VESTIBULAR REHABILITATION OUTCOME IN PATIENTS WITH VESTIBULAR NEURONITIS

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ABSTRACT

Objectives: Our study evaluates the benefits of vestibular rehabilitation (VR) in patients with vestibular neuronitis and tries to identify appropriate assessment tools for monitoring the outcome.

Material and methods: Fourteen patients with vestibular neuronitis were included in a prospective study conducted in the Institute of Phono-Audiology and Functional ENT Surgery Bucharest. All patients underwent a combined medical (betahistine 48 mg per day) and physical (VR exercises) treatment. The recovery was assessed through clinical examination (nystagmus, Romberg and Unterberger tests), computerized dynamic posturography and several physical performance tests (Berg Balance Scale, Short Physical Performance Battery, Performance Oriented Balance and Mobility Assessment and Dynamic Gait Index), both at first visit and 30 days after treatment.

Results: Afer one month of VR, statistically significant improvements ($p<0.05$) were found in clinical aspects, computerized dynamic posturography, Berg Balance Scale, Short Physical Performance Battery and Dynamic Gait Index. There were no statistically significant differences of these tests by gender, age (</≥ 45 years old) or affected part. Time past before starting VR correlated significantly with the duration of VR (Spearman correlation coefficient, rho equal to 0.694).

Conclusions: Recovery after vestibular neuronitis usually takes place during first weeks. Berg Balance Scale and Dynamic Gait Index are useful in identifying balance and gait impairments after vestibular neuronitis and their evolution. VR improves clinical aspects and performance tests and promotes compensation. Starting rehabilitation sooner shortens the necessary period of VR.

Key words: vestibular neuronitis, vestibular rehabilitation, Berg Balance Scale, Dynamic Gait Index

INTRODUCTION

Vestibular neuronitis is an acute peripheral dysfunction which causes intense vertigo lasting for hours or days, nausea, vomiting and gait impairment. Most patients recover completely within few weeks due to a combination of vestibular function restoration and central compensation. The condition is considered benign and self-limited nowadays, but persistent dizziness, lightheadedness and disequilibrium which interfere with usual activities for a long period are not uncommon.

Vestibular rehabilitation (VR) is a form of physical therapy currently used for the treatment of a variety of chronic and stabilized peripheral and central balance disorders. Several studies (1,2,3,4) have already provided solid evidence about VR effectiveness in the management of unilateral peripheral dysfunction. Less evidence there is still about the efficiency of VR in patients with acute unilateral

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vestibular loss such as vestibular neuronitis. In such a situation, the outcome of a VR program is more difficult to assess than it seems, because most patients with vestibular neuronitis will get better on their own, so the improvement achieved can't be entirely attributed to rehabilitation therapy. The most frequently used tools in monitoring VR progress are subjective scales (questionnaires), posturography and physical performance tests such as Berg Balance Scale (BBS), Short Physical Performance Battery (SPPB), Performance Oriented Balance and Mobility Assessment (POMA), Dynamic Gait Index (DGI) and so on. As there are many functional balance assessment tests available, it is often difficult for a therapist to decide which to use. The perfect functional test would have to be reliable, objective and easily administered, to accurately identify balance impairments and to be sensitive to improvement.

The present study aims to evaluate clinical aspects and performance tests in patients with vestibular neuronitis and their improvement after a customized VR program in order to find appropriate assessment means for monitoring rehabilitation outcome.

MATERIAL AND METHODS

This is a prospective study on patients with vestibular neuronitis referred to the Institute of Phono-Audiology and Functional ENT Surgery Bucharest from November 2010 till October 2011.

Vestibular neuronitis was diagnosed based on medical history, clinical ENT examination (including Romberg/sharpened Romberg, Unterberger and head thrust tests), infrared camera examination for nystagmus, computerized dynamic posturography (CDP) and pure-tone audiometry.

All patients were screened for socio-demographic data (age, gender), duration of the illness, time past before starting VR, duration of the program, number of rehabilitation sessions needed, concurrent medical conditions (benign paroxysmal positional vertigo, vestibular migraine, hearing or vision problems, orthopedic or neurological impairment and so forth). In order to customize the VR protocol we also looked for aggravating factors of the dizziness (rapid head/eye movements, walking in crowded places, supermarket, on uneven surfaces or in poor light) in each patient. Pregnant women, patients who lived far away from the hospital (another city) and non-adherent patients to the VR program were excluded from this study.

Patients referred to our department during their first days of disease received symptomatic treatment consisting in vestibular sedatives (diazepam), antiemetics (metoclopramide) for 3 days and corticosteroids for 5 days. Afterwards, they underwent a combined medical (betahistine) and physical (VR) treatment. Patients, who came after the acute phase of disease had subsided, were submitted directly to VR protocol and betahistine treatment.

