

Efficacy of Vestibular Rehabilitation Therapy in Reducing Falls

John D. Macias, MD, Shelly Massingale, PT, and Richard D. Gerkin, MD,
Phoenix, Arizona

OBJECTIVE: To assess the short-term effectiveness of vestibular rehabilitation therapy in reducing fall risk in an at-risk population.

STUDY DESIGN AND SETTING: Retrospective chart review of 70 patients older than 50 years of age at risk for falls treated at a tertiary vestibular therapy center. Fall risk was assessed by the Berg balance test.

RESULTS: Vestibular rehabilitation therapy resulted in a statistically significant improvement in Berg balance test scores (pretherapy, 36.8, to posttherapy, 46.4). Referring diagnosis, age, and gender had no impact on outcome.

CONCLUSION: Vestibular rehabilitation therapy significantly reduces the risk of falls in elderly at-risk patients with improvement measured at the termination of therapy.

SIGNIFICANCE: Vestibular rehabilitation therapy plays an important preventive role in reducing falls in at-risk elderly patients, with beneficial effects seen at termination of therapy.

© 2005 American Academy of Otolaryngology–Head and Neck Surgery Foundation, Inc. All rights reserved.

Vestibular rehabilitation therapy (VRT) is an important therapeutic option for the neuro-otologist in treating patients with significant balance deficits. Fall prevention is an important consideration in elderly patients at high risk, because falls represent a major source of morbidity.^{1,2} About 1 in 10 falls results in a serious injury requiring hospitalization.^{1,3} An estimated 6% of health care costs are spent on unintentional injuries in patients older than 65 years of age, with average charges per fall injury estimated at \$11,800 in 1993.⁴ Vestibular deficits, central neurologic deficits, and gait disturbances can place a patient at significant risk of falling, with potentially life-threatening sequelae.^{3,5} Forty percent of elderly patients admitted to a

hospital with fall-related injuries are discharged to an assisted care facility.⁴

Previous studies have supported the use of vestibular therapy on elderly patients with gait and balance disturbances.^{4,6–11} We wished to assess the short-term clinical utility of VRT in these high-risk patients with multiple diagnoses. The Berg balance score (BBS) is an easily obtained and useful measure of fall risk in older patients who are referred for vestibular therapy.^{12–15} The score relates to the relative risk of any individual patient falling and is easily obtained. We performed a retrospective chart review to determine whether VRT performed by trained vestibular therapists on patients at risk resulted in a significant improvement in fall risk, as measured by pre- and posttherapy BBSs. We also looked at pretreatment variables such as age, gender, and referring diagnosis to determine whether specific subgroups outperformed or underperformed others.

PATIENTS AND METHODS

Approval of this study was obtained from the Institutional Review Board of Banner Good Samaritan Medical Center. A retrospective review was made of patients referred to

Table 1
Distribution of patient therapy visits and age

Parameter	Minimum	Maximum	Mean
Visits	2	15	7.3
Age (yr)	51	96	77.1

From Macias Otolaryngology (Dr Macias), the Department of Vestibular Rehabilitation Therapy, Banner Good Samaritan Rehabilitation Institute (Ms Massingale), and Banner Good Samaritan Medical Center (Dr Gerkin).

Reprint requests: John D. Macias, MD, 1515 North Ninth Street, Suite B, Phoenix, AZ 85006.

E-mail: jdmacias@earthlink.net.

Table 2
Referring vestibular rehabilitation therapy diagnoses

Diagnosis	Number
Central vertigo	32
Dizziness	6
Brainstem/cerebellar infarct	2
Gait imbalance	26
Peripheral vestibular diagnosis	4

Banner Good Samaritan Rehabilitation Institute between 2000 and 2004 for VRT. Patients older than the age of 50 and with the diagnoses of central imbalance, dizziness, posterior cranial fossa stroke, gait, and peripheral vestibular disturbances were included in the study. The diagnostic categories were the referring diagnostic codes to the vestibular therapy center. Patients with benign paroxysmal positional vertigo referred for canalith repositioning were excluded. Patient information was obtained from patient medical records after the patient had been discharged from therapy. Data variables evaluated included patient age, gender, number of treatment visits, diagnosis, and BBSs pre- and posttherapy. Treatment consisted of vestibular habituation and vestibulo-ocular exercises, gait and balance training, safety and fall risk education, and lower extremity strengthening and was performed by trained vestibular therapists. Statistical analysis was performed to determine whether vestibular therapy significantly improved BBSs in this patient population.

