The Dizziness Handicap Inventory questionnaire scores before-and-after vestibular rehabilitation therapy of presbyastasis patients

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Research

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ABSTRACT

Background: Presbyastasis is multifactorial balance dysfunction that occurs in the elderly person. Presbyastasis can increase the risk of fall, anxiety, and decrease the quality of life. Vestibular rehabilitation therapy (VRT) has been proven effective to overcome balance disorders, and it is safe for the elderly. Several studies had reported the success of VRT for balance disorders. All this time, the accomplishment of VRT was assessed by using balance test, which had a risk of falling in elderly patients. **Objective:** To find out the outcome of Dizziness Handicap Inventory (DHI) questionnaire score in presbyastasis patients after VRT. **Method:** Ten presbyastasis patients in age range 60-75 years old who met the study criteria were taken by consecutive sampling. A longitudinal observational (pre and posttest) study by analyzing the DHI questionnaire scores. Assessment was performed twice, before and after VRT. The data was analyzed using paired T test and Wilcoxon signed rank test with outcome $p < 0.05$. **Result:** The measurement of the emotional subscale DHI (DHI.E) showed the mean score before VRT was 4.00 (1.63), after therapy was 0.00 (0.63), $p = 0.004$. The functional subscale (DHI.F) measurement showed the mean score before VRT was 10.40 (3.98), after therapy was 2.40 (2.07), p 0.00. The mean score of physical subscales (DHI.P) measurement before VRT was 9.00 (4.40), after therapy was 2.00 (1.58), $p = 0.008$. The total DHI score (DHI.T) before VRT was 22.6 (7.67), after VRT was 4.20 (2.2) with $p = 0.000$. **Conclusion:** There was an improvement in DHI questionnaire score before and after 6 weeks VRT.

Keywords: Vestibular rehabilitation therapy (VRT), Dizziness Handicap Inventory (DHI), presbyastasis

ABSTRAK

Latar belakang: *Presbiastasis dapat meningkatkan angka jatuh, kecemasan dan menurunkan kemandirian sehingga menurunkan kualitas hidup pada usia lanjut. Terapi rehabilitasi vestibuler (TRV) merupakan modal terapi yang terbukti dapat mengatasi gangguan keseimbangan, dan aman untuk usia lanjut. Beberapa penelitian melaporkan adanya keberhasilan TRV pada penderita gangguan keseimbangan. Keberhasilan dari TRV selama ini dinilai dengan menggunakan pemeriksaan keseimbangan yang memiliki risiko jatuh pada penderita usia lanjut.* **Tujuan:** *Membuktikan adanya perubahan skor kuesioner* Dizziness Handicap Inventory (DHI) *pada penderita presbiastasis sesudah TRV.* **Metode:** *Sepuluh penderita presbiastasis usia 60-75 tahun yang memenuhi kriteria penelitian diambil secara* consecutive sampling. *Studi observasi longitudinal (*pre *dan* posttest*) dengan menghitung dan menganalisis skor kuesioner DHI. Pengukuran dilakukan 2 kali yaitu sebelum TRV dan sesudah TRV. Analisis data dilakukan dengan* paired T test *dan* Wilcoxon signed rank test, *dengan hasil p<0,05.* **Hasil:** *Pengukuran skor kuesioner DHI subskala Emotional (DHI.E) sebelum TRV mempunyai* mean *4,00 (1,63), 6 minggu sesudah TRV didapatkan* mean *0,00 (0,63), p=0,004. Hasil subskala Functional (DHI.F) sebelum TRV didapatkan* mean *10,40 (3,98), 6 minggu sesudah TRV, * mean *2,40 (2,07), p=0,00. Pada subskala Physical (DHI.P) didapatkan* mean *9,00 (4,40), dan 6 minggu sesudah TRV didapatkan mean 22,6 (7,67), sesudah TRV didapatkan* mean *4,20 (2,2) dengan p=0,000.* **Kesimpulan:** *Terdapat perbaikan skor kuesioner DHI sesudah 6 minggu terapi rehabilitasi vestibuler (TRV).*

