Caspian Journal of Neurological Sciences
"Caspian J Neurol Sci"

Research Paper: Balance Disorders and Their Related Factors Among the Elderly in the Northern Rural Areas of Iran

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ABSTRACT

Background: Aging is a natural and physiological process. Moreover, balance disorders frequently occur in the elderly and cause many morbidities in this population.

Objectives: The present study aimed to evaluate balance disorders and their related factors in the healthy elderly population of the rural areas of Guilan province, in the north of Iran.

Materials & Methods: In this cross-sectional descriptive study, 425 individuals over 65 years old were selected by random cluster sampling method from the villages of Rasht, the capital city of Guilan province. After obtaining written consent, the subjects were examined for balance disturbance through gait and balance adjusted scale (GABS) index. The obtained results were reported as frequency. We applied the Mann-Whitney U test and non-parametric regression analysis for non-normally distributed dependent variables. The obtained data were analyzed in software version 18.

Results: The Mean±SD score of GABS was 10.07±8.00 [median (IQR):7(10.5)]. A total of 425 individuals were selected, but 413 completed the research (218 males and 195 females). In total, 73.1% of the subjects reported at least one disorder among the investigated parameters, and 45.2% mentioned a disorder in at least one of the studied parameters in medical history. By modified GABS; 42.2% of the subjects reported disorders in at least one of the investigated parameters.

Conclusion: Nearly half of the elderly population in the rural areas of the north of Iran suffer from balance disorder. This data was obtained by their medical history and physical examinations.

Keywords: Aging; Rural population; Postural balance

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Highlights

● Balance disturbance takes place through aging.

● Slight balance disturbance was observed among approximately half of the elderly population in the rural areas of northern Iran.

Introduction

In many countries, medical services are practically categorized into three major branches of pediatrics, middle age, and geriatric medicine [1]. Aging is a biological phenomenon, not a disease. It is, in fact, a natural and physiological process; however, various chronic, degenerative, and neoplastic diseases are more prevalent at older ages [2, 3]. More than half of the world's elderly population live in Asia. The population of Iran is growing old, as well.

The Population and Housing Census data suggest that the older adult population has grown 4.4 times during the 50 years of 1956-2006; while the total population of the country has grown 3.7 times during the same period. Studies also reported that the aging process of the Iranian population would be accelerated and more intense in the future [4]. According to the available resources, Guilan province has the oldest population in Iran [4]. Falling due to the imbalance is the main cause of morbidity and the sixth cause of death in the elderly [5]. As an essential skill for daily living, maintaining balance involves various components such as visual, hearing, and positioning capabilities.

Increasing age deteriorates progressive performance, which can lead to imbalance. Imbalance causes a growing concern about general health, including frequent falls and injuries. About one-third of people over 65 years old living in advanced societies have experienced at least one falling per year; while 10-15% of these falls have caused serious injuries [6]. Two prevalent neuro-otologic disorders in the elderly are hearing impairment and balance disorder [7]. Few studies in Iran have addressed the neuro-otologic issues of the elderly at the community level. Moreover, as they were conducted in nursing homes, they cannot be generalized to all elderly Iranian population. Furthermore, they have only considered few aspects. The elderly's health and medical care are of importance. Additionally, data on the prevalence of balance disturbance in the elderly are scarce. Stevens et al. evaluated 2925 elderly over 65 years old in the United Kingdom; 21.5% of the subjects reported balance disorder, and 11.1% reported dizziness. There was a significant relationship between balance disorder and age, diabetes mellitus, arthritis, visual problems, and muscle strength. There was significant relationship existed between dizziness and abnormal heart rhythm, hearing disorder, visual impairment, and muscle strength [8]. Barozzi et al. assessed balance disorder in 40 elderly (19 males and 21 females; age range: 65-83 y) with symptoms like dizziness. Somatosensory, vestibular, and visual disorders were observed in 85%, 60%, and 40% of the subjects, respectively [9].

Falling in the elderly has many complications, including bone fracture, limbs disability, head trauma, and secondary outcomes such as disability, bed sore, deep vein thrombosis, and even death or being laid up. These issues are associated with socioeconomic burdens. The prevention of falling requires alarming high-risk groups, recognizing the relevant disorders or abnormalities, and obtaining data about these disorders. One of these conditions is imbalance disorder in the elderly. Therefore, the present study aimed to determine the prevalence of balance disorders in the elderly living in the rural areas of northern Iran.

