Original Article
http://mjiri.iums.ac.ir
Medical Journal of the Islamic Republic of Iran (MJIRI)
Iran University of Medical Sciences

Falls and postural control in older adults with cataracts

Afsun Nodehi Moghadam[1], Maryam Goudarzian*[2], Farhad Azadi[3]
Seide Masume Hosseini[4], Zahra Mosallanezhad[5], Nouraddin Karimi[6]
Yassin Larne[7], Maryam Habibi[8], Poorya Yaghmaei[9]

Received: 5 May 2015 Accepted: 26 September 2015 Published: 27 December 2015

Abstract

Background: There is increasing evidence that visual impairment contribute to falling. The aim of this study was to determine the influence of vision impairment of old adult patients with cataract on the occurrence of falls and postural control.

Methods: According to the results of screening ophthalmic examination, 48 cataract patients (mean±SD aged 68.5 ± 6.08 yrs.) and 50 individuals without any obvious eye disorders (mean age ± SD 70.7 ± 5.97 yrs.) were enrolled in this study. The postural control was determined using the clinical test of Sensory Interaction and Balance (CTSIB) and Timed up and Go (TUG) test.

Results: The results of this study revealed that 18% (n = 9) of the normal individuals and 22.9% (n =11) of the cataract patients had at least two falls in the past 12 months. However, the result of chi-square test did not show any differences between the two groups (p= 0.36). The mean ± SD TUG times in cataract and control groups in our study were15.17 ± 3.58 and13.77 ± 4.90, respectively. However, no significant differences were found between the two groups (p= 0.12).The results of CTSIB test showed no significant differences between the two groups on standing on the floor with eyes open and eyes closed (p= 0.61, p= 0.89) and on standing on the foam with eyes open and eyes closed (p= 0.32, p= 0.74).

Conclusion: According to the results of CTSIB and TUG tests, vision impairment of old adult patients with cataract is not associated with falls and balance disorders. Further work including assessment of postural control with advanced devices and considering other falls risk factors are also required to identify predictors of falls in cataract patients.

Keywords: Balance, Falls, Cataract, Vision Loss.

Cite this article as: Nodehi Moghadam A, Goudarzian M, Azadi F, Hosseini SM, Mosallanezhad Z, Karimi N, Larne Y, Habibi M, Yaghmaei P. Falls and postural control in older adults with cataracts. *Med J Islam Repub Iran* 2015 (27 December). Vol. 29:311.

Introduction

Visual impairment is an important health problem and a major cause of injury in the elderly. In general, vision becomes progressively worse after the age of 50. In addition to normal age –related refractive changes, older people are particularly susceptive to common eye pathologies such as cataracts. Cataract is a major cause of vision impairment in the elderly, particularly

1. PhD, PT, Associate Professor, Department of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran, & Iranian Research Center on Ageing, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. afsoonnodehi@gmail.com, afsoonnodehi@yahoo.com
2. (**Corresponding author**) MSc Student of Geriatric Nursing, Iranian Research Center on Healthy Aging, Sabzevar University of Medical Sciences, Sabzevar, Iran. mary_ac_ir@yahoo.com
3. PhD, PT, Assistant Professor, Department of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. fa_azadi@yahoo.com
4. BSc Optomtery. hosseini2222@yahoo.com
5. PhD, PT, Assistant Professor, Department of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. zmosallanezhad@yahoo.com
6. PhD, PT, Assistant Professor, Department of physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. karimi@uswr.ac.ir
7. MSc Student of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. yassin_15049@yahoo.com
8. BSc of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. habibi.maryam2020@yahoo.com
9. BSc Student of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. poorya_yaghmaei@yahoo.com

in low income societies (1). The high prevalence of cataract may be explained largely by inadequate access to cataract surgery and some environmental risk factors such as poor diet and occupational sunlight exposure. It is clear that cataracts cause visual impairment, measured traditionally by visual acuity. Cataract, affecting mainly visual acuity and contrast sensitivity, contributes to about 50% of visual impairments in the elderly (2,3). The consequences include decreased ability to perform activities of daily living (such as reading, watching television, driving and interacting socially), depression, increased number of falls, and increased mortality (3-5).

Falls become more frequent with age and can cause serious musculoskeletal injuries that may lead to functional limitation, permanent disability, institutionalization or even mortality (6-9).

The ability to control the body's position in space (postural control) and body's center of mass in relation to the base of support(postural stability) are dictated by the efficiency of the individual's balance mechanism related to anticipatory postural adjustments, as well as compensatory postural adjustment that are initiated by sensory feedback signals. The important sensory systems involved in postural control are somatosensory information, vestibular system and vision (10,11). Patients with visual impairment must place a greater emphasis on somatosensory and vestibular information to maintain postural stability and control body's position in space (7,8). When vision is impaired, older adults experience greater problems with mobility that lead to reduced ability to perform independent activities of daily living (12,13). Vision allows a person to identify a potential hazard and triggers a motor response in central nervous system. Decreasing visual processing speed reduces the ability of the older adult to detect hazards in the environment, and increases falls risk (14).

