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RESEARCH

FALL RISK ASSESSMENT OF ELDERLY BY USING POSTUROGRAPHY

ABSTRACT

Introduction: The purpose of the study is to identify the fall risk in a group of elderly subjects by using an objective measurement, posturography.

Materials and Method: Thirty volunteers, 65 years or older were enrolled in this study. The subjects with debilitating cardiac or respiratory illness, focal neurological disease, peripheral neuropathy, or musculoskeletal conditions limiting motion were excluded from the study. Balance of the subjects was evaluated by using four plate posturography and the Berg balance scale.

Results: The mean age of the participants was 70.4±4.6 years and 50% were women. The mean Berg balance score was 54.5±3.2 and the mean fall index score was 42.1±23.6. 46.7% of the subjects had low, 30.0% had moderate and 23.3% had high risk of falling. No significant correlation was found between Berg balance scale and fall index scores.

Conclusion: Fall index measurement by posturography can identify the individuals who have a high risk of falling, and seems to be a promising screening tool for the elderly.

Key words: Balance, Fall risk, Posturography, Elderly

ARAŞTIRMA

YAŞLILARDA POSTUROGRAFİ KULLANILARAK DÜŞME RİSKİNİN DEĞERLENDİRİLMESİ

ÖZ

Giriş: Bu çalışmanın amacı objektif bir ölçüm yöntemi olan posturografi kullanılarak bir grup yaşlı bireyin düşme riskinin belirlenmesidir.

Gereç ve Yöntem: Çalışmaya 65 yaş ve üzeri 30 gönüllü birey dahil edildi. Düşkünleştirici düzeyde kardiyak veya solunum sistemi hastalığı olanlar, fokal nörolojik hastalığı olanlar, periferik nöropatisi olanlar yada hareketi engelleyecek şekilde kas iskelet sistemi rahatsızlığı olanlar çalışma dışı bırakıldı. Bireylerin dengeleri Berg denge skalası ve posturografi kullanılarak değerlendirildi.

Bulgular: Katılımcıların yaş ortalaması 70.4±4.6 yıldı ve %50'si kadındı. Berg denge. skorunun ortalaması 54.5±3.2, düşme indeksi skorunun ortalaması ise 42.1±23.6 idi. Bireylerin % 46.7'si düşük, %30'u orta, %23.3'ü yüksek düşme riskine sahipti. Berg denge skalası ile düşme indeksi skorları arasında anlamlı bir korelasyon bulunmadı.

Sonuç: Posturografi kullanılarak ölçülen düşme indeksi, düşme riski yüksek olan bireyleri saptayabilmektedir, bu nedenle bu uygulamanın yaşlılar için gelecek vadeden bir tarama aracı olduğu düşünülmektedir.

Anahtar sözcükler: Denge, Düşme riski, Posturografi, Yaşlı

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INTRODUCTION

Falls present a substantial health problem among the geriatric population due to the overwhelming rise in life expectancy. Fall-induced injuries are one of the most common causes of longstanding pain, functional impairment, or disability in elderly. Many studies have focuced on the possible risk factors associated with falling in the elderly population. These risk factors are categorized into two groups: intrinsic and extrinsic. Extrinsic factors are a direct result of one's environment such as improper footwear and unstable living conditions, whereas intrinsic factors consist of those factors related to the physiological changes associated with aging (1,2). The most frequently reported intrinsic factors in community-dwelling men and women are gait and balance disturbances, neurological diseases, visual impairment, and medications (3-8). Poor postural balance is one of the major risk factors for falling. Numerous investigations carried out during the last 15 years have documented the relationship between impared postural control and falling risk, especially in populations above the age of 65 (9,10). It was suggested that posturography, which is a measuremet of body sway, may be a useful tecnique for quantifying imbalance in older persons and identifying those at risk for falling (11). The present study aims to identify the fall risk in a group of community-dwelling elderly subjects by using posturography which has been developed as a means of quantitatively measuring balance.