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INTRODUCTION

Presbyastasis is multifactorial balance dysfunction and dizziness that occurs in the elderly person. Balance disorders have an estimated prevalence of 75% to 85% of the individuals over 65 years of age and are directly related to an increased chance of falls to 12 times per year. It affects loss of quality of life and psychological sequelae such as anxiety, depression and panic.[1,2,3]

Balance disorder symptoms, such as dizziness is difficult to be assessed, it could cause difficulties in doing daily activities, and declining the quality of life.[8]

Presbyastasis is the result of age-related physiological changes in three sensory systems and their central connections that contribute to balance. Presbyastasis is a complex condition involving many intertwined systems rather than a lesion within the vestibular system only, thus evaluation and management need to be holistic.[3]

To maintain the quality of life, The objective of therapy for presbysatasis is to raise the functional capability of the person to reduce the risk of fall. Pharmacologic treatment could provide an improvement to acute vestibular disturbance, however there are unsafe side effects for the elderly. General vestibular rehabilitation therapy (VRT) seems to be an effective and dependable therapy for the elderly group.[2-7]

A previous study had been conducted in South Korea. In majority of the elderly patients with dizziness, the etiology of dizziness is not found and is attributed to presbyatasis. A total of 240 patients older than 70 years with dizziness were treated with 16 times VRT and they got improvement in balance disorder.[2]

The most favorable tool to use for assessing the handicap in patients with balance disorder is Dizziness Handicap Inventory (DHI). A valid and reliable version of the DHI adaptation can be used to measure the quality of life and also as a modality for assessing the effectiveness of therapeutic outcomes in balance disorders patients.

The result of VRT in Indonesia could be assessed by DHI translated into Indonesian language and re-translated with validation process and cultural adaptation. The Indonesian adaptation of DHI instrument was valid and reliable based on WHO transcultural validation rule, therefore it can be used as a psychometric instrument to assess the quality of life of patients with balance disorders.[8]

Presbyastasis treatment with VTR and the assessment of successful VTR using DHI questionnaire has never been performed at the Outpatient Clinic of Neurotology Division, Department of Otorhinolaryngology, Dr Soetomo General Hospital.

The objective of this study is to find out DHI questionnaire scores before-and-after VRT on presbyastasis patients.

METHOD

A longitudinal observational (pre and posttest) study by calculating and analyzing the *Dizziness Handicap Inventory (*DHI) questionnaire scores. DHI questionnaire was scored before VRT and after 6 weeks VRT.

Data was taken from elderly patients with balance disorders at Geriatric Outpatient Unit

of Dr. Soetomo General Hospital (DSGH), from January until December 2017 was 64 patients.

The inclusion criteria were: patients' age was 60 years old and older, complaining of balance disorder diagnosed as presbyastasis, able and willing to answer DHI questionnaire, the total DHI score was between >3 to <60, patient agreed to join VTR training for 15-20 minutes per day, every day, in 6 weeks period with a minimal of 24 times training, and had a relative to accompany during home-training. There was no exclusion criteria in this study. Dropout criteria was whenever the presbyatasis patient came for VRT training less than 24 times in 6 week period.

Sample was taken by consecutive sampling method until the total sample size was sufficient. DHI questionnaire score was the value of the answer "yes" = score 4, "sometimes" = 2, and "no/never" = 0 of each question in DHI questionnaire. The DHI questionnaire used was from Jacobson and Newman which had already been translated to Indonesian language consisted of 25 questions and 3 totals.

The minimum score was 0 and the maximum score was 100. The elderly patient with balance disorder would be diagnosed as presbyastasis based on anamnesis, otorhinolaryngology head and neck examination, balance examination using Gans sensory organization performance test, dynamic visual test (DVA) test, coordination test (*finger to nose*), and the result of DHI questionnaire. Patients who were included in the study, received a VTR training for 6 weeks, training once a day for 15-20 minutes, minimal training was 24 times in 6 weeks period. The researcher brought supporting visual apparatus, such as pictures and video VRT training movement for easy training example at home. The movements were: saccade, visual tracking exercise, balanced standing exercise, balls moving exercise, and cross stepping exercise. The training was evaluated at the first week and the third

week during patient's training course, and also through telephone interview between the researcher and subject, and the attending relative, and also by video recording during home training.

