



FIVE-YEARS PREVALENCE OF VESTIBULAR DISORDERS, AS SEEN IN A TERTIARY CARE HOSPITAL

Kumaran Thirunavukkarasu^{1*}, Jayashri Padmanaban¹, S.A. Ramsankar¹

¹Department of Audiology and Speech-Language Pathology, SRM Medical College Hospital and Research Centre, Kattankulathur, Chengalpattu District-603203, Tamil Nadu, India.

*Address Correspondence to: Kumaran Thirunavukkarasu, Assistant Professor, Department of Audiology and Speech-Language Pathology, SRM Medical College Hospital, and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District-603203, Tamil Nadu, India.

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ABSTRACT

Vestibular disorders can affect the peripheral or central vestibular systems, controlling and maintaining balance. Several studies have confirmed the high prevalence rate of vestibular disorders in other countries. To our knowledge, only one study has been conducted on benign paroxysmal positional vertigo in eastern India, and limited knowledge on other vestibular disorders in the country. Hence, the present study was conducted at SRM hospital, Kattankulathur, Chengalpattu District, Chennai, Tamil Nadu, India, to estimate the overall prevalence of vestibular disorders in a tertiary care hospital between January 2016 and December 2020. The prevalence was identified through a register-based study that examined the case files of those who visited SRM Hospital with complaints related to balance and analyzed them in a retrospective manner. The present study found that 392 individuals with vestibular disorders were among the 214,004 clients. Thus, the prevalence of vestibular disorders according to the present study is 0.18 percent. The salient results of the present study were: Adults are more likely to experience vestibular disorders 323 (0.15%) children 1 (0.0004%), and, adolescents 7 (0.003%). Therefore, the prevalence of vestibular disorders is higher in adults than in other age groups. Prevalence of vestibular disorders was higher in women 236 (0.11%) than in men 156 (0.07%). The prevalence of vestibular disorders based on different types reveals that 311 (0.14%) BPPV is the most prevalent type, followed by 30 (0.014%) Meniere's and 15 (0.007%) vestibular neuritis.

KEYWORDS: vestibular disorder, Prevalence, Tertiary care hospital.

1. INTRODUCTION

The vestibular disorder is a partial or complete deficit of the Balance System. There are two types of vestibular disorders which can be classified by the site of lesion: peripheral and central. [1] Vestibular disorders may affect the individual quality of life and day-to-day activities. [2,3] In addition, it is associated with several conditions such as motion illness, [4] anxiety, [5,6] migraine [7], and faints. [8] The symptoms of the vestibular disorders are dizziness, nausea, headache, vomiting, tinnitus, ear fullness, disequilibrium, nystagmus, hearing loss, physical distress, unsteady gait, fatigue, and oscillopsia. [1, 9, 10] The prevalence of vestibular disorders is greater in women compared to men. [11-13] An epidemiological survey on 70,315,919 populations from 123 health insurance Companies data were collected in Germany reported that the prevalence of peripheral vestibular disorder was significantly more in women (65.4%) than in men (34.6%). [9] Also, the prevalence rate reported by Huppert et al. (2012) was significantly greater in women (37.5%) compared to men (27.5%). [14] The prevalence of vestibular disorders increases as the age increases, vestibular disorders in geriatrics are more prevalent than in adults, and adults with vestibular disorders are greater in number compared to children

and adolescents. [11, 15-18] The prevalence of vestibular dysfunction among the US population based on the data of the National Health and Nutrition Examination Survey (NHANES) from 2001 to 2004, showed 35% of US adults had vestibular dysfunction and 85% of geriatrics (80 years and above) had vestibular dysfunction. [9] An epidemiological study in the US also revealed that almost 69 million people from the US are affected by vestibular dysfunction. [20] According to Von Brevern et al. (2007), the prevalence of benign paroxysmal positional vertigo was seven times greater in the geriatric population than in young adults below 40 years. [21] Despite this, a German study showed a prevalence rate of 2.4% for BPPV, of which 1.6% were men and 3.2% were women. [22] A questionnaire-based study was conducted among children to find the prevalence of vestibular disorders and they found that the prevalence range falls between 0.7% and 15%. [18, 23, 24] Nevertheless, a study on 700 children to estimate the prevalence of vestibular pathology revealed 19% of them had benign paroxysmal vertigo of childhood (BPVC), and 18% of the children had vestibular migraine. The prevalence rate of children versus adolescents differs by age, but in elementary school children, the prevalence rate is similar for benign paroxysmal vertigo of childhood (BPVC) and vestibular



