Orginal Article:

Investigation of Balance in Old People Residing in Nursing Homes Using Clinical Assessments

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ABSTRACT

Background and Objectives: Balance problems are the main cause of falls and fall-related complications in the elderly. The objective of this study was to investigate the balance in old people residing in nursing homes using clinical assessments.

Methods: A total of 54 people participated in this cross-sectional study. Timed Up and Go (TUG) was used to assess balance regarding mobility impairments. The modified Clinical Test Of Sensory Interaction on Balance (CTSIB) was also used to assess balance regarding sensory problems. This test was used in 4 conditions: standing with eyes open on a firm surface, standing with eyes closed on a firm surface, standing with eyes open on a compliant foam, and standing with eyes closed on a compliant foam. Data analysis was done by SPSS V. 18 software.

Results: The mean time for the completion of TUG was significantly higher than standard scores in all age groups (P<0.05). Postural sway during standing with eyes closed on the ground, eyes open and eyes closed on the foam was more than standing with eyes open on the ground (P<0.001). Postural sway in standing with eyes closed on the foam was more in comparison with standing with eyes closed on the ground and eyes open on the foam (P<0.001).

Conclusion: Elderly people living in nursing homes had poorer motor skills to maintain balance. They also showed greater dependence on visual and sensory systems to maintain balance.

Keywords: Older adults, Postural equilibrium, Sensory function

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↑ *What is "already known" in this topic:*

Clinical tests are commonly used to assess balance because of their cost effectiveness and their ease of application.

→ *What this article adds:*

This study describes balance of Iranian elderly residing in nursing homes using modified version of the clinical test of sensory interaction and balance.

1. Introduction

Falling is one of the most common problems among old people, especially, in nursing home residents [1]. There are many complications in relation to falls such as physical and psychological trauma, loss of independence, or even death [2-4]. Falling of the elderly has a multifactorial etiology. Impaired balance due to the process of aging has been considered as an important risk factor [5, 6].

Balance is defined as the ability to maintain equilibrium by keeping the center of body mass over its base of support when exposed to a perturbation [7]. Processing and integration of sensory information from somatosensory, visual, and vestibular systems, as well as motor planning and adjustment of motor responses, are necessary to maintain balance [8]. Functional declines in sensory and motor systems due to age-related changes may disturb the balance and postural control [9].

Careful assessment of the elderly's sensory and motor capacity and enhancement of these capacities can help improve their balance. In this regard, the use of clinical tests to assess balance has been emphasized [10]. Clinical evaluations are commonly used because of their cost-effectiveness as well as their ease of application [11]. The Timed Up and Go (TUG) is a widely used clinical assessment to investigate balance in older adults regarding mobility impairments [8]. The modified version of the Clinical Test of Sensory Interaction and Balance (CTSIB) is also a cheap, suitable, and valid clinical alternative for laboratory measures to assess the dependency of an individual to visual, somatosensory, and vestibular inputs in maintaining balance [12]. These tools can easily screen balance problems in nursing home residents and be a criterion for balance function in these individuals. To our knowledge, there is no study to investigate the balance of Iranian elderly residing in nursing homes using CTSIB. The objective of this study was to investigate balance in old people residing in nursing homes by using clinical measures of TUG test and the modified version of CTSIB.

2. Materials and Methods

This cross-sectional research was run in the Noor and Imam Ali care centers of Semnan City, Iran. The Ethics Committee of Semnan University of Medical Sciences approved the study protocol, and all participants gave their written/verbal informed consent before study entry.

The study participants were people aged 65 years and older selected non-randomly. The inclusion criteria were the following: good general health with no cognitive or neurologi-

cal impairment, not any vestibular or hearing disability, as well as the ability to ambulate independently without the use of assistive devices or orthotics in the lower extremities. The participants who fall during the examination or those who were reluctant to complete all stages of the study were also excluded from the study.

In the beginning, the subjects were asked to complete 3 trials of the TUG test. In each trial, the subjects were given verbal instructions to stand up from an armchair, walk 3 m as quickly and as safely as possible, cross a line marked on the floor, turn around, walk back and sit down. The subjects were observed and timed by a stopwatch from the instant they rose from the armchair to a fully seated position. The final TUG score was the mean score for 3 trials. The TUG test is an effective valid and reliable method of assessing and screening the elderly for fall risk [13]. The TUG scores of the participants were compared with the normative reference values described by Bohannon [14].

