



A Review of Postural Balance and its Related Factors in the Elderly

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Abstract

Objective: The slowing down of the nervous system function and changes in the musculoskeletal system (including joint changes and instability) during old age have resulted in imbalance and lack of postural control becoming common problems during this age period. Using balancing tests and identifying those at risk can be an important step in the prevention of falls and its consequences in the elderly. The purpose of this study was to investigate the balance status of the elderly according to some demographic characteristics.

Materials and Methods: In this descriptive cross-sectional study, 194 elderly retired from public institutions were selected using systematic random sampling method and studied. To gather information, tinetti gait and balance evaluation tests were performed which included 16 items in 2 sections of dynamic balance and static balance. After collecting the data, they were analyzed using SPSS software, and Kruskal-Wallis test, Mann-Whitney U test, and Spearman's rank correlation coefficient.

Results: Results showed that regarding static balance, 82% of participants had natural balance and 18% had abnormal balance. Regarding dynamic balance, 95.4% of participants had natural balance and 4.6% had abnormal balance. Among the demographic characteristics (age, gender, and disease), age had a significant relationship with balance (dynamic and static). Moreover, a significant relationship was observed between dynamic balance and disease. Therefore, the possibility of imbalance in the elderly increased with age and history of a disease.

Conclusion: Imbalance has been introduced as one of the most common risk factors for falls in the elderly. Therefore, using balance tests and identifying elderly with balance disorders, and using multilateral interventions (including balance rehabilitation programs), regular exercise programs, suitable living environment (safer furniture, installing rails and handles, and showers with no tub), and specialist counseling if needed, can prevent unwanted falls and injuries in the elderly.

Keywords: Elderly, Postural Balance, Postural Equilibrium

Introduction

Today, with the advancement of medical knowledge, reduction of fertility levels, and improvement of socio-economic and nutritional status, life expectancy, and consequently, the world's elderly population is rapidly increasing (1). According to the census of 2006, the population over 60 years of age was approximately 5,119,000, and this figure will rise to about 10 million people by the year 2022 (2). These figures further prove the need to consider the

phenomenon of aging. Aging is associated with a gradual acceleration of the decline in body organs' function. This phenomenon increases the risk of physiological and psychological disorders for humans (3). As an example, changes in the nervous system impact the balance status of the elderly; due to the slowing down of its functions and impaired balance, they are prone to falls and injuries. On the other hand, changes in the musculoskeletal system, including joint changes and instability, worsen the

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condition (4,5). Studies, have reported imbalance, muscle weakness, confusion, and vision disturbances as the most common risk factors for falls among the elderly. Accidental falls and injuries are one of the major concerns of the elderly. The consequences include loss of functional skills, social isolation, and admission to nursing homes (6). Given that loss of balance and postural control are common problems in the elderly and prevention of falls among them is a major concern of public health systems of many countries, using balancing tests to predict the risk of falls among the elderly can have a significant role in its reduction (7,8). This study was aimed to investigate the balance status of the elderly and its related factors in Rasht, Iran.

Materials and Methods

This research was a descriptive cross-sectional study. The research population consisted of all retired individuals of the Civil Servants Pension Organization (C.S.P.O) and Social Security Organization of Guilan. By studying several papers which used the following formula, the samples size was estimated at 190 subjects with 95% confidence interval, 5% accuracy, and $p = 0.58$. By applying a 10% loss in the samples a total of 210 subjects were chosen via systematic random sampling from among those over the age of 60 in the retirement list. Due to the higher population of the Social Security Organization, 86 subjects were recruited from the National Retirement Organization and 124 subjects from the Social Security Organization.

$$n = \frac{Z_{1-\frac{\alpha}{2}} \times pq}{d^2}$$

In order to obtain general information on the elderly, a socio-demographic questionnaire was used, and to identify balance tinetti gait and balance evaluation tests were conducted. Maghsoudnia introduced this test as a scale to assess the balance status in the elderly (9). It consists of 2 parts which include balance and gait tests. The checklist was completed, during test performance and by observation of the test subjects. The first part was the balancing test including 9 tests and a total score of 16. A score of 13 and higher indicated a normal static balance and a score of 0-12 showed unnatural static balance. The second part included a walking test with 7 tests and a total score of 12. A score of 9 or higher indicated normal dynamic balance and 0 to 8 showed unnatural dynamic balance. To validate the questionnaires, content validity was used. Thus, the survey was given to 15 professors and experts of the School of Nursing and Midwifery of Guilan University of Medical Sciences and Shahid Beheshti University, Tehran, Iran, for evaluation. After collecting their

opinions and correction proposals, the final questionnaire was adjusted. To evaluate the reliability of the questionnaire, test-retest was conducted on 11 elderly individuals. As a result a 98% reliability was calculated. The researcher, after receiving an introduction letter from the department and referring to the Social Security and National Retirement Organizations, using simple random sampling, selected and wrote down the names and telephone numbers of individuals of over 60 years of age. He, then, contacted them, and if they were willing to participate in the study, they were invited to the retirement center of the same organization. From the total of 210 subjects, 16 people were excluded from the study (8 cases due to lack of physical ability to come to the organization, 1 person due to blocked phone, 1 person due to location change, 3 had died, and 3 people because of unwillingness to cooperate). It should be noted that according to the instruction of the statistics advisor, as the people with disabilities who were not able to visit the center and participate in the study were less than 15% of the samples, they were excluded from the study. The questionnaire was completed by the researcher.