migraines (VM), with a prevalence rate of around 30%. Age is indirectly related to Benign Paroxysmal Vertigo of Childhood (BPVC) and Vestibular Migraine (VM).^[25] In distinctive countries, the prevalence of Meniere's disease was found to be superior in the range of 17 to 513 per 100,000 individuals.^[26-30] The prevalence of Meniere's disease was higher in the adult population between 30 years and 50 years of age compared to the children.^[31] The prevalence of Meniere's disease increases as age increases and it affects women more than men.^[32] In the United Kingdom, the prevalence was found to be one in every 1,000 people, with women being affected more than men.^[33] Meniere's disease affects the majority of people between the ages of 40 and 60, but it can occur at any age.^[34] The prevalence of semi-circular canal dehiscence dived concerning three semi-circular canals, results stated that the prevalence of superior semi-circular canal dehiscence was 0.5% to 12.4%^[35-38] lateral and posterior semi-circular canal dehiscence was 1.7% and 1.2%, however, male were affected greater than female.^[39] According to Neuhauser the prevalence rate of vestibular neuritis falls between 3% and 10%.^[12] The prevalence of vestibular migraine was estimated in several countries, In the United States nationwide study was carried out based on the ICHD-3 to estimate the prevalence of vestibular migraine and they reported that 2.7% of the adults were affected with vestibular migraine.^[40] However, in Germany larger population-based study reported that 1% was the prevalence rate of vestibular migraine^[12] community-based study revealed middle-aged women were found to be prevalent in vestibular migraine is 5%.^[42] A survey conducted by the German health system found 6 to 7% of the individuals who visited neurological clinics had vestibular migraine and 9% of the individuals who visited migraine clinics had vestibular migraine.^[43] An epidemiological study in the US found that the prevalence of acoustic neuroma was 1 per 100,000 in a year.^[44] In Japan, a medical records-based retrospective study in the general hospital revealed, that 2.6% of the individuals with asymmetrical sensorineural hearing loss were affected by acoustic neuroma.^[45] A Taiwan population-based study revealed that 2,833.4 per 100,000 affected by peripheral vestibular disorders, 446.4 per 100,000 with benign paroxysmal positional vertigo, 70.4 per 100,000 reported with Meniere's disease, 307.2 per 100,000 reported with vestibular neuritis, 2009.5 per 100,000 stated with others or unspecified peripheral vestibular dizziness and they mentioned peripheral vestibular disorders prevalence rate was greater in females compared to the male population and as the age increases the prevalence of peripheral vestibular disorder also increases.^[11] In the Indian context, only one Retrospective study was done concerning the prevalence of Vestibular disorder in eastern India and reported that out of 685 vertigo patients 172 were diagnosed with Benign Paroxysmal Positional Vertigo disorder from 23 to 76 years of age.^[46] There is confirmation of the high prevalence rate of vestibular disorders in other countries.^[9, 47] Hence it is important to know the prevalence of vestibular disorders in tertiary care hospitals in the Indian context. To our knowledge only one study was carried out about the prevalence of Benign Paroxysmal Positional Vertigo disorder in India, Due to limited availability of information about the prevalence of

vestibular disorders in India, the present study aimed to find out the prevalence of vestibular disorders from January 2016 to December 2020 in a tertiary care hospital.

2. METHOD

The goal of this study was to find out how common vestibular diseases are in a tertiary care hospital. The present study was carried out in the Department of Audiology and Speech-Language Pathology, SRM Medical College Hospital, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Chennai, Tamilnadu. In the present study, a register-based study design was used and a retrospective case analysis was done to find the prevalence rate of vestibular disorders from January 2016 to December 2020.