MATERIALS AND METHODS

Thirty volunteers aged 65 years and over were enrolled in this study. They were screened to exclude the ones with debilitating cardiac or respiratory illness, focal neurological disease, peripheral neuropathy, or musculoskeletal conditions limiting motion. Firstly, all of the subjects were evaluated with the Berg balance scale. This scale consisted of a 14-item balance specific activities ranging from sit to stand and to standing on one leg. Participants were scored on a scale of 0-4 and ranked depending on their ability to successfully complete the tasks (12). Then, fall risk assessment was performed by the Tetrax system (Sunlight Medical Ltd, Israel) during standing quiet on a static force platform in eight different positions (32 seconds at each one); head straight with eyes open and closed, standing on foam pads with eyes open and closed, bending head upwards and downwards, turning head towards left and right with eyes closed. This posturography device uses a system of force gauges in four plates on which subject stands, and translates the vertical forces on the plates into wave signals into a computer. The computer then interprets these signals to analyze the subject's balance upon the concept that the human postural behavier depends on the coordination and pressure fluctuations generated by four sources of support; ie. the two heels and two toe parts, respectively, and measures not only the force exerted by four sources support but also the interaction between them.

A fall index derived from Tetrax balance parameters has been developed to produce a score that will express the patient's risk of falling based on the spesific balance factors that effect falling. This score, which takes into account the patient's stability, Fourier transformation, and syncronization results, rates the patient's risk of falling on a scale from 0-100, where 0 indicates no risk of falling and 100 indicates that it is extremely likely that the patient will fall. Patients are graded according to following groups: low (0-35), moderate (36-57), and high (58-100) risk of falling.

All analyses were performed using the statistical analysis software package SPSS version 11.5 for Windows. The difference between genders were compared using the independent t test. The correlations were performed with Pearson correlation analysis. Results were considered statistically significant if the p value was <0.05.

RESULTS

The mean age of the volunteers was 70.4±4.6 years (range, 65-80y) and 15 of them were women. The number of the individuals who suffered from dizziness and/or imbalance was nine. Only 5 of the participants -with the mean fall index score of 47.6 ±31.6- had experienced at least one fall in the last six months. The mean score of Berg balance scale was 54.5 ±3.2 (range, 44-56) and the mean of fall index score was 42.1±23.6 (range, 12-100). 46.7% of the subjects had low, 30.0% had moderate and 23.3% had high risk of falling. Women had significantly higher fall index score than men (p<0.05). These descriptive characteristics of both genders were listed in Table 1. There was no correlation between fall index scores and age of the participants (p=0.653). Futhermore, no significant correlation was found between scores of fall index and Berg balance scale (p=0.705).

DISCUSSION

Fall prevention is an important part of health care of the elderly. An ability to identify the risk of the future falls, is

Table 1— Descriptive characteristics of participants enrolling in balance asssessment

	Women (n=15)	Men (n=15)
Mean age (range)	70.5 (65-78)	70.3 (65-80)
Dizziness and/or imbalance, n (%)	6 (40)	3 (20)
Mean Berg balance score (range)	53.8 (44-56)	55.3 (47-56)
Mean fall index (range)	51.6 (14-100)	32.7 (12-68)
Risk groups, n (%)		
Low (0-36)	4 (26.7)	10 (66.7)
Moderate (37-58)	6 (40.0)	3 (20.0)
High (59-100)	5 (33.3)	2 (13.3)

needed in order to target high-risk individuals for preventive intervention (13). A functional and objective measure of a patient's balance can help the physician decide if the patient needs physical therapy to improve balance, supports or walking aids, or other interventions to improve his/her balance.

Throughout the years, several instruments have been developed as a means of quantitatively measuring balance in the elderly population. These screening tools have been instrumental in evaluating the ability to maintain balance and, subsequently, in the identification of those individuals who present a substantial risk of falling in the very near future. Although the Berg balance scale was indeed one of the most effective predictors for falls within community-dwelling adults, it has been reported that this tool is not entirely representative in relation to its predictability of completing more complex tasks or activities (1,14).

Fall index assessment with Tetrax is designed to assess the individual's risk of falling, provides information that is essential in decisions that affect the quality of life of the individual patient. This index reflects balance factors that influence a patient's risk of falling which include contrast sensitivity, proprioception and sway (15). Deterioration in postural stability in older people may contribute to falls incurred during activities of daily life. Impaired balance has been correlated with an increased risk of falling (16). In a previous study, Melzer and et al. examined postural stability in 143 healthy volunteers aged 65 and over and stated that measurement of spontaneous postural sway to predict future falling risk suggests a possible clinical application as a preliminary screening tool for risk of falling (13). In this study balance and fall risk of a sample of elderly subject were evaluated by using Berg balance scale and four plate posturography. All of the subjects were ambulatory and living in noninstitutionalized settings. We

found that women had greater risk of falling compared to men. However, in the relevant literature, results have been conflicting with some studies reporting women having better balance than men, and others reporting men having better balance than women (17-20). Unexpectedly, in the present study no significant correlation was detected between Berg balance scale and posturographic measurents. This finding is consistent with a recent study in which it was reported that posturographic evaluation compared to the clinical tests, appears to be a more sensitive tool to identify those at high-risk of recurrent falls in a sample of non-institutionalized older persons aged over 65 (21). Thus, we can speculate that fall index measured by using posturography can identify the individuals with high risk of falling, and so seems like a promising application as a screening tool for elderly. Nevertheless, posturography is an expensive system and not readily available in all rehabilitation units. Furher investigations are needed to determine sensitivity, specificity and reliability of this measurement for detecting risk of falling in elderly population.

