

## Original Research Article

# Latent vestibular dysfunction and its effect on quality of life in elderly individuals, the need of active screening and intervention

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## ABSTRACT

**Background:** Dizziness is a commonly reported complaint among elderly.. Among the elderly in particular, factors such as Ageing, presbycusis, diabetes, chronic kidney disease, osteopenia, and osteoporosis increase the risk. Dizziness handicap inventory is used to assess the quality of life among the individuals with vestibular dysfunction. This is also used to assess the impact of interventions for vestibular dysfunction. This study aims to estimate the prevalence of latent vestibular dysfunction among the Indian population, and the impact of interventions among the same.

**Methods:** A prospective observational study was conducted at a tertiary care hospital. As per sample size estimates, 200 participants aged >60 years without previous diagnosis of vestibular dysfunction were screened using appropriate tests. The quality of life of the affected individuals were assessed using Dizziness Handicap Inventory Score (DHIS) before and after intervention.

**Results:** The prevalence of latent vestibular dysfunction was found to be 23.5%. Most of them reported having moderate handicap due to the condition. Following intervention, those with moderate handicap either became normal (47.8%) or had residual mild handicap (52.2%). The mean DHIS score significantly decreased from 40.91 points during pre-intervention to 16.12 points post-intervention.

**Conclusions:** Around one-fourth of the Indian elderly is found to have latent vestibular dysfunction. It has a major impact on the individual's quality of life. Yet, screening and intervention is found to make a considerable improvement among the affected individuals.

**Keywords:** Dizziness, Vestibular dysfunction, Elderly, Quality of life

## INTRODUCTION

Dizziness is a symptom commonly prevalent in the population particularly among the elderly people.<sup>1</sup> It has profound impacts on various aspects of the affected individual, especially the quality of life. The symptoms are recurrent and often disabling. Vestibular patients have reported to visit their physicians 1-8 times/year and 60.8% of them reported disability. In addition, approximately 40% of the affected individuals report interruption of daily activities due to dizziness.<sup>2,3</sup> There

are very few studies which assess the epidemiological burden of dizziness among the population, especially among the elderly.

Dizziness caused due to vestibular dysfunction is still under-investigated. The prevalence of dizziness and vestibular dysfunction has been estimated to be 16.7% and 1.84% respectively in a study by Koo et al.<sup>4</sup> Older age groups, female gender, hearing loss and stress were found to be associated with vestibular dysfunction. Other risk factors include Diabetes, where vestibular

dysfunction increased the odds of falls by 2 fold.<sup>5</sup> Co-existing osteopenia/osteoporosis was also found to increase the risk by 2 folds.<sup>6</sup> Ageing and presbycusis were also found to be independently associated with vestibular dysfunction.<sup>7</sup> Moderate, severe and very severe chronic kidney disease was associated with progressively increasing odds of vestibular dysfunction.<sup>8</sup>

Various clinical tests have been utilized for the diagnosis of latent vestibular dysfunction among elderly. Spontaneous nystagmus, provocative nystagmus, optokinetic reflex, vestibulo-ocular reflex are some of the parameters used. A battery of tests are usually recommended for diagnosis.<sup>9,10</sup> However, measurement of quality of life has also been proposed to be included along with the tests.<sup>11</sup> This is expected to facilitate better patient care.

Dizziness handicap inventory, developed by Jacobson et al has been utilized for assessing the impact of dizziness on the quality of life. The 25-item inventory has questions on three content domains regarding functional, emotional and physical aspects of dizziness. It has been demonstrated to have good internal consistency and reliability and it is widely accepted as well.<sup>12</sup> DHI has also been suggested as a valuable tool to assess functional outcomes in patients with dizziness following interventions.<sup>13</sup>

Various interventions have been performed for the management of vestibular dysfunction. They include surgical measures and rehabilitation exercises.

The burden of latent vestibular dysfunction among elderly is still yet to be widely explored among the Indian population. This study seeks to assess the prevalence and functional disability due to latent vestibular dysfunction among the elderly and the impact of vestibular rehabilitation on the same.

### Objectives

- To evaluate latent vestibular asymmetry/dysfunction in elderly
- To measure quality of life (QoL) in elderly using Dizziness Handicap Inventory (DHI) suitably validated.
- To apply appropriate intervention where required and assess the impact of these interventions on QoL as measured by DHI.