2.1. Participants

During the retrospective analysis, the case files of those individuals who visited the Audiology and ENT OPD from January 2016 to December 2020 with the complaint of giddiness (or) vertigo (or) balancing problems were reviewed.

2.2. Procedure

The Department OPD Register was used to determine the total number of people who visited the Department during the above-mentioned period. Information about the person's age, gender, and the number of people who visited the Department OPD with a complaint of giddiness, balance problem, or vertigo was collected. OPD registers with individuals who reported the complaint of giddiness, balancing problems, or vertigo to find the information such as a primary and secondary complaint of each person, duration of the giddiness, type of the giddiness, age, and gender of the individuals, and medical history of the person. Individuals who visited the department of Audiology with the complaint of giddiness, balancing problems or vertigo had undergone a complete audiological and vestibular assessment.

The Audiological assessment carried out in the department included detailed case history of the particular individuals. Clinical history was used to ascertain the nature, frequency, and triggering mechanism of attacks. Information on concomitant visual and neurological problems was also gathered, along with relevant medical history. Pure tone audiometry testing was done using the Modified Hughson Westlake procedure^[48] Thresholds were measured at octave intervals between 250 Hz and 8000 Hz and 250 Hz to 4000 Hz for air conduction and bone conduction testing respectively. Speech Audiometry test (SRT & SIS) in live voice presentation, using the standardized speech materials concerning the patient's mother tongue, such as Spondee words and Phonetically Balanced words were used at 20 dB SPL (re: PTA) and 40 dB SL (re: SRT) for Speech Recognition Threshold and Speech identification Score. Acoustic Immittance (Tympanometry & Acoustic Reflex) Tympanometry was performed by using a probe tone frequency of 226 Hz at 85 dB SPL, to test the reflex thresholds 500, 1000, 2000 and 4000 Hz reflex eliciting tones were administered ipsilaterally and contralaterally. Distortion Product Otoacoustic Emissions



(DPOAE) was done to evaluate the status of outer hair cells in the cochlea using Neuro Audio software. The frequency range assessed was 2–8 kHz, and the Distortion Product (DP) gram was obtained at the resolution of 12 points/octave. F 2/F 1 frequency ratio was 1.22 and the intensity values of the F 1 and F 2 were 65 and 55 dB SPL, respectively. DPOAE was performed on the subjects using the PMS after assigning them to their respective groups. Measurements were conducted using calibrated equipment in a sound-treated room. Participants were seated comfortably in a chair and participants were instructed to relax and avoid physical movements. The vestibular assessment was carried out in the department were subjective vestibular test battery (Romberg test, Gaze test, Tandem walking test, Fukuda stepping test, Head shaking test, Dix-hall pike test, Spontaneous nystagmus test, and Sharpened Romberg test). Cervical Vestibular Evoked Myogenic Potential (C-VEMP), Ocular Vestibular Evoked Myogenic Potential (O-VEMP) Vestibular function test performed by stimulating one ear with repetitive pulse or click sound stimulation and then measuring surface EMG responses over selected muscles averaging the reaction of the muscle electrical activity associated with each sound click or pulse. When the myogenic response is recorded from sternocleidomastoid muscle, it is known as cervical VEMP (cVEMP). Cervical VEMP is a useful tool to tap the function of the sacculo-collic reflex. Cervical VEMP responses are from the saccule as the end organ. The response recorded consisted of an initial positive peak (p13 or p1) followed by a negative peak (n23 or n1). In ocular VEMP (oVEMP), electrodes placed below the eyes are used to record a short-latency biphasic potential. The oVEMP peaks at 10 ms and 15 ms. [49]

The stimulus and acquisition parameters used were suggested by the previous studies. [50-53] An individual who ever undergone complete audiological and vestibular assessment in the department those individual audiological and vestibular test

results and overall interpretation were analyzed based on the presence or absence of the vestibular disorder and types of vestibular disorders were identified in the present study.