Materials and Methods

This descriptive study was conducted in the north of Iran in 2014. The statistical population comprised of adults over 65 years old living in the rural areas of Guilan province in northern Iran. The subjects who were disabled or bedridden or were undesired to participate in the study were excluded from the research.

The study participants were classified as follows: 65-69, 70-79, 80-89, and ≥90 years old groups. According to the latest statistics of the health center of Guilan Province in 2012, the total population of the villages of Guilan Province was 23945 individuals and the percentage of ≥65 years old population was equal to 13.2 The study participants were selected from 35 randomly selected villages covered by rural health centers. First, the total number of villages was divided by 35 for the

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random selection of villages. Accordingly, all villages were coded from 1 to 180.

Furthermore, the random number table was used to randomly and systematically select the villages. To select the number of elderly in each main village or its satellite villages, the number of elderly in each village was divided by the total older adults of Rasht. The number of elderly required for each village was determined; then, they were systematically selected from the list of elderly in each health center.

First, the selected people were informed by the care providers of healthcare centers. After obtaining written informed consent, a researcher-made checklist was completed for demographic data and general health status, and the study participants were examined for vertigo.

Gait and balance scale (GABS) was used to examine the balance status of the study participants [10]. Its reliability was reported to be 0.315-0.839 [11]. The first part of GABS (part A) contains history items, including walking space, walking, falling, and activity limitation due to the fear of falling. The second part (part B) contains clinical examination items, including the walking-related parameters of balance, and Romberg test and single-leg and heel-toe standing. Each item is scored from zero for normal status to 4 for the maximum limitation. The third part (part C) or the modified performance oriented assessment of gait scale (POAGS) measures the patient's backward and forward walking for 10 meters. The total obtainable score of GABS is 44 without considering the time of the stand-walk-sit part.

The required sample size to estimate the prevalence of balance disorder was calculated based on similar previous studies [12]. With the confidence interval (CI) of 99% and the accuracy of 5%, the sample size was estimated as 185 people.

$$n = \frac{Z_{1-\alpha/2}^2\, P(1-P)}{d^2} = \frac{1.962 \times 0.86 \times 0.14}{0.05^2} = 185$$

Considering the design effect of 2.5, as well as the cluster sampling method used in this study, the final sample size was determined as 462 persons.

As the study participants were examined in three stages, there were several dropouts at each stage. Family physicians examined 413 elderly, and an otolaryngologist re-examined 351 individuals.

The obtained results were reported as frequency. We used the Mann-Whitney U test and non-parametric regression analysis for non-normally distributed dependent variables. The obtained data were analyzed in software version 18.

Results

A total of 413 individuals participated in this study; of whom, 218(52.8%) were male, and 195(47.2 %) were female. The Mean±SD age of the study participants was 73.47±7.04 years. A total of 313(79.6%) participants were young elderly (i.e. <85 years old) and 80(20.4%) participants were old elderly. Moreover, 89(22.6%) of them were smokers, 76(19.3%) were opium-dependents, and 3(0.8%) were alcohol consumers.

About 134(34.1%) of the study participants reported abnormal hearing status. Additionally, 40.7%(168) individuals reported experiencing dizziness in the last 6 months. Regarding the first part of the GABS scale, 54.72% of the 413 examined people reported no medical problems history; however, 45.2% of cases mentioned a disorder in at least one of the studied parameters. In the second part of the GABS scale (performance), 26.9% of cases reported no problems. However, 73.1% of cases reported disorders at least in one of the studied parameters. In the third part of GABS (modified POAGS), about 57.8% of cases reported no problems, and 42.2% of the subjects reported disorders in at least one of the studied parameters. The stand-walk-sit test took <10 seconds for 16.5% of the subjects, 10-30 seconds for 74.3%, and >30 seconds for 6.5%; while 3.1% failed to perform this test.

The Mean±SD score of GABS was 10.07±8.5 (range: 0.00-43.00), and its median (IQR) was 7(10.5). The median score of all subscales of GABS and total score were significantly higher in women than men. Furthermore, subscale scores were higher among the subjects with abnormal hearing status than those with normal hearing. Considering the age of participants; all subscale scores were higher among old elderly, compared to young elderly. Smoking had no significant effect on performance and POAGS in GABS. Interestingly, the total GABS score and the score of history subscale were higher in non-smokers. Contrarily, with the history of opium consumption, all subscale scores were significantly higher, except in POAGS score (Table 1).