### METHODS

The study was conducted in the department of ENT Command Hospital, Air Force Bangalore. The study was a prospective observational study. The study had included all the Subjects above 60 years will be screened for the study without gender bias. The data collection for the study was done over a period of one year from one year from June 2016 to June 2017. Sample size was calculated

assuming the expected prevalence of vestibular dysfunction as 20% in the elderly as per the study by Iwasaki et al.<sup>14</sup> The other parameters considered for sample size calculation include, 5% precision and 95% confidence level. The following formula was used to calculate sample size.<sup>15</sup>

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

Where  $n$  = Sample size

$Z$  = Z statistic for a level of confidence = 1.96

$P$  = Expected prevalence of proportion

(If the expected prevalence is 20%, then  $P = 0.20$ ), and

$d$  = Precision (If the precision is 5%, then  $d = 0.05$ ).

$$n = \frac{1.96^2 * 0.2(0.8)}{0.05^2}$$

As per the above mentioned calculation a total of 171 subjects were needed. To be on after side and to account for a loss to follow up of 10%, a total of 200 subjects were included in the final study.

The study of inclusion criteria elderly population (aged > 60 years), both male and female. The study of exclusion criteria patients who are or were under treatment for vestibular disorders, subjects in whom vestibular test battery cannot be performed due to orthopedic problems, Subjects who have neurological/ psychiatric/ ophthalmological disorders, which could contribute disequilibrium above mentioned calculation a total of 171 subjects were needed. To be on safer side and to account for a loss to follow up of 10%, a total of 200 subjects were included in the final study. All the study participants were recruited sequentially by purposive sampling till the sample size is reached.

After obtaining the informed written consent all the participants were evaluated by through clinical history, clinical examination as follows.

1. All subjects recruited in the study were given a unique Patient Identification Number (PIN).
2. Quality of Life (QoL) based on Dizziness Handicap Inventory (DHI) was assessed in all subjects. Validated DHI in English and vernacular languages (Tamil, Kannada, Malayalam, Hindi) were used. Numerical score of DHI were tabulated by the examiner in a cover and will seal the completed DHI.
3. The subjects thereafter undergone clinical Vestibular Test Battery (CTB) consisting of
  - Romberg's test
  - Unterberger's test
  - Head Impulse Test
  - Dix Halpike Test
4. An examiner blinded to the result of DHI will carry out the VTB. Results of VTB were scored on a numerical scale as 0 and 2 for every negative and positive test result respectively.

5. Results of DHI were correlated to VTB results and then the strength of correlation were evaluated statistically.
6. Those subjects with significant DHI ( $>10$ ) as well as positive VTB ( $\geq 2$ ) will undergo complete neuro-otological work up and a diagnosis made. Based on the diagnosis, one of the four generic treatment were given to the patient
  - Only counseling
  - Pharmacological treatment
  - Non-surgical intervention
  - Surgical intervention
7. The subject undergoing vestibular intervention were evaluated after one month with DHI.
8. Pre and post management DHI were correlated and statistical significance of the correlation were ascertained.

### Ethical issues

The study was approved by institutional human ethics committee. Informed written consent was obtained from the parent/guardian of the child, after thoroughly explaining the study objectives, risks and benefits involved, purely voluntary nature of participation. Confidentiality of the study participants was maintained throughout the conduction and reporting of the study findings.

### Statistical methods

Pre and post intervention DHIS score was considered as primary outcome variable. Vestibular battery test score in pre and post intervention group also was considered as other outcome variable.

### Descriptive analysis

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram and box plots. The pre and post intervention DHIS score was compared using paired t-test. DHIS score was categorized into mild, moderate and severe handicap basing on standard cut-off values. The proportions of subjects in each of the categories were compared pre and post intervention using cross tabulation and McNemar test.

$P < 0.05$  was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.<sup>16</sup>

## RESULTS

A total of 200 elderly subjects were included in the analysis.

Among the study Participants, 25 (12.50%) were 60 to 64, 49 (24.50%) were 65 to 69, 56 (28.00%) were 70 to

74, 53 (26.50%) were 75 to 79 and 17 (8.50%) were in the 80 and above of age group. Out of the 200 study subjects, 57% were males and 43% were females (Table 1).