RESULTS

Descriptive statistics were used to describe baseline characteristics. Spearman rank correlations were performed. Wilcoxon signed-ranks and Kruskal-Wallis tests were used for continuous data when the data were not normal. A 2-tailed $P < 0.05$ was considered significant. SPSS (version 11.5; SPSS, Inc., Chicago, IL) was used for the analysis.

Only those patients aged 50 years and older were analyzed ($n = 70$). There were 43 females and 27 males. The ranges and means for age and number of visits are listed in Table 1. The breakdown by referring vestibular therapy diagnoses is given

Table 3
Average therapy visits by diagnosis

Diagnosis	Mean (median)
Central vertigo	7.34 (7.00)
Dizziness	8.17 (9.77)
Brainstem/cerebellar infarct	5.50 (5.50)
Gait imbalance	6.85 (6.50)
Peripheral vestibular diagnosis	9.00 (8.00)

Table 4
Average Berg balance score before and after therapy

Berg score	Mean (Median)
Initial	36.8 (40.0)
Final	46.4 (49.5)

in Table 2. The mean and median number of treatments for each diagnosis is given in Table 3. There was no significant difference between groups.

The mean and median BBSs before and after treatment are given in Table 4. The Wilcoxon ranks test was significant for the difference between the final and initial BBSs ($P < 0.001$). There were differences in both initial and final BBSs by diagnosis (Table 5). Only diagnoses 1 and 4 (central vertigo and gait imbalance, respectively) were compared, because other diagnoses were made in 6 or fewer patients. Both initial and final BBSs were less in the gait-imbalance than the central-vertigo group ($P = 0.016$ and $P = 0.001$, respectively)

There were significant correlations between initial and final BBSs, between final BBS and age (score was lower with increasing age), and between age and gender (males were older; Table 6).

DISCUSSION

The American Geriatrics Society and the American Academy of Orthopedic Surgery recommend VRT for elderly patients with gait and balance disturbances.¹⁶ These recommendations are based on the tremendous medical costs generated by fall injuries^{1,4} and by the effectiveness of supervised VRT in patients at risk.⁶⁻¹¹ The purpose of our study was to assess whether our older patients received an immediate benefit from

Table 5
Average Berg balance scores before and after therapy by diagnosis

Berg score	Diagnosis	Mean (Median)
Initial	Central vertigo	40.03 (43.50)
	Dizziness	40.33 (42.00)
	Brainstem/cerebellar infarct	39.00 (39.00)
	Gait imbalance	33.04 (35.00)
	Peripheral vestibular diagnosis	29.25 (26.00)
Final	Central vertigo	49.94 (52.00)
	Dizziness	49.33 (49.00)
	Brainstem/cerebellar infarct	45.50 (45.50)
	Gait imbalance	41.04 (44.00)
	Peripheral vestibular diagnosis	49.00 (51.50)

Table 6
Correlations between Berg balance score and age and gender

Spearman's rho	BERG1	BERG2	Age	Gender
BERG1	1.000	.719†	-.153	114
	—	.000	.207	.347
BERG2	-.†	1.000	-.278*	.022
	—	—	.020	.858
Age	—	—*	1.000	.256*
	—	—	—	.032
Gender	—	—	—*	1.000
	—	—	—	—

Berg1, initial Berg score; *Berg2*, final Berg score. For each correlation, the top value is *r*, and the bottom value is the *P* value.

*Correlation is significant at the 0.05 level (2-tailed).

†Correlation is significant at the 0.01 level (2-tailed).