1. Saccade exercise

The patient sits in a comfortable position, holding a small playing card in each hand, on eye level and about 18 inches apart, keeping the head still. Without stopping between cards, have the patient look quickly from one card to the other. The patient has to perform this action for 15-20 times. After the patient gets accustomed to this activity, the eyes focus to horizontal and diagonal sides of the card. The level of difficulty could be increased to focus to the eyes, nose and mouth of the card picture. To correct a standing posture, the same exercise is performed in standing position.

2. Visual tracking exercise

The exercise is performed in sitting position with index finger placed 25 cm in front of the nose. The head turns to left and right while the eyes continue to focus on the index finger. Repeat the exercise 15-20 times. Gradually the speed of head movement is increased.

3. Balanced standing exercises

Standing position with the feet close together, maintain balance by reaching out both hands to touch the wall in front, hands released one by one from the wall. The exercise is continued with the legs slightly apart, strengthening the footing, focus the eyes towards a target in the wall, arms stretched then arms straight beside the body, followed by arms folded on the chest.

4. Ball circles

Stand in relaxed, upright posture, body weight is equally distributed on both legs. Hold a ball with both hands, arms straight.

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Keep the eyes focused on the ball. Keep the arms straight, move the ball in a large circle. Follow the ball movement with the head and eyes, and then move the ball in reverse direction. Make the circle larger by lifting the ball high over the head, and low to the ground, bending the knees to touch the ground with the ball. Move smoothly and continuously. Repeat 15-20 times. If patient become dizzy, stop the movement until the feeling subsides, then begin again.

5. Cross over step

Have the patient stand with the head leaning against the wall, with feet slightly apart. Instruct the patient to cross his/her right foot in front of the left, hold it there for 5 seconds, and return the foot to its starting position. Perform this action with the left foot. Repeat 15-20 times.
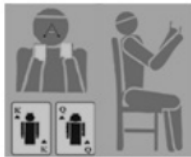
| Picture 1. Saccade | Picture 2. Visual tracking | Picture 3. Ballanca standing | Picture 4. Ball movement | Picture 5. Cross over step |

RESULT

Sample distribution based on education was shown in Table 1.

Table 1. Education level

Education	Total (person)	Percentage (%)
Elementary	0	0
Junior High	1	10
High Sch/Vocational	5	50
Associate degree	1	10
Bachelor	3	30
Total	10	100.0

The highest number of education level was High School/Vocational School as many as 5 persons (50%), followed by Junior High 1 person (10%), while Elementary level was 0, Associate degree level (*D3*) was 1 person, and Bachelor (*S1*) was 3 persons (30%).

Sample distribution based on work was shown in Table 2.

Table 2. Occupation

Occupation	Total (person)	Percentage (%)
House wife	4	40.0
Food vendor	1	10.0
Teacher (retired)	2	20.0
Nurse (retired)	2	20.0
Architect (retired)	1	10.0
Total	10	100.0

Research data of occupation revealed: housewife 4 persons (40%), food vendor 1 person (10%), retired teacher 2 persons (20%), retired nurse 2 persons (20%), and retired architect 1 person (10%).

DHI questionnaire consisted of 25 questions divided into 8 questions from emotional aspect, 8 questions from functional aspect, and 9 questions from physical aspect.

The total DHI score was 100, divided into 3 aspects: 28 points from emotional aspect, 36 points from physical aspect, and 36 points from functional aspect. The total score from 3 aspects subscores were converted into scale 0-100. Zero was the worst value and 100 was the best value. Assessments were performed twice, first was before VTR training and secondly was after 6 weeks of VTR training.