There is not a consistency on the association between visual impairment and the increase in the number of falls. There are several reports that indicate visual impairment is a risk factor for falls in the elderly. Several studies described visual impairment as one of the main physiological components associated with falls in the elderly; these being explained by the reduction caused in their balance and proprioceptive information (15-19). However, other studies have not found any association between visual impairment and falls (20-22).

The Timed up-and Go test (TUG) is a clinical test of mobility and fall risk in the elderly, and includes standing up from a chair, walking straight-ahead, turning and sitting down (23). Gait impairments are well-known risk factors for falls in older persons .Elliott et al. (24) found that Gait speed was reduced when young healthy persons with simulated cataract walked across a curved pathway in dim light. When people stand with their eyes closed, postural sway increases by 20–70% (15).Walking with eyes closed led to decreased walking speed and cadence in older adults compared to younger adults (24). Helbostad (25) also showed that visual problems in older adults lead to a more cautious and unstable gait pattern even under relatively simple conditions. Also, difficulties with postural control and balance have been reported in children and adolescents with visual impairments (26,27).

Most of the mentioned studies evaluated the impact of visual impairments of older adults with different types of eye disorders(refractive errors and different kinds of eye pathologies) on falling, while our study aimed to verify the influence of visual impairment of older adults with cataract on the occurrence of falls and postural control.

Methods

Participants

A total of 114 elderly community residents aged 60 to 96 that referred to a health center in Tehran from 2013 to 2014 underwent an ophthalmologic screening examination by an experienced optometrist. The cataract diagnosis was made by an experienced optometrist, who measured visual acuity and observation of cloudiness of the crystalline lens using ophthalmoscope. Visual acuity was measured for each participant using the Snellen's illiterate E chart. Cataract diagnosis was performed using ophthalmoscope (Heine, made in Germany, Beta 200). According to the results of screening ophthalmic examination, 48 cataract patients and 50 individuals without any obvious eye disorders were enrolled in this study. The inclusion criteria were as follows: age 65 years or older, living independently in the community, able to walk with or without an assistive device, but without the assistance of another person, able to follow simple instructions, an absence of known neurological, musculoskeletal or cardiovascular disorders (6,7,10).

Before participating in the study, all participants signed an informed consent form approved by the Human Subjects Committee of University of Social Welfare and Rehabilitation Sciences. During the interview, demographic characteristics, medical history, and the previous falling events were examined. If the participants experienced at least two falls in the past 12 months, they were considered as fallers (7).

Postural Control Tests:

Clinical Test of Sensory Interaction and Balance (CTSIB)

All participants were tested in four trials. The conditions were: Quiet standing on the floor, looking straight ahead; quiet standing on the floor, with eyes closed; quiet standing on the foam with the eye open; and quiet standing on the foam, with the eye closed (28). Prior to testing, the examiner demonstrated the test condition. For all conditions, the participants were instructed to stand quietly with arms across the chest, feet together with ankle bones touching for as long as possible up to 30 seconds. The length of time the participant could maintain balance was recorded. The experiment ended when the participant's arm or feet changed position (28). To eliminate the confounding effect of fatigue, the participants were allowed to rest between trials for 60 -120 seconds. The order of tests was randomized to minimize the effects of fatigue.

Timed up and Go (TUG) Test

The participant sat on a standard chair and placed his/her back against the chair. This test was measured in seconds; and the time the participant took to stand up from the chair, walk three meters, and return to the chair by walking back to the chair and sitting down again was measured (23).

Statistical Analysis

SPSS version 19 statistical software was used to conduct all data analysis. Analysis included descriptive summaries and one way analysis of variance to determine if there were any differences in postural control tests between the two groups. The chi-square test was used to compare the falling prevalence rate for older adults with and without cataracts. The significance level was set at 0.05.

Results

The study population included 114 persons 60 years of age and older (mean ± SD ages: female = 69.42 ± 6.31yrs., male 69.86 ± 5.65 yrs.) that underwent ophthalmologic screening examination at a center for the elderly in Tehran. Among the 114 screened participants, 43.8 % (n= 50) did not have any especial eye problem, while the others (56.2%) had a problem. The most common cause of visual impairment in the screened old participants was cataract (n= 48, 42.10%). Seventy percent (n= 35) and 70.8 % (n= 34) of the participants were female, and 30% (n= 15) and 29.2% were male in the normal and cataract groups, respectively. Eighteen percent of the normal eye group and 22.9% of the cataract patients had at least 2 falls in the past 12 months; however, the result of chi-square test did not reveal any difference between the two groups (p= 0.36). The results of CTSIB test

Table 1. The results of One- Way Analysis Variance to Compare CTSIB and TUG Tests in Older Adults with and without Cataract

Variables (Measurement Unit)		Mean(SD)		
		Control	cataract	p
Age (years)		68.46(6.08)	70.69(5.97)	0.07
CTSIB test (seconds) *	1	29.87(0.87)	30(0.00)	0.32
	2	29.64(1.72)	29.53(1.61)	0.74
	3	29.50(3.18)	29.15(3.43)	0.61
	4	25.25(8.79)	25.48(7.93)	0.89
TUG test (seconds)**		13.77(4.90)	15.17(3.58)	0.12