3. RESULTS

The present study aimed to find the prevalence of vestibular disorders in the tertiary care hospital, the department OPD registers, and case files were analyzed retrospectively on individuals who visited from January 2016 to December 2020. In total 2,14,004 Individuals visited the department OPD during the above-mentioned period.

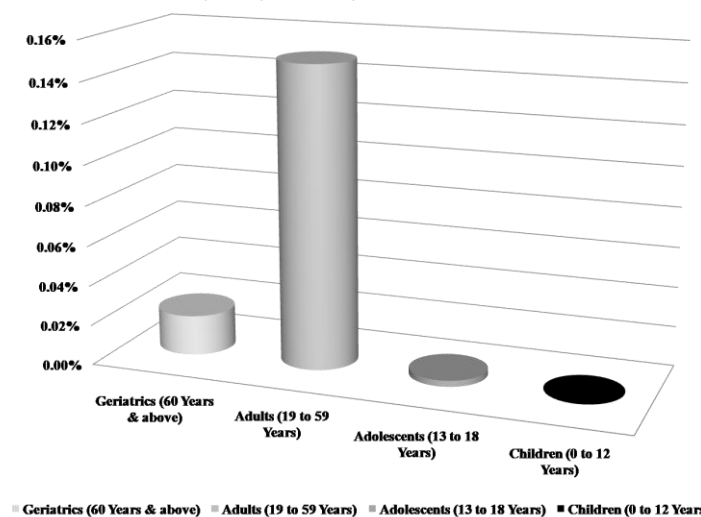
3.1. Prevalence of vestibular disorders

Of the 2,14,004 individuals, 392 reported the complaint of vestibular problems, hence the prevalence of vestibular disorders was estimated to be is 0.18 %.

3.2. Vestibular disorders in different age groups

In the present study prevalence rate of vestibular disorders was obtained across different age groups. Among 392 individuals only one child was diagnosed with the vestibular problem, hence the prevalence rate of vestibular impairment among children was estimated to be (0.0004%), 7 (0.003%) Adolescents (13-18 years) were diagnosed with vestibular disorders, Total of 323 Adults (19-59 years) were diagnosed with the vestibular disorders, the prevalence of vestibular disorders in adults is 0.15%, and 61 Geriatrics (60 years & above) (0.02%) diagnosed with vestibular disorders. However, comparing the prevalence rate across different age groups revealed Adults are more prevalent with vestibular disorders than other age groups. (Adults > Geriatrics > Adolescence > Children). Age-wise prevalence of vestibular disorders is depicted in figure 1.

Figure 1. Percentage of individuals with vestibular disorders among Children, Adults, Adolescents, and Geriatrics



To see the variations across age categories were statistically significant or not, we performed the equality of

proportions test. The outcomes of our experiment between age categories were statistically significant, as shown in table 1.

Table 1. The percentage of individuals with vestibular disorders was analyzed age-wise for equality of proportions

Age Group	Z value
Children (0-12 yrs) and Adolescent (13-18 yrs)	5.5 *
Children (0-12 yrs) and Adult (19-59 yrs)	179.1 *
Children (0-12 yrs) and Geriatric (60 & above)	48.1 *
Adolescent (13-18 yrs) and Adult (19-59 yrs)	180.9 *
Adolescent (13-18 yrs) and Geriatric (60 & above)	52.2 *
Adult (19-59 yrs) and Geriatric (60 & above)	152.5 *