Table 3. The result of DHI score before and 6 weeks after VRT

DHI	N	Mean	SD	Median	Minimum	Maksimum	p
DHI.E. Pre	10	4.00	1.63	4.00	2.00	6.00	0.004*
DHI.E. Post	10	0.20	0.63	0.00	0.00	2.00	
DHI.P. Pre	10	8.40	4.40	9.00	2.00	16.00	0.008*
DHI.P. Post	10	1.60	1.58	2.00	0.00	4.00	
DHI.F. Pre	10	10.40	3.98	9.00	6.00	18.00	0.000**
DHI.F. Post	10	2.40	2.07	2.00	0.00	6.00	
DHI Total. Pre	10	22.80	7.67	21.00	12.00	34.00	0.000**
DHI Total. Post	10	4.20	2.20	4.00	2.00	8.00	

Note: DHI= Dizziness Handycap Inventory score, pre = before VRT, post = 6 weeks after VTR, DHI.E = DHI. Emotional, DHI.P= DHI.Physical, DHI.F= DHI.Functional, DHI Total = DHI total score, p = probability, * = Wilcoxon test (p<0.05), **= Paired t test (p>0.05)

The mean significant difference of presbyastasis patients' DHI score between 2 groups of before-and-after VRT was analyzed with paired T test and Wilcoxon test. The test result from DHI.Emotional (DHI.E), the mean value before VRT training was 4.00 and standard deviation 1.63. The mean value after VRT was 0.00 and standard deviation was 0.63. Statistical test using Wilcoxon test obtained p=0.004.

The test result from DHI.Physical (DHI.P) revealed the mean value before VRT training was 9.00 and standard deviation was 4.40. The mean value after VRT was 2.00 and standard deviation was 1.58. Statistical test using Wilcoxon test obtained p=0.008.

The test result from DHI.Functional (DHI.F) revealed the mean value before VRT training was 10.40 and standard deviation was

3.98. The mean value after VRT was 2.40 and standard deviation was 2.07. Statistical test using paired T test obtained p=0.00.

The test result from Total DHI score (DHI Total) revealed the mean value before VRT training was 22.60 and standard deviation was 7.67. The mean value after VRT was 4.20 and standard deviation was 2.20. Statistical test using paired T test obtained p=0.000.

DISCUSSION

This was an observational study with longitudinal approach, which assessed the patients by counting all scores of three aspects of DHI namely the emotional, functional and physical aspects before-and-after VTR.

Longitudinal study is a type of research which compares the changing in research

subjects, a comparison over a certain period of time, using pre and posttest without control group; it is a study based on time dimension.[9,10]

The analysis in this study was performed by doing an intervention to the observed samples, in this case, VRT training by applying 5 similar movements on every sample without a control group.

The accessible population of this research was presbyastasis patients at the Geriatric Outpatient Clinic and Neurotology Division of Otorhinolaryngology Head and Neck Surgery Outpatient Clinic, Dr.Soetomo General Hospital, Surabaya.

All management of the samples was performed in the Neurotology division of Otorhinolaryngologic Head and Neck Surgery Outpatient Clinic, Dr.Soetomo General Hospital, Surabaya, in accordance with the study criteria, from August 2018 until December 2018.

Sample was chosen by consecutive sampling method until the total number of sample population was fulfilled. The size of sample was counted according to hypothesis testing on matched pairs design for mean formula.[10] It was found that the minimal sample size was 2, the minimal sample size of a research with quantitative data case group was 7. Our study enrolled 10 sample units.

A research in Brazil was conducted on sample size of 10 balance disorder patients, for 2 months period, 16 times VTR training.[5] The size of research sample in Iran was 21 balance disorders in elderly patients, conducted for 2 months period, 16 times VTR training.[11] A retrospective study in South Korea had 240 elderly patients with balance disorder, the samples were taken from 4 years hospital visit, VRT was performed 3 months.[2]

The bigger the size of sample in a study, the closer the result to real condition of the population.[10] The sample of our study is in accord with the sample size of a previous study in Brazil.[5]

Our study had 10 presbyastasis patients as samples who matched the qualification criteria, with basic data of age, gender, education and work. The research result found the youngest age was 60 years and the oldest age was 75 years, and the mean age was 66.5.