VRT, based on relative risk according to the BBS. The BBS is one method to assess fall risk and is particularly useful in elderly patients. We also wanted to assess the impact of referring diagnosis on outcome.

In patients referred to our center for VRT, the probability of falling in the average patient was approximately 98% (BBS 36.8). We felt that this was an appropriately high-risk group of patients to study. After 1 course of therapy (an average of 7.3 visits), this risk dropped to approximately 67% (BBS 46.4). VRT resulted in a statistically significant improvement in BBSs immediately after therapy in these patients ($P < 0.001$). Improvement was not affected by age, gender, or diagnosis. Therefore, older patients showed good benefit with VRT, regardless of diagnosis. Of particular note was that central neurologic disease, such as posterior cranial fossa strokes, did not prevent improvement with therapy. Diagnosis also had no effect on the number of overall treatment visits. Further analysis on the basis of these diagnoses is limited by their inherent vagueness, because they are based on established vestibular therapy referring codes and not necessarily on specific medical diagnosis.

On the basis of the improved BBSs after therapy, treatment resulted in a significant reduction in fall risk. These findings would suggest that VRT has a significant positive impact on healthcare cost savings in older patients with balance and gait disturbances. Higher BBSs also are correlated with a higher level of independence and less aid required for ambulation.¹² The improvement in scores also does not reflect the impact of improved balance and safety on the quality of life of these high-risk patients.⁵

The authors thank Amy Champlin, PT, and Amy Alexander, PT, for assisting in the treatment of patients and thank Kerry Mungia for data management.

REFERENCES

1. Runge JW. The cost of injury. *Emerg Med Clin North Am* 1993;11:241–53.
2. Sattin RW, Lambert Huber DA, De Vito CA, et al. The incidence of fall injury events among the elderly in a defined population. *Am J Epidemiol* 1990;131:1028–37.
3. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988;319:1701–7.
4. Rizzo JA, Baker DI, McAvay ??, et al. The cost-effectiveness of a multifactorial targeted prevention program for falls among community elderly persons. *Med Care* 1996;34:954–69.
5. Nevitt MC, Cummings SR, Kidd S, et al. Risk factors for recurrent nonsyncopal falls: a prospective study. *JAMA* 1989;261:2663–8.
6. Campbell AJ, Robertson MC, Gardner MM, et al. Randomized controlled trial of a general practice programme of home based exercises to prevent falls in elderly women. *BMJ* 1997;315:1065–9.
7. Close J, Ellis M, Hooper R, et al. Prevention of falls in the elderly trial (PROFET): a randomized controlled trial. *Lancet* 1999;353:93–7.
8. Gillespie LD, Gillespie WJ, Robertson MC, et al. Interventions for preventing falls in elderly people. *Cochrane Database Syst Rev* 2001; 3:CD000340.
9. Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N Engl J Med* 1994;331:821–7.
10. Wagner EH, LaCroix AZ, Grothaus L, et al. Preventing disability and falls in older adults: a population-based randomized trial. *Am J Public Health* 1994;84:1800–6.
11. Hall CD, Schubert MC, Herdman SJ. Prediction of fall risk reduction as measured by dynamic gait index in individuals with unilateral vestibular hypofunction. *Otol Neurotol* 2004;25:746–51.
12. Berg K, Wood-Dauphinee S, Williams JI, et al. Measuring balance in the elderly: preliminary development of an instrument. *Physiother Can* 1989;41:304–11.
13. Berg KO, Maki BE, Williams JI, et al. Clinical and laboratory measures of postural balance in an elderly population. *Arch Phys Med Rehabil* 1992;73:1073–80.
14. Chiu AY, Au-Yeung SS, Lo SK. A comparison of four functional tests in discriminating fallers from non-fallers in older people. *Disabil Rehabil* 2003;25:45–50.
15. Shumway-Cook A, Baldwin M, Polissar NL, et al. Predicting the probability for falls in community-dwelling older adults. *Phys Ther* 1997;77:812–9.
16. American Geriatrics Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the prevention of falls in older persons. *J Am Geriatr Soc* 2001;49:664–72.