**Table 1: Descriptive analysis of Age Group in study group (N=200).**

Demographic characteristic	Frequency	Percentage (%)
<b>Age group (years)</b>		
60 to 64	25	12.50
65 to 69	49	24.50
70 to 74	56	28.00
75 to 79	53	26.50
80 and above	17	8.50
<b>Gender</b>		
Male	114	57.00
Female	86	43.00

**Table 2: Association of gender with age group of study population (N=200).**

Age group (years)	Gender	
	Male (%)	Female (%)
<b>60 to 64</b>	9 (36)	16 (64)
<b>65 to 69</b>	19 (38.77)	30 (61.22)
<b>70 to 74</b>	35 (62.5)	21 (37.5)
<b>75 to 79</b>	39 (73.58)	14 (26.41)
<b>80 and above</b>	12 (70.58)	5 (29.41)

The proportion of subjects with gender, male was 9(36%) and female 16 (64%) were in the age group in 60 to 64. The proportion of subjects with male was 19 (38.77%) and female was 30 (61.22%) were in the age group in 64 to 69. The proportion of subjects with male was 35 (62.5%) and female was 21 (37.5%) were in the age group in 70 to 74. The proportion of subject with male was 12 (70.58%) and female was 5 (29.41%) were in the age group of 80 and above (Table 2).

**Table 3: Descriptive analysis of VTBS2 in study group (N=200)**

	Frequency	Percentage (%)
<b>VTBS</b>		
Negative	153	76.50
Positive	47	23.50
<b>Pre-intervention DHIS category</b>		
Mild handicap	153	76.50
Mild handicap	1	0.5
Moderate handicap	46	23.00
<b>Intervention</b>		
No intervention	152	76.00
Medical	48	24.00

Out of the 200 study subjects were positive for vestibular dysfunction and were treated with medical intervention.

Remaining 153 were not having any vestibular dysfunction. Among the 200 subjects 1 (0.5%) had mild handicap as assessed by DHIS score at baseline and 46 (23%) had moderate handicap. Among the study participants, 152 (76%) were in the no intervention of Intervention and 48 (24%) were in the Medical of Intervention (Table 3).

**Table 4: Association of pre DHIS with post DHIS of study population (n=200).**

		Post DHIS	
		Normal (%)	Mild handicap (%)
<b>Pre DHIS</b>	Mild handicap (n=1)	1 (100.0)	0 (0)
	Moderate handicap (n=46)	22 (47.8)	24 (52.2)

The one subject with mild handicap has improved and became normal post intervention. Out of 46 subjects with moderate handicap, 22 (47.8%) have become normal and 24 (52.2%) still had mild handicap after intervention. None of the subjects had moderate handicap in the post intervention period (Table 4).

**Table 5: Comparison of mean pre and post DHIS score (paired t-test).**

Parameter	Mean±SD	P- value
<b>DHIS</b>	40.91±3.572	<0.001
<b>Post DHIS</b>	16.12±4.601	

The mean DHIS score in the pre intervention period was 40.91±3.572, which has reduced to 16.12±4.601 in the post intervention period, which was statistically significant ( $p<0.001$ ) (Table 5).

## DISCUSSION

From the above results, it is inferred that a majority of the population belonged to the 65 to 80 years age group. The participants consisted of a slightly higher proportion of males compared to females. Majority of the females were in the 60 to 70 years age group while most males belonged to 70 to 80 years age group. On testing for latent vestibular dysfunction, the prevalence among the study participants was found to be 23.5%. This is similar to the prevalence of 22.9% estimated by Neuhauser et al.<sup>3</sup> But this prevalence was much higher than Koo et al which estimated the prevalence of dizziness as 16.7% and vertigo as 1.84% respectively.<sup>4</sup> Almost three-fourths of the participants reported experiencing mild handicap due to the vestibular dysfunction. This was higher than the 60.8% estimated by Gutierrez- Marquez et al.<sup>17</sup> Around one-fourth reported having severe handicap due to the condition. Those with vestibular dysfunction were managed with medical intervention. On assessment after providing intervention, the degree of handicap reduced.

One participant became normal and the others had only mild handicap in the post intervention period. The mean score of dizziness handicap inventory was 40.91 pre-intervention and reduced to 16.12 during post-intervention. The difference in the mean score was statistically significant. This is similar to the results of the study by Giray et al.<sup>18</sup> But much higher than the 10% drop reported in the study by Treleaven et al.<sup>13</sup> Thus despite the burden of latent vestibular dysfunction being high among elderly, majority of them showed improvement after appropriate interventions.

## CONCLUSION

Hence it is concluded that the burden of latent vestibular dysfunction has been found to be quite high among the Indian elderly population. With additional co-morbidities such as osteopenia, diabetes, chronic kidney disease increasing the risk, efforts to screen the elderly is a need of the hour. Since a significantly high proportion of individuals improved with interventions, efforts to educate the people on the need for screening and motivating them for interventions also needs to be done.

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