A previous research in 2012 conducted in Iran had 33 elderly patients with chronic balance disorders, with age range was 61-74 years old, and the mean age was 66.8.[4]

A similar study in Iran on 21 elderly patients with unilateral balance disorders, the age range was 61-74 years old, the mean age was $67.71\pm 5,43$ years.[11] Another study in South Korea with samples as big as 240 elderly presbyastasis patients, with age >70 years old, and the mean age was 76.5 ± 6.2 years old.[2] All samples in our research and the previous studies were compliant with WHO age range, that the elderly was 60-74 years old.

In our study, the number of female samples compared to male samples was 9:1. This was similar with a previous research in Brazil with 10 balance disorder patients who had been given VRT, where the samples were 9 females and 1 male.[5]

The study in Iran in 2012 obtained male samples 36.36%, and female samples 63.64% in 33 elderly patients with balance disorders.[4] Another study in Iran in 2017 on 21 elderly patients with chronic balance disorders, had ratio of male patients were more than female 11:10.[11]

In our study, the number of female samples was higher than male due to the fact that member of community of elderly citizen (health club for elderly) who visited the Geriatric Outpatient Clinic at Dr. Soetomo General Hospital was majority female.

The majority of samples were High School graduates, as many as 50% (Table 1). In our study a high school graduate was

considered adequately educated to understand health value, and was willing to go to health facilities for medical check-up compared to those of lower education.[12]

In our study, the level of education was not limited, but in the inclusion criteria it was mentioned that the sample should be able to fill correctly the particular given DHI questionnaire, because the comprehension of DHI questionnaire could be biased from one person to another.[12]

In this study, all samples were not professional workers: retiree, housewife and food vendor (Table 2), thus, all samples had ample time to visit the hospital to do VRT training. The advantage of having non-professional participants was no drop out sample.

Using Wilcoxon test, the analysis of DHI. Emotional (DHI.E) subscale questionnaire result, before and after VRT, showed a significant decrease after 6 weeks VRT.

DHI.E consists of nine questions with 36 as maximal score, about balance disorder patient's feeling in pertaining of his/her emotional sufferings such as frustration, difficult to concentrate, fear of being alone, felt inhibited in human relation, and all other emotions that decreasing the quality of life.[8,13] A study in Brazil with 10 samples had shown a significant decrease of DHI.E score after 16 times training and 8 weeks VRT on 9 samples.[5] A research in Iran on 33 samples aged >60 years, the DHI.E score declined at second week evaluation, and at eighth week the score evaluation showed a significant decrease.[4] A study in South Korea on 150 balance disorder samples aged 26-79 years old, after one month VRT showed a significant result of DHI.E reduction score using questionnaire of Korean adaptation version.[14] In our study, the researcher found that all 10 samples had significant decrease in all scores of DHI.E after 6 weeks VRT. This result was in accord with several previous studies and showed higher result compared to the Brazilian study which had only 9 samples out of 10 samples had significant DHI.E decreased scores. This could be caused by excessive exercise and the longer duration of exercise executed by the patients on VRT program.[5]

The result of DHI Functional (DHI.F) subscale measurement, before and after 6 weeks VRT exercise, using statistical paired t test, found a significant decreased of DHI.F subscale score after 6 weeks of VRT exercise (Table 2). Earlier studies in Korea 2012, in Brazil 2015, and also in Iran 2017, all exhibited significant decreased score of DHI.F after the execution of VRT.[5,11,14] DHI Functional subscale consists of 8 questions with total score 36, about patient's complain of limited function in doing activities, for example: constrained activities outside home, difficulty in waking up, complexity in doing house errands as well as office work, and fear of height.[8] All these functional disturbances would decline one's performance, thus decreasing the quality of life and independency of balance disorder patients. The result of this study was in accord with earlier studies, showing there was a significant reduction of DHI.F subscale scores after VRT.