Statistical analysis

After data collection, data were analyzed using SPSS software (version 16, SPSS Inc., Chicago, IL, USA) and statistical methods such as Kruskal-Wallis test (marital status, education, income, and balance status), Mann-Whitney U test (gender, balance status, and disease), and Spearman's rank correlation coefficient (age and balance).

Results

The results showed that the majority of participants (70.6%) were male. The mean age of the subjects was 66.1 ± 4.5 years, and their maximum age was 83 and minimum age was 60 years. Most of the participants (79.4%) were married. The majority of participants had an average monthly income of 400000-600000 Toman. Regarding education level, 34% of the elderly were illiterate, 24.3% were under diploma, 26.8% had diploma, and 14.9% had university education. In addition, 66% of the elderly had a history of chronic illness. Among the 8 studied illnesses, diabetes with a rate of 42.9% of subjects had the highest percentage and cardiovascular disorders with 39.8% had the second highest rate. Regarding balance status, 18% of the elderly had static balance and 4.6% had unnatural dynamic balance. The balance distribution of the subjects in terms of demographic characteristics (age, gender, and disease) is shown in table 1.

Table 1. Distribution of dynamic and static balance based on the demographic characteristics of the subjects

Variable		Test type	P
Age	Static balance	Spearman	< 0.0001
	Dynamic balance	Spearman	< 0.0001
Gender	Static balance	Mann-Whitney U	< 0.383
	Dynamic balance	Mann-Whitney U	< 0.726
History of disease	Static balance	Mann-Whitney U	< 0.081
	Dynamic balance	Mann-Whitney U	< 0.016

Discussion

According to the results, 18% of the elderly had static balance and 4.6% had unnatural dynamic balance. Joghataii and Nejati reported these figures in their study on the elderly of Kashan as 27% and 30%, respectively (10). This difference might be due to the large margin between musculoskeletal problems in the present study (7.8%) and the study by Joghataii and Nejati (41.7%). As explained by Joghataii and Nejati and suggested in recent researches, the imbalance and falls of the elderly are mostly related to musculoskeletal factors. Decreased range of motion and loss of flexibility of the spine, conditions such as arthritis, pain due to limited functional range of motion, and joint pain can affect the balance of the elderly (10). Regarding the relationship between balance status and age, the results showed that the mean age of the patients with normal static balance was 65.4 ± 4.07 years, and unnatural balance was 69 ± 5.6 years. The mean age of the elderly with normal dynamic balance was 66 ± 3.7 years and unnatural dynamic balance was 67.1 ± 4.6 years. Based on the Spearman's rank correlation coefficient, there was a significant relationship between age and the status of dynamic and static balance ($P < 0.0001$). As age increases, the possibility of impaired balance becomes greater. This finding was consistent with that of the study by Manckoundia et al. who studied the clinical determinants of the balance status of 2368 elderly aged over 60 years in France (11). They found that in all the balance tests, the success rate of the elderly at a younger age, compared to others, was higher (11). Regarding the same matter, Joghataii and Nejati found that with increased age body fluctuations increase, and thus, the likelihood of falls also increase (10).

The static and dynamic balance distribution of participants based on gender revealed that while 19.3% of women and 17.5% of men had static balance, and 5.8% of men and 1.8% of women had unnatural dynamic balance, based on Mann-Whitney U test, the relationship between gender and balance was not significant. In this regard, Manckoundia et al. reported that the risk of impaired balance and fall in women was higher than men due to reasons such as lower physical strength of women and gender differences in the musculoskeletal system (11).

In regards to the relationship between balance status and history of disease, 21.9% of the participants with a history of illness and 10.6% with no history of disease had unnatural static balance. However, the relationship between history of disease and static balance, based on Mann-Whitney U test, was not significant. Regarding dynamic balance, 5.5% of the participants with a history of disease and 3% with no history of disease had unnatural dynamic balance. Based on Mann-Whitney U test, this relationship was statistically significant ($P < 0.016$). Manckoundia et al. suggested that a history of an illness will impact the elderly's senses, weaken their muscles, and reduce their attention as factors effecting balance (11). Overall, the results showed that

the risk of loss of balance in the elderly increased with age and a history of disease.

Conclusion

Imbalance has been introduced as one of the most common risk factors for falls in the elderly. Therefore, using balance tests and identifying elderly with balance disorders, using multilateral interventions (including exercise programs to improve muscle strength and balance rehabilitation programs), eliminating environmental hazards (including the use of furniture with suitable height and stability), installing facilities such as cross handles and guard rails, and specialist counseling, if needed, can prevent unwanted falls and injuries in the elderly.

Ethical issues

Written informed consents were obtained from the patients for publication of this study. The study has been approved by the local ethics committee.

Conflict of interests

We declare that we have no conflict of interests.

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