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REFERENCES

1. Lajoie Y, Gallagher SP. Predicting falls within elderly community: comparison of postural sway, reaction time, the Berg balance scale and Activities-spesific balance confidence (ABC) scale for comparing fallers and non-fallers. Arch Gerontol Geriatr 2004;38:11-26.
2. Kannus P, Sievanen H, Palvanen M, Jarvinen T, Parkkari J. Prevention of falls and consequent injuries in elderly people. Lancet 2005;366:1885-1893.

3. Means KM, rodell DE, O'Sullivan PS. Obstacle course performance and risk of falling in community-dwelling elderly persons. Arch Phys Med Rehabil 1998;79:1570-1576.

4. Tromp AM, Pluijm SM, Smit JH, Deeg DJ, Bouter LM, Lips P. Fall risk screening test: a prospective study on predictors of falls in community-dwelling elderly. J Clin Epidemiol 2001;54:837-844.

5. Nevitt MC, Cummings SR, Kidd S, Black D. Risk factors for recurrent nonsyncopal falls: a prospective study. JAMA 1989;261:2663-2668.

6. Lord SR, Dayhew J. Visual risk factors for falls in older people. J Am Geriatr Soc 2001;49:508-515.

7. Leipzing RM, Cumming RG, Tinetti ME. Drugs and falls in older people: a systematic review and metatanalysis: I. Psychotropic drugs. J Am Geriatr Soc 1999;47:30-39.

8. Leipzing RM, Cumming RG, Tinetti ME. Drugs and falls in older people: a systematic review and metatanalysis: II. Cardiac and analgesic drugs. J Am Geriatr Soc 1999;47:40-50.

9. Alpini D, Kohen-Ratz R, Burstin A, et al. Falls in the elderly: the development of a risk questionnaire and posturographic findings. Int Tinnitus J 2001;7:105-108.

10. Runge M, Rehfeld G, Resnicek E. Balance training and exercise in geriatric patients. J Musculoskelet Neuronal Interact 2000;1:61-65.

11. Baloh RW, Jacobson KM, Enrietto JA, Corona S, Honrubia V. Balance disorders in older persons:quantification with posturography. Otolaryngol Head Neck Surg 1998;119:89-92.

12. Whitney SL, Poole SL, Cass SP. A review of balance instruments for older adults. Am J Occup Ther 1998;52:666-671.

13. Melzer I, Benjuva N, Kaplanski J. Postural stability in the elderly: a comparison between fallers and non-fallers. Age Ageing 2004;33:602-607.

14. Shumway-Cook A, Baldwin M, Polissar NL, Gruber W. Predicting the probability for falls in community-dwelling older adults. Phys Ther 1997a;77:812-819.

15. Lord SR, Clark RD, Webster IW. Physiological factors associated with falls in an elderly population. J Am Geriatr Soc 1991;39:1194-1200.

16. Tinetti ME, Speechley m, Ginter SF. Risk factors factors for fallls among elderly persons living in the community. N Eng J Med 1998;319:1701-1707.

17. Ekdahl C, Jarnlo GB, Andersson SI. Standing balance in healthy subjects. Evaluation of a quantitative test battery on a force platform. Scand J Rehab Med 1989;Supp 21: 187-195.

18. Era P, Avlund K, Jokela J, et al. Postural balance and self-reported functional ability in 75-year-old men and women: a cross-national comparative study. J Am Geriatr Soc 1997;45: 21-29.

19. Overstall PW, Exton-Smith AN, Imms FJ, Johnson AL. Falls in elderly related to postural imbalance. BMJ 1977;1:261-264.

20. Panzer VP, Bandinelli S, Hallet M. Biomechanical assessment of queit standing and changes associated with ageing. Arch Phys Med Rehab 1995;76:151-157.

21. Buatois S, Gueguen R, Gauchard GC, Benetos A, Perrin PP. Posturography and risk of recurrent falls in healthy non-institutionalized persons aged over 65. Gerontology 2006;52:345-352.