The modified clinical test of CTSIB was then used to assess participants' ability to use sensory inputs for balance. According to previous studies, this test could be a valid, cheap, and available alternative for sensory organization test [15-17]. The modified CTSIB consists of 4 test conditions: standing with eyes open on a firm surface, standing with eyes closed on a firm surface, standing with eyes open on a compliant foam, and standing with eyes closed on a compliant foam. For any of these conditions, the participants completed three trials with a maximum of 30 s for each trial by standing with bare feet. If the subjects opened their eyes during an eye closed trial or moved their feet from the standing position, the trial was discontinued and repeated. An examiner observed and scored postural sway in each condition based a 4-point Likert-type scale ranging from 1 to 4. Score 1 indicated minimal sway, score 2 moderate sway, score 3 maximal sway, and score 4 falling [15]. The examination was done in a quiet treatment room; the temperature was set at 22°C and no talking was permitted during the examination. The foam was a high-density viscoelastic foam sized (60×45×18) cm.

The total test time for each subject was approximately 40 minutes. All participants were tested by two investigators, one for recording and one for the safety of the participants.

All data were analyzed in SPSS,18. The normal distribution of variables was investigated by the Kolmogorov-Smirnov test. Descriptive statistics were used to describe all variables. Numbers with percentages or the Mean±SDs were used to describe the participants' demographic information and results of clinical assessments. The Wilcoxon test was used to compare the TUG score with the standard score. Friedman test was also used to compare postural sway in different con-

ditions of the CTSIB. A P value of 0.05 or less is considered statistically significant.

3. Results

A total of 54 subjects were selected using non-random sampling to participate in this study, 42 subjects from Imam Ali and 12 subjects from Noor care centers. Table 1 presents the participants' characteristics. Results of the laboratory balance measures with the TUG test showed that the mean time for the completion of TUG was significantly higher than standard scores in all age groups. Table 2 presents these results.

The results of the modified CTSIB showed significant differences in postural sway in different conditions of the test. Postural sway in the condition of standing with eyes closed on a firm surface and standing with eyes open and closed on a compliant foam was significantly more than postural sway in the condition of standing with eyes open on a firm surface (P<0.001). Also, postural sway in the condition of standing with eyes closed on a compliant foam was more than standing with eyes closed on a firm surface and standing with eyes open on a compliant foam (P<0.001). There were no significant differences in postural sway during standing with

eyes open on a compliant foam and standing with eyes closed on a firm surface. These results are presented in Table 3.

4. Discussion

Visual, vestibular, and somatosensory inputs are considered as the sensory prerequisites for balance [18]. accordingly, balance can be assessed by challenging these sensory inputs, as proposed in the clinical test of sensory interaction and balance. this test is easily affordable and can be run anywhere without special equipment.

According to CTSIB results in this study, postural sway in the condition of standing with eyes closed on a firm surface and a compliant foam was significantly more than postural sway in the condition of standing with eyes open on a firm surface. This finding is congruent with previous studies [19-21] which confirmed the visual reliance in old women and a reduction in balance control by visual occlusion. It was also demonstrated in the present study that greater postural sway occurred during standing with eyes closed on a firm surface and standing with eyes open on a compliant foam. In these two conditions, visual information was blocked and somatosensory in-

Table 1. Participants' characteristics

Variables		Mean±SD/ No. (%)
Age (y)		74.9±8.4
Gender	Male	4 (7.4)
	Female	50 (92.6)
Body mass index, kg/m^2		28.2±5.6

Table 2. Results of the laboratory balance measures in the timed up and go test

Age (y)	No.	Mean±SD	95% CI	Standard Score	P
60-69	16	11.08±4.05	8.92-13.23	8.1 (7.1-9)	
70-79	18	14.30±4.50	12.06-16.54	9.2 (8.2-10.2)	<0.05
≥80	20	20.06±5.87	17.31-22.80	11.3 (10-12.7)	

Table 3. Results of the modified clinical test of sensory interaction and balance

Condition	Mean±SD	P
Standing with eyes open on a firm surface	1.07±0.26	
Standing with eyes closed on a firm surface	1.69±0.72	
Standing with eyes open on a compliant foam	1.59±0.81	<0.001
Standing with eyes closed on a compliant foam	2.56±0.98	

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puts were challenged, respectively, so the participants were obliged to rely only on the other two sensory systems for balance control. As there was no significant difference in postural sway during these two positions, visual and somatosensory systems could complement each other's work in challenging tasks and environments.