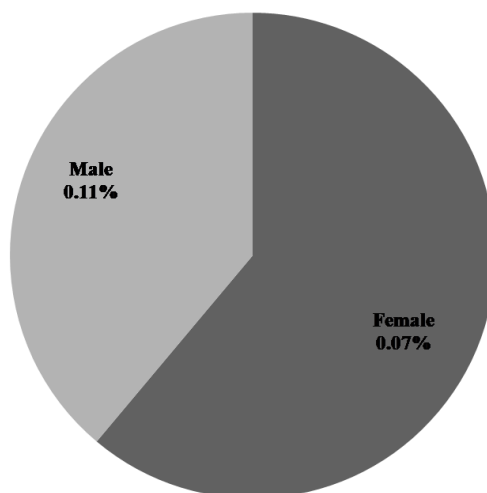
*|Z| > 1.96

3.3. Gender-wise analysis of Vestibular disorders

In the current study prevalence of vestibular disorders was analyzed to find out the gender difference. Results showed that out of 392 individuals 156 (0.07%) males and 236 (0.11%)

females were diagnosed with vestibular disorders. Females were more prevalent than males, as represented schematically in figure 2.

4.2. Percentage of individuals with vestibular disorders among males and females



We used a proportional equality test to see whether the variation in prevalence between genders was statistically significant or not,

the results have shown there is a statistically significant difference between gender ($|Z|=45.7$).

Table 2. Percentage of individuals with vestibular disorders was analyzed gender-wise for equality of proportions

Gender	Z value
Male and Female	45.7 *

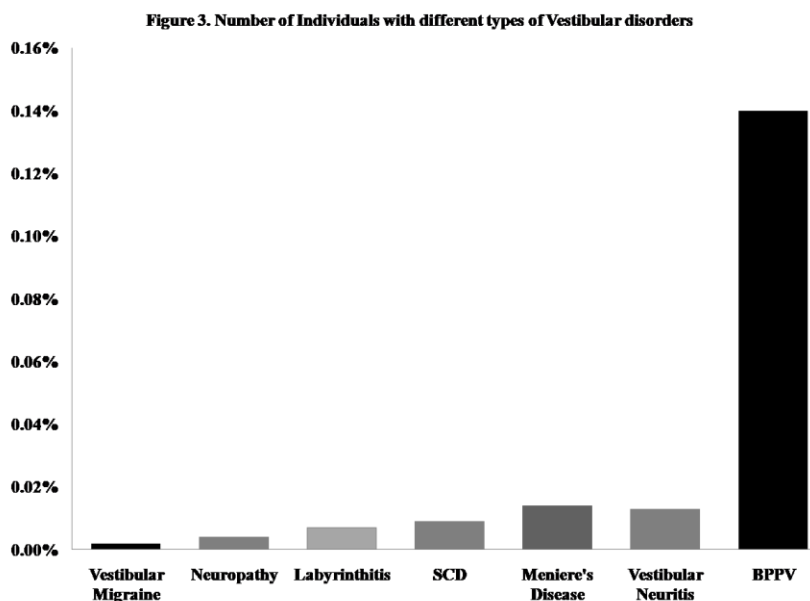
* $|Z| > 1.96$

Comparing the Gender-wise analysis of vestibular disorders both Male and Female were found to be significant.

3.4. Type of Vestibular disorders

To estimate the prevalence rate concerned to types, all 392 individuals were grouped based on their vestibular disorders, results revealed that 311 (0.14%) individuals were diagnosed with BPPV, 28 (0.013%) individuals were diagnosed with Meniere's

disease, 30 (0.014%) individuals were diagnosed with vestibular neuritis, 15 (0.007%) individuals were diagnosed with labyrinthitis, 5 (0.002%) individuals were diagnosed with vestibular migraine, 2 (0.009%) individuals were diagnosed with Semi-circular canal dehiscence and 1(0.0004%) individuals were diagnosed with vestibular neuropathy. These results were depicted graphically in figure 3.



The equality of proportions test was used to distinguish the two forms of vestibular diseases to see if the differences were

statistically significant and the results were shown in table 3.

Table 3. The percentage of individuals with different kinds of vestibular disorders as determined by a test of proportions.