Customized VR program was started as soon as the patient was vertigo-free for at least 3 days and the protocol consisted in twice a day home-exercises and once a week exercises on a powered platform under specialized supervision. Most of the exercises were taken from Cawthorne's, Cooksey's and Herdman's protocols and used according to the patient complaints and improvement of symptoms. VR program ended when the patient's complains disappeared.

Physical performance was assessed before starting VR and one month afterwards with several tests: BBS, SPPB, POMA and DGI. Other physical aspects such as: presence/absence of spontaneous nystagmus, deviations or pathologic results on Romberg and Unterberger tests were also checked for.

BBS was developed in the early 1990s as a tool for measuring balance in the elderly. It has been shown to be consistent and reliable and it is currently used to identify balance impairment in patients with vestibular disorders, Parkinson's disease, stroke and multiple sclerosis. The scale consists in 14 tasks which assess representative aspects of daily activities that require balance, such as sitting, standing, standing on a leg, changing position, transfer, leaning over, reaching forward, stepping, turning around 360 degree or turning with fixed feet. Some items are rated according to the quality of the performance and some according to the time a patient need to perform the task. Each task is scored on a scale of 0 to 4: 0 meaning the patient is unable to do the task, and 4 meaning the patient is able to complete the task based entirely. The maximum total score of 56 is associated with excellent balance, while a lower than 45 score signifies a high risk of falling (5).

Developed by the National Institute on Aging, SPPB is an objective assessment tool for evaluating lower extremity functioning in older persons. This test has the advantages of being reproducible and sensitive to change. It measures lower limb strength, balance and gait speed. The patient has to perform 3 different physical tasks: stand up straight as quickly as he can five times, without stopping in between and without using hands, tandem or semi-tandem or side-by-side stand depending on the patient's capacity and walk at usual pace. Each task is timed with a stopwatch and the score is higher if the patient can perform the activity faster. It is believed that the test can identify older adults with impaired physical function, or those at risk of decline (6).

POMA tool is an easily administered test that measures an older adult's gait and balance abilities. The required tasks are similar with those included in BBS, but scoring is based on fewer categories of performance: three-point ordinal scale ranging from 0 (highest level of impairment) to 2 (independence level). POMA score quantifies fall risk as follows: <19 = high fall risk, 19-24 = medium fall risk, 25-28 = low fall risk (7).

DGI is a reliable test developed to assess falling risk while walking in older adults. It consists in tasks evaluating gait in 8 challenging situations: normal speed walking for 20 feet distance, change in gait speed, gait with head turns (horizontal/vertical), gait and pivot turning, stepping over/around obstacle, walking up stairs. Maximum score is 24 points and scores of 19 or less have been related to increase incidence of falls in the elderly (8).

We calculated pre and post vestibular rehabilitation scores for CDP, BBS, SPPB, POMA and DGI in order to evaluate the benefits achieved in physical performance.

Data were analyzed using SPSS version 19 statistical package. Confidence interval level was 95% and a p value below 0.05 was considered statistically significant. Statistically significant differences were marked with asterisks in the charts. The non-parametric Wilcoxon and McNemar tests were used to compare the parameters obtained before and after rehabilitation within the whole lot. The Mann-Whitney U test was used to compare results of the tests between different groups (gender, age, normal/pathologic results on Romberg/Unterberger tests). Spearman correlation coefficients were used to compare the relationship between time past before VR and duration of VR program.

RESULTS

We followed-up 14 patients, 5 women and 9 men. Descriptive information about patients' age, gender, affected part, time past before VR, duration of VR program and number of sessions are displayed in table 1 and 2. The age ranged between 12 and 59 years old with a mean age ± standard deviation (SD) of 38.7 ± 14.4 years. There was no difference between right and left part. Patients began physical therapy during their first week of disease or no longer than 15 weeks from the onset of symptoms. The number of sessions ranged from 0 to 20 over a mean period ± SD of 7.7 ± 7.4 weeks.

Table 1. *Demographic Features*

Characteristics		
Age (years)	Mean ± SD	38.7 ± 14.4
	Range	12-59
Gender	Male	9
	Female	5
Affected part	Right	7
	Left	7

Table 2. *Rehabilitation Features*

	Mean ± SD	**Range**
Time past before VR (weeks)	4.4 ± 4.1	1-15
No. of VR sessions	6.4 ± 5.8	0-20
Duration of VR (weeks)	7.7 ± 7.4	1-25

During first clinical examination, 11 out of 14 patients presented with spontaneous nystagmus, 2 patients revealed head-shaking nystagmus and 1 had no nystagmus. One month after VR, spontaneous nystagmus was detected in only 2 patients, while 5 patients had mild head-shaking nystagmus and 7 were nystagmus free. The distribution of spontaneous nystagmus across the 2 sets of measurements is significantly different according to related-samples McNemar test ($p<0.05$) (table 3).

