that 26.9% of adult patients with sensorineural hearing loss exhibit abnormal balance responses and suggested that the frequency of saccule involvement increases with the severity of hearing loss. Jia et al.(2017) looked at the relationship between the severity of hearing impairment, vestibular function, and balancing function and found that in both patients with and without vertigo the occurrence of balance issues were highest. Additionally, Rubens and colleagues' (2020) posturographic analysis study of elderly people with and without sensorineural hearing loss and concluded that older people with SNHL showed increased postural instability, and elderly men performed worse on the test.

The absence and impairment of VNGs demonstrated the otolithic dysfunction and vestibular balance issues. However, in the analysis of the medical records of all of the 100 patients in this study, neither the patients nor the doctors noticed balance problems or otolithic dysfunction. Consequently, otolithic damage, which has a high incidence among patients with profound sensorineural hearing loss, is hidden (Xin et al, 2015).

The findings suggested that normal people in the 50–60 age group might have balance problems. According to data, 30% of persons have right posterior canal BPPV, which may be caused by a history of viral infections. Additionally, BPPV can develop in those who only sleep on one side. The fact that 50% of the 20 normal participants had normal VNG results suggests that there is a lower likelihood of developing vestibular balance problems than other hearing loss. Patients with BPPV present with recurrent episodes of vertigo that last less than 1 minute and are provoked by changes in head movements relative to gravity.

The current study only looked at people between the ages of 50 and 60, but due to high cognitive function, lifestyle habits, and brain connections, not everyone of this age group displayed balance problems. Balance and cognitive performance are interrelated in middle-aged and older persons (Tao et al 2020). According to Renea et al. (2015), cognitive processing has a significant impact on balance and gait and contributes to falls in older persons. He discovered that cognitive training is a viable strategy for preventing falls since it reduces the loss of balance and enhances gait while distracted.

V. CONCLUSION

The findings suggested that normal people in the 50–60 age group might have balance problems. According to data, 30% of persons have right posterior canal BPPV, which may be caused by a history of viral infections. The fact that 50% of the 20 normal participants had normal VNG results suggests that there is a lower likelihood of developing vestibular balance problems than other hearing loss. Patients with BPPV present with recurrent episodes of vertigo that last less than 1 minute and are provoked by changes in head movements relative to gravity. People with minimal sensorineural hearing loss had a greater presence of BPPV (24%) in the right ear, suggesting that they had more balance issues than those with other losses. Those with moderate hearing loss also had a greater presence of BPPV (20%) in the right ear. Furthermore, people with profound sensorineural hearing loss had less episodes of BPPV (4%) in their right ear, which may suggest that the participants did have histories of balance problems. But not all degree of hearing loss subjects were having balance issues.

Future research is warranted to further confirm the cause-effect relationship of sensorineural hearing loss and balance among middle-aged and older adults and its influencing factors in intervention studies with larger sample size. The study's limitations include the absence of information on the impact of hearing loss and gender balance, the use of only one age group, and the exclusion of socioeconomic factors. The fact that all participants were Indian restricts the applicability of our findings to groups that are not Indian.

This study can be applied clinically to swiftly determine the prevalence of vestibular problems in adults between the ages of 50 and 60. It gives a basic idea of the vestibular balance issues that persons in this age range who can hear properly experience. It also helps audiologists find suitable amplification options for those with balance and hearing problems.

VI. ACKNOWLEDGMENT

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