Type of vestibular disorders	Z value
BPPV and Meniere's disease	156.3*
BPPV and Labyrinthitis	166.7*
BPPV and Vestibular neuritis	154.6*
BPPV and Vestibular migraine	175.8*
BPPV and SCD	163.2*
BPPV and Neuropathy	178.7*
Labyrinthitis and Meniere's disease	19.7*
Meniere's disease and Vestibular neuritis	2.8*
Meniere's disease and Vestibular Migraine	41.7*
Meniere's disease and SCD	12.5*
Meniere's disease and Neuropathy	50.55*
Labyrinthitis and Vestibular neuritis	22.5*
Labyrinthitis and Vestibular Migraine	24.4*
Labyrinthitis and SCD	7.3*
Labyrinthitis and Neuropathy	35.6*
Vestibular neuritis and Vestibular Migraine	44.1*
Vestibular neuritis and SCD	15.3*
Vestibular neuritis and Neuropathy	52.6*
Vestibular Migraine and SCD	31.0*
Vestibular Migraine and Neuropathy	15.1*
SCD and Neuropathy	41.1*

*|Z| > 1.96

When comparing the |Z| values, the most significant value is between BPPV and neuropathy; after which BPPV and vestibular migraine shows the significant value. Labyrinthitis and semicircular canal dehiscence are the second least significant |Z| value and Meniere's disease and vestibular neuritis show the least significant value in the above data.

4. DISCUSSION

The current study was designed to estimate the prevalence rate of vestibular disorders in SRM hospital patients presenting with complaints of vestibular problems between January 2016 and December 2020. The number and percentage of patients with vestibular disorders were determined across the various domains.

4.1. Prevalence of vestibular disorders

In the present study, the prevalence of vestibular disorders was 0.18 % in patients who visited the Department of Audiology and ENT with a complaint of vestibular problems between January 2016 and December 2020. These findings show a lower prevalence rate of vestibular disorders than previous findings. [18, 23, 24, 54] Among children, Riina et al. (2005), Bower and Cotton, (1995), Eviatar et al. (1986), and Abrol et al. (2001)

reported a prevalence rate of 0.7 %. The differences between the present study and earlier studies may be because the criteria used to diagnose vestibular disorders, aging, etc. can influence the prevalence rate of vestibular disorders. And also, earlier studies have considered prevalence in a specific population, namely children, but the present study encompassed all age groups.

4.2. Vestibular disorders in different age groups

In the present study, Adults had a higher prevalence rate of vestibular disorders than other age groups, while children, Geriatrics, and young adults had the lowest prevalence rates of vestibular disorders. Similarly, Wahat et al. reported that adults had a higher prevalence rate of vestibular disorders than other age groups. [55] In contrast, previous studies found that the elderly have the highest prevalence. [12, 29, 56] the total number of adult visits to the OPD may be double that of older adults, which could explain such findings and also vestibular symptoms among the older age groups (60 years & above), due to their numerous other diseases and symptoms. [55]

4.3. Gender-wise analysis of Vestibular disorders

The present study found that 0.07% of those with



vestibular disorders were men, while 0.11% were women. The prevalence of vestibular disorders was higher in women than in men; similar findings were reported in other studies, and the reason could be due to certain medical conditions, such as migraine, pre-menstrual syndrome, and hormonal imbalance. [13, 55, 57-59] Also, women seek assistance more often than men with health-related matters, such as health status and general well-being. [60, 61]

4.4. Type of Vestibular disorders

In the current study, found that 311 (0.14 %) out of 2,14,004 participants were diagnosed with BPPV, 30 (0.014 %) with Meniere's disease, 28 (0.01%) with vestibular neuritis, 15 (0.007%) with labyrinthitis, 5(0.002%) with vestibular migraine, and 2(0.009%) with SCD and 1(0.0004%) with vestibular neuropathy. In the present study, BPPV and Meniere's disease were discovered to be the most prevalent than other vestibular disorders. However, vestibular neuritis was the third most prevalent in the present study and it is followed by semicircular canal dehiscence, labyrinthitis, neuropathy, and vestibular migraine, the present study results are almost similar to earlier studies' findings on the reason for the variations in the prevalence rate of vestibular disorders could be a difference in the study method, diagnostic criteria used, population-based studies, and BPPV and Meniere's disease are associated with several conditions like migraine. [13, 55, 62-66]

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