Romberg and Unterberger tests were pathologic in 10 and 12 patients, respectively, before starting the rehabilitation program, but became normal in 11 and 9 patients, respectively, one month later. The difference between the 2 measurements is statistically significant according to related-samples McNemar test ($p<0.05$) (table 3).

Table 3. *Clinical finding before and after VR*

		Before VR	After 1 month of VR	P value (Related-samples McNemar test)
Nystagmus	Spontaneous	11	2	**.004***
	Not spontaneous (head-shaking or none)	3	12	
Romberg	Pathologic	10	3	**.039***
	Normal	4	11	
Unterberger	Pathologic	12	5	**.039***
	Normal	2	9	

**Statistically significant difference.*

When separating patients into normal group and pathologic group according to the pretherapy Romberg test results, there was no significant difference in the length of the VR program or number of sessions needed between the 2 groups (independent-samples Mann-Whitney U test). Similar results were found when dividing patients according to normal and pathologic result at pretherapy Untergerber test.

The mean mathematical value of the pre and post rehabilitation scores in CDP, BBS, SPPB, POMA, DGI and their difference are displayed in table 4. We used the Wilcoxon signed-rank test to compare the parameters before and after VR for the whole lot of patients and there were significant improvements in CDP, BBS, SPPB and DGI scores.

Table 4. *Physical performance tests before and after VR*

	Before VR	After 1 month of VR	Mean difference	P value (Related-samples Wilcoxon signed rank test)
CDP	66.8 (47-87)	78.1 (68-87)	11.3	**.007***
BBS	53.7 (50-56)	55.6 (53-56)	1.9	**.005***
SPPB	10.5 (9-12)	11.6 (10-12)	1.1	**.011***
POMA	27.8 (27-28)	27.9 (27-28)	0.9	.317
DGI	21.7 (17-24)	23.9 (23-24)	2.2	**.011***

CDP: Computerized Dynamic Posturography. BBS: Berg Balance Scale. SPPB: Short Physical Performance Battery. POMA: Performance Oriented Balance and Mobility Assessment. DGI: Dynamic Gait Index.
**Statistically significant difference.*

There were no statistically significant differences of the tests scores by gender, age (</≥ 45 years old) or affected part (independent-samples Mann-Whitney U test).

None of the physical performance tests scores obtained at the beginning of VR program correlated significantly with the length of the VR program (Spearman correlation coefficient).

Time past before starting VR correlated significantly with the duration of VR (Spearman correlation coefficient, rho = 0.694).

DISCUSSION

Vestibular neuronitis recovery is the result of a combination of restoration of vestibular function, most of the times incomplete, and central vestibular compensation. It usualy takes several weeks, but long-lasting periods of persistent symptoms are not uncommon. This study reveals the way physical impairment caused by vestibular neuronitis is rehabilitated using VR. Similar to other studies (1,2,4,9), our survey also shows that customized VR can improve postural stability, mobility and independence in patients with peripheral vestibular dysfunction.

Most patients in our study experienced acute severe vertigo and gait incapacity during first days of disease, therefore clinical performance tests were not always possible to perform during this phase. All parameters included in this study were measured the day rehabilitation started, this happening as soon as the patient was vertigo-free for at least 3 days or the day of reference to our department when the acute phase had already passed.

Clinical examination before VR revealed pathologic results in most patients included in our study: spontaneous nystagmus (11 out of 14), pathologic deviation/rotation during Romberg/Unterberger test, although time past from the onset of symptoms varied considerably from 1 week to 15 weeks.

Conversely, during the same examination, most patients scored very high on BBS, SPPB, POMA and DGI, showing a high functional level or even normal level. These high scores can be explained by 2 facts: on the one hand, spontaneous recovery usually takes place very soon after acute vestibular neuronitis, and on the other hand all performance tests used in our study are designed for older people who are supposed to have less mobility and balance ability.

After 1 month of VR, clinical examination was normal in more than half of our patients: 12 persons displayed no spontaneous nystagmus, 11 had normal Romberg and 9 had normal Unterberger test. The improvement is statistically significant, as already stated above (table 3).