Standing with eyes closed on a compliant foam was the most challenging position because both visual and somatosensory inputs were challenged and the subjects had to rely only on the vestibular information. When the vestibular system is also incompetent, an increase in postural sway or falling may occur. Similar to the previous study [21], our results showed that old people's vestibular system may not have enough proficiency for balance control. Accordingly, preventive and rehabilitative strategies should be implemented that target the elderly about such changes in postural control and functional balance.

The results of this study also showed that the time of completing the TUG test was higher than standard scores in all age groups. This study was done in Imam Ali Daily Care Center and Noor Hostelry Center. Usually, the elderly have decreased mobility and physical activity in such institutionalized centers which may affect this result. According to previous studies, settlement in elderly care centers and a decrease in social and familial experiences together with a decrease in physical activities can limit the functional mobility of old people [22]. According to past studies, these elderly have nothing to do in most of their time and this inactivity harms their functional mobility and participation [22, 23].

The present study investigates the balance in the elderly regarding individuals' sensory and motor functions. Various other factors, such as environmental factors and information processing in the central nervous system, also affect balance control, which could not be studied in this study. The limitation of this study was a relatively small sample size and a lack of sexual harmony in participants' gender as female participants were the majority of the study participants.

5. Conclusions

Elderly people living in nursing homes had poorer motor skills to maintain balance. They also showed greater dependence on visual and sensory systems to maintain balance.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article.

Conflict of interest

The authors declare no conflicts of interest.

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بررسی تعادل سالمندان ساکن سرای سالمندان با استفاده از ارزیابی‌های کلینیکی

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چکیده

مقدمه مشکلات تعادلی علت اصلی زمین خوردن و مشکلات ناشی از آن در سالمندان است. مشکلات حسی و حرکتی یکی از مهم‌ترین دلایل مشکلات تعادلی در این افراد است. هدف از این مطالعه توصیف عملکرد تعادلی سالمندان ساکن مراکز سالمندان با استفاده از ابزارهای آزمایشگاهی است.

مواد و روش‌ها در این مطالعه مقطعی ۵۴ فرد سالمند شرکت کردند. برای ارزیابی عملکرد تعادلی بر اساس مشکلات حرکتی از آزمون Timed up and go استفاده شد. آزمون Modified Clinical Test of Sensory Interaction on Balance نیز برای ارزیابی عملکرد تعادلی با در نظر گرفتن مشکلات حسی مورد استفاده قرار گرفت. این آزمون در ۴ وضعیت اجرا می‌شود: ایستاده با چشم باز روی سطح صاف، ایستاده با چشم بسته روی سطح صاف، ایستاده با چشم باز روی سطح فوم، ایستاده با چشم بسته روی سطح فوم.

یافته‌ها Timed up and go در تمام گروه‌های سنی به طور معناداری بیشتر از نمره استاندارد بود (P<۰/۰۵). نوسان وضعیتی در حالت ایستاده با چشم بسته روی سطح صاف و ایستاده با چشم باز روی سطح فوم بیشتر از ایستاده با چشم باز روی سطح صاف بود. همچنین نوسان وضعیتی در حالت ایستاده با چشم بسته روی سطح فوم بیشتر از ایستاده با چشم بسته روی سطح صاف و ایستاده با چشم باز روی سطح فوم بود (P<۰/۰۰۱).

نتیجه‌گیری سالمندان ساکن مراکز سالمندان مهارت‌های حرکتی ضعیف‌تری را برای حفظ تعادل داشتند. همچنین برای حفظ تعادل وابستگی بیشتری را به سیستم‌های حسی بینایی و حسی پیکری نشان دادند.

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