In the non-parametric regression for each subscale of GABS, all factors with (P<0.25) were entered. Hearing status, the age group of elderly, and the history of opium dependence significantly affected GABS and all of its

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Table 1. Comparing GABS score and its subscales in term of studied variables

Variable	Level	Mean±SD / Median(IQR)	History	Performance	POAGS	Total GABS
Gender	Male	Mean±SD	1.2±2.4	3.5±4.2	1.6±2.4	8.3±8.5
		Median(IQR)	0.5(1)	2(6)	1(2)	5(8)
	Female	Mean±SD	2.3±2.8	5.6±4.2	2±2.3	12±8.3
		Median(IQR)	1(4)	6(7)	1(3)	10(10)
	P		0.000*	0.000*	0.013*	0.000*
Hearing status	Normal	Mean±SD	1.4±2.4	4.0±3.9	1.5±1.9	9.0±7.4
		Median(IQR)	0.5(2)	3(7)	1(2)	7(9)
	Abnormal	Mean±SD	2.4±3	5.4±4.9	2.5±3	12.3±10.1
		Median(IQR)	1(4)	5(9)	1(2.2)	9(14)
	P		0.002*	0.016*	0.002*	0.006*
Age group	Young elderly	Mean±SD	1.4±2.4	3.9±4.1	1.6±2.2	9.0±7.8
		Median(IQR)	0.09(2)	2.1(7)	1(2)	6.1(9)
	Old elderly	Mean±SD	3.1±3.4	7.0±4.6	2.6±3.1	14.6±9.7
		Median(IQR)	2(5.7)	7(7.7)	1(3)	12.5(14.7)
	P		0.000*	0.000*	0.029*	0.000*
Smoking	Yes	Mean±SD	1.4±2.8	3.8±4.3	1.7±2.5	8.8±8.7
		median(IQR)	0.5(2)	2(7)	1(2)	5(9)
	No	Mean±SD	1.8±2.6	4.7±4.4	1.9±2.3	10.5±8.5
		Median(IQR)	0.5(3)	4(8)	1(2.7)	8(11)
	P		0.018*	0.097	0.17	0.038*
Opium dependence	Yes	Mean±SD	2.8±3.5	6.6±5.2	2.6±3.3	14.1±10.9
		Median(IQR)	1(5)	7(9)	1(2.7)	10.5(18.7)
	No	Mean±SD	1.5±2.8	4±4	1.60±2.1	9.10±7.6
		Median(IQR)	0.5(2)	3(7)	1(2)	7(10)
	P		0.009*	0.000*	0.060	0.000*

Data are reported as median and interquartile range (IQR) and examined by Mann-Whitney U test.

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*Significant at the level of 0.05

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Table 2. Logistic regression analysis of factors affecting on GABS score

Parameter	Wald CI 95%							
	History				Performance			
	B	Lower	Upper	P	B	Lower	Upper	P
Gender	-1.10	-1.66	-0.54	0.00*	-2.100	-2.98	-1.21	0.00*
Hearing	-0.76	-1.28	-0.250	0.004*	-1.04	-1.85	-.23	0.012*
Age	-1.67	-2.28	-1.06	0.00*	-3.16	-4.12	-2.19	0.000*
Smoking	-0.11	-0.787	0.551	0.729	-.310	-1.36	0.747	0.565
Opium dependence	1.13	0.50	1.766	0.000*	2.428	1.42	3.42	0.000*

Parameter	Wald CI 95%							
	POAGS				Total GABS			
	B	Lower	Upper	P	B	Lower	Upper	P
Gender	-0.31	-0.84	0.218	0.24	-3.52	-5.28	-1.76	0.00*
Hearing	-0.92	-1.41	-0.43	0.00*	-2.63	-4.26	-1.01	0.001*
Age	-0.74	-1.32	-0.16	0.012*	-5.52	-7.44	-3.60	0.000*
Smoking	-0.30	-0.93	0.33	0.35	-0.80	-2.91	1.29	0.452
Opium dependence	0.92	0.32	1.52	0.003*	4.58	2.59	6.57	0.000*

*Significant at the level of 0.05

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subscales (P<0.05). Moreover, gender had a significant effect on all scores (P<0.05), except for POAGS (P=0.247). Smoking did not affect any score (P>0.05) (Table 2).

Discussion

The present research aimed to investigate the prevalence of balance disorder in the elderly living in the rural areas of Guilan Province, northern Iran. A part of the examination was performed by a general practitioner trained in health centers and another part by an otolaryngologist. A total of 413 people participated in the study. The present research is unique in Iran in terms of sampling method, and sample size (a total of 413 healthy elderly adults presenting to health centers in the rural areas of Guilan Province participated in the study).