Although first BBS, SPPB, POMA and DGI scores were high, one month of VR managed to increase them even more, therefore almost all patients achieved maximum number of points. Statistically significant differences were calculated for BBS, SPPB and DGI (table 4).

According to BBS, the most frequently encountered deficits were inability to reach forward 25 cm and to place foot tandem independently and hold 30 seconds, both present in 7 patients. Incapacity to lift one leg independently and hold it >10 seconds or to turn 360 degrees safely in 4 seconds or less were found in 4 cases. Other difficulties in physical performance were required supervision while standing unsupported with eyes closed for 10 seconds, encountered in 2 patients, required supervision while picking up objects, using hands while standing up and while transferring, each of them being present in only one patient. Three patients reached maximum score on their first examination. After 1 month of VR, 11 patients scored maximum points on BBS, but there still were minor problems in: reaching forward 25 cm, picking up objects, turning

360 degrees and foot tandem for 30 seconds, every deficit being found in one person only.

Five patients achieved maximum score on SPPB during first examination, but 7 persons walked slowly, 5 couldn't sustain tandem foot position for 10 seconds and 3 stood up five times slowly. Follow-up examination after 1 month revealed 10 subjects with normal scores on SPPB and 4 persons who still walked slowly.

POMA identified 12 patients with maximum score on first examination, 1 patient with mild walk deviation within 30 cm and another one with instability while standing with eyes closed and obvious use of hands while sitting. After 1 month only one patient showed instability while standing with eyes closed and the rest of them completed the test successfully.

First DGI score was maxim for 6 patients. The most frequent gait difficulties were minor disruption to smooth gait path while turning head horizontally and slowing down while stepping around obstacles, each of them being present in 6 cases. Slowing down while stepping over obstacles and walking slowly were found each one in 5 patients. Other impairments were inability to achieve a significant change in walk speed and slow pivot turning, present in 3 patients, and using rail while walking up stairs alternating feet, found in 2 patients. Only one person revealed minor disruption to smooth gait path while turning head vertically. After 1 month, 13 patients achieved maximum score and only one patient still experienced mild impairment while walking 20 feet (slow speed).

Our group of patients proves that balance and gait tends to get normal over a short period of time after vestibular neuronitis. Thus, only difficult tasks are challenging enough to reveal physical impairments. This is not the case of POMA tasks which appeared simple to our patients, so all scores were very high even during first days, not reflecting any disability. A helping factor for achieving high results is the scoring scale for each task which is very loose and doesn't identify several disability levels. These are our reasons for considering POMA not suited for physical assessment in patients with vestibular neuronitis.

BBS and DGI appear to assess more accurately balance and gait in vestibular neuronitis patients. They are among the most rigorously developed functional balance tests and although both are susceptible to ceiling effect, they seem to be sensitive enough to improve after VR ($p<0.05$). Similar to other studies (9,10,11), we found a statistically significant correlation between DGI and BBS (Spearman correlation coefficient was rho = 0.802) at the beginning of VR. There was also a significant correlation between SPPB and BBS, and DGI, respectively (Spearman correlation coefficient was rho equal to 0.804 and 0.681, respectively) during first evaluation. SPPB showed a good ability in identifying some physical impairments in patients after vestibular neuronitis and was sensitive to change after VR ($p<0.05$). Its main withdraws are limitation of the assessment to lower extremity functioning and scoring based only on time required for the task and not at all on quality.

In agreement with other studies (12), we did not find gender to influence any clinical aspect, physical performance or recovery pattern after vestibular neuronitis. Right and left part were equally affected in our patients and there was also no statistically significant difference between them, as already found in other studies (13).

None of the pretherapy clinical aspects or physical tests alone influenced the length of rehabilitation period. However, we did found a moderate correlation between time past before starting VR and duration of rehabilitation program (Spearman correlation coefficient was rho = 0.694) which suggests that beginning VR sooner after the onset of disease accounts for a shorter period of physical therapy.

The main limitation of our study was the lack of a control group which could establish how much of the improvement accomplished in one month was due to rehabilitation program and how much was the consequence of spontaneous recovery.

CONCLUSIONS

Physical recovery after vestibular neuronitis usually takes place during first weeks, but clinical abnormal aspects (nystagmus, pathologic Romberg and Unterberger tests) can be revealed even after several weeks. These findings tend to get normal after VR.

The most useful physical performance tests in identifying balance and gait impairments after acute vestibular neuronitis and monitoring efficiency of customized VR seemed to be BBS and DGI.

Customized VR program promotes recovery after vestibular neuronitis and faster achievement of complete compensation of the sudden vestibular deficit. Starting rehabilitation sooner shortens the necessary period of VR.

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