In this study, the result of DHI Physical (DHI.P) subscale measurement, exhibited a significant DHI.P subscale decreased score after the execution of VRT. The minimum value before VRT was 2 and maximum was 16. The minimum value after VRT was 0 and the maximum value was 4. The DHI.P subscale score consists of 8 questions with total score 28. Assessment of movement or physical activities, such as looking upward, quick movement of the head, changing sleeping position, walking in a flat surface, bending down, and strenuous work. All these activities could aggravate balance disorder complaints.[8,15] Several earlier studies with differences in sample size, time span of

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VRT and balance disorder type, had shown significant reduction of DHI.P subscale score after VRT execution on balance disorder patients.[4,5,11,14] This study obtained a result in accord with previous studies, a significant reduction of DHI.P. Thus, VRT is an effective method for management of elderly presbyastasis patients.

In this study, the result of DHI Total (DHI.T) measurement, exhibited a significant DHI.T decreased score after the execution of VRT. The minimum value before VRT was 12 and maximum was 34. After VRT the minimum value was 2 and the maximum value was 8. Previous study in Brazil on 10 patients with chronic balance disorders, had been treated with Cawthorne & Cooksey version VRT for 8 weeks, exercise was performed twice a week (total 16 times). The DHI score of samples were measured before and after VRT.[5] Another study in Iran on 21 elderly patients with chronic unilateral balance disorders, was treated with VRT for 8 weeks by adaptation and habituation exercises, the DHI were evaluated before VRT, 2 weeks and 8 weeks after VRT. Improvement was observed in all DHI subscores, and was most profound in the functional aspect.[11] A study in Korea on 150 samples with balance disorder case, were treated with VRT for 1 month, and the therapy was assessed before and after VRT by DHI Korean adaptation. This study showed that DHI Total score after VRT had a significant reduction.[14]

A study by Yung et al.[2] in South Korea on 240 patients aged above 70 years old, complaining dizziness, was retrospectively assessed from 4 years hospital visit data. Out of 240 samples, 153 patients were diagnosed as presbyastasis, and 106 were trained for VRT and adaptation as well as habituation 3 times a day for 3 months. Evaluation was performed in 3 weeks and 3 months after executing VRT, using the tools of Verbal Analogue Scale (VAS) and Activities Specific Balance Confidence (ABC). The result

showed a significant improvement in groups with VRT. The majority of samples (112) were elderly patients with comorbid hypertension, diabetes mellitus, chronic kidney disease, chronic heart disease, cataract, glaucoma, and musculoskeletal diseases. All patients were in stable condition with the help of medication while undergoing VRT.[2]

The result of all DHI subscale scores and DHI Total had shown a significant decrease after VRT. This result was in accordance with the purpose of VRT exercise, to improve presbyastasis patient's balance as described in prior studies. The VRT program was using several movements from various protocols such as Gans, Cawthorne & Cooksey with adaptation and habituation mechanism towards Vestibulo Ocular Reflex (VOR) and Vestibulo Spinal Reflex (VSR). The training among other was saccade, cross step exercise, balanced standing exercise, and moving a ball, which will increase the VOR and the VSR. A regular and proper exercise will increase VOR and VSR, thus improving the balance system.[4,5,11,14]

Our research provided more scientific information supporting earlier studies about VRT role for balance disorders, particularly to presbyastasis patients. VRT could be a therapeutic modality of choice for presbyastasis sufferers. The limitation of this study lies on lack of control group. Any presbyastasis sufferers with systemic comorbids, such as diabetes mellitus, hypertension, and chronic heart disease could join the study while consuming their specific medication. This fact could decrease the homogeneity of the study.

A significant reduction of DHI score after VRT showed that VRT is an effective therapeutic method for elderly patients with presbyastasis. DHI questionnaire is a good tool to evaluate the success of VRT in prebyastasis sufferers.

It is worthy to consider further research on presbyastasis patients in the form of clinical study with control group.

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