Furthermore, the range of examinations was unique among the elderly population, as various tests were employed. The study design can be a guide for future studies. The sample size of the present research was more than that of Barozzi (n=40) [9] and Hiromi-Tsuroha (n=60) [12], Malayeri (n=130) [13], Jalilvand [14], and Matlabnejad (n=275) [15]. The complete

random sampling method was another strength of our investigation. People with disabilities who were unable to visit health centers were excluded from the study; therefore, the sample population fails to fully represent all community members. However, it is closer to a healthy population, compared to similar studies conducted in nursing homes.

The Mean±SD age of the study subjects was 73.47±7.04 years; 52.8% were male, and 47.2% were female. These findings are inconsistent with those of Malayeri et al. (2003), in terms of gender distribution (38.46% male and 61.5% female). However, the mean age of the present study participants is close to that of Hiromi-Tsuroka study (mean age: 75 y) [12]. Guilan Province holds the oldest population in Iran according to the national statistics, which suggests 13.2% of the population in the province is >65 years old. According to Barozzi et al., 85% of the 40 elderly samples reported somatosensory and vestibular disorders, while 43.3% of the samples reported dizziness [9]. Their sample size was very smaller (40 elderly) than that of the present study. The type of dizziness in this research was not described in details, while Barozzi investigated the types of dizziness and their

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consequences, including falling, which is useful in this type of research.

However, the critical point in the current study is that GABS [10] was used to assess patients to investigate balance disorder. GABS provides a precise assessment of medical history and clinical examination as an appropriate indicator of the patient's balance disorder. The Mean±SD score of GABS was 10.07±8.00 (range: 0.00-43.00). Total obtainable GABS score is 44, without considering the time of the stand-walk-sit part. It seems that the score of imbalance among the elderly is not high.

According to the collected scores of the first part of GABS (history), approximately 50% of the subjects reported a disorder in at least one of the studied parameters. In the second part of GABS (performance), about 75% of the subjects reported disorders at least in one of the studied parameters. In the third part of GABS (modified POAGS), also approximately 50% of the subjects suffered from disorders in at least one of the studied parameters.

The mean score of all parts of GABS and the total score were significantly higher in women than men. Furthermore, these scores were higher among the subjects with abnormal hearing status than those with normal hearing. Considering the age of study participants, all scores were higher among old elderly, than young elderly. Smoking had no significant effect on the scores of performance and POAGS in GABS. Interestingly, the total GABS score and the relevant score in the history part were higher in nonsmokers.

Contrarily, with the history of opium dependence, all scores were significantly higher, except for POAGS score. In the non-parametric regression analysis for each field of GABS, all factors with (P<0.25) were entered. Hearing status, the age group of elderly, and the history of opium dependence significantly affected GABS score and all its subscales. Soto et al. assessed the neuropharmacological effect of opioids on the vestibular system. The opioids affect the operation of vestibular nucleus neurons. Opioids affect the excitability of the inner ear, which explains why abusing opioids such as heroin and dihydrocodone can impact the balance. Additionally, a Ménière's like-syndrome may occur after epidural morphine use [16].

The present study revealed that gender significantly affects GABS and all its subscale scores, except POAGS. According to Lin et al., women were more likely to experience balance problems than men [17].

However, in this study, smoking did not affect all scores. In contrary to the present study, Wada et al. revealed that smoking is associated with peripheral vestibular disease (PVD) occurrence, specifically among males. Smoking consumption of >30 pack-years is strongly associated with an increased risk of developing PVDs. They concluded that patients with PVD should strongly avoid smoking [18]. People with disabilities that were unable to visit health centers were excluded from the study; thus, sampling does not fully represent the healthy population of the community.

Conclusion

Nearly half of the elderly population in the rural areas of northern Iran had a slight abnormality detected in history collection or physical examinations. Of course, the imbalance score was not high. Guilan holds the oldest population in Iran according to the national statistics; therefore, health planning in different cities of this province can help treat those identified in the present or future studies.

Ethical Considerations

Compliance with ethical guidelines

All the study procedures complied with the ethical guidelines of the Declaration of Helsinki (2013).

Funding

Authors contributions

Conceptualization: Shadman Nemati, Houshang Gerami; Methodology: Ehsan Kazemnezhad Leyli, Somayeh Ahmadi, Alia Saberi; Investigation: Zahra Karimi, Rastin Hosseinzadeh; Writing-original Draft: All authors; Writing-review, and editing: All authors; Supervision: Shadman Nemati.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgements

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