*Clinical Test of Sensory Interaction and Balance
**Timed up and Go
1) Quiet standing on the floor, looking straight ahead; (2) Quiet standing on the floor with eyes closed; (3) Quiet standing on the foam, with the eyes open; (4) Quiet standing on the foam, with the eyes closed

revealed no significant differences between the two groups on standing on the floor with eyes open and eyes closed (p= 0.61, p= 0.89) and on standing on the foam with eyes open and eye closed (p= 0.32, p=0.74). The average TUG times in cataract and control groups in our study were15.17 (3.58) and13.77 (4.90), respectively; however, no significant differences were found between the two groups (p= 0.12) (Table 1).

Discussion

The findings of this study revealed no significant differences between average TUG times and the CTSIB test result in the cataract and control groups.

The average TUG times in cataract and control groups in our study were 15.17(3.58) and13.77 (4.90), respectively. Shumway-Cook et al. (29) found that TUG is a sensitive and specific indicator of whether falls occur in community dwelling older adults, and they also found that older adults who take longer than 14 seconds to complete the TUG are at a high risk for falls. TUG times are important in identifying older adults with a likelihood of falling. For example, Shumway-Cook et al. (29) showed individuals with TUG times of 13 and 14 seconds had a 69% and 83% probability of being a faller, respectively. Thus, the longer TUG time of the cataract group in our study is in agreement with their higher falling rate. The results of our study revealed that the older adults in cataract group had higher frequency of falls (22.9%) compared to normally sighted community-dwelling elderly individuals (18%). The occurrence of at least two falls in the past 12 months was higher in the cataract group; however; there was not any significant difference between the two groups. There was not any consistency on the association between visual acuity and the increase in the number of falls. There are several reports that indicate visual impairment is a risk factor for falls in the elderly (15-19). However, other studies have not found this to be the case (20-22). Contrary to our results, Nunes et al. (30) and Almeida et al. (31), showed that elderly patients with visual impairment were more likely to suffer falls. They measured vision based on self-report, while our results were based on clinical measures of impairment. Also, the results of Ray et al. (27) and Ray and Wolf (32) studies indicated that postural stability was reduced and modified in those participants with vision loss. These discrepancies may relate to differences in subjects used in these studies. Ray et al. (27) and Ray and Wolf (32) studies included younger adults with visual acuity disorders. In contrast, we studied community-dwelling older adults with and without cataract. On the other hand, in agreement with our results, some researchers showed that visual impairment is not independently associated with falls in people with low vision, and explained that visual acuity plays a more significant role as a falls risk factor when the subjects are dependent (20-22). It should be noted that our participants were mobile and independent community-dwelling individuals; and therefore, the role of visual acuity as an independent predictor of falls may be less important.

Also, it should be considered that falls have a multi-factorial etiology that is categorized as person specific (or intrinsic) and environmental (or extrinsic) (9). Some previous studies have shown other aspects of visual function such as edge contrast sensitivity, rather than visual acuity, to be more strongly associated with falls and fractures (20,21). Low contrast sensitivity can be a symptom of certain eye conditions or diseases such as cataracts, glaucoma or diabetic retinopathy. Whereas visual acuity measures fine detail vision, contrast sensitivity tests assess the person's ability to detect edges under low contrast conditions such as low light, fog or glare situations when the contrast between objects and their background is often reduced (21). In support of this claim, the most commonly reported causes of falls are trips, slips and environmental hazards such as obstacles (8,9)

It is well known that even while our participants in the control group did not have any obvious visual impairment, as a sequence of aging, their mobility and balance might have been influenced by multiple physiological and psychological processes. Several studies have shown the musculoskeletal system changes in older people over time by losing mass, strength, and muscle fiber distribution (8,9). Reduced lower extremity muscle strength and flexibility (especially in hip and ankle muscles) have been found to correlate with an increased risk of falls (9,33).

There were some limitations in this study. Some studies have shown that fall risk is also related to cognitive function (29,9); thus, adding a dual-task challenge may be more successful in assessing at- risk older adults. Also, it is suggested that the postural control be assessed using advanced devices in future studies.

Conclusion

According to CTSIB and TUG tests, vision impairment in old adult patients with cataract is not associated with falls and balance disorders. Further work including assessment of postural control with advanced devices and considering other falls risk factors are also required to identify predictors of falls in patients with cataract.

Acknowledgement

This work was supported by Iranian Research Center of Healthy Aging, Sabzevar University of Medical Sciences, Sabzevar, Iran (Grant number: 392222257).

References

1. Voleti VB, Hubschman JP. Age-related eye disease Maturitas 2013;75:29-33.
2. Chew M, Chiang PP, Zheng Y, Lavanya R, Wu R, Saw SM, et al. The impact of cataract, cataract types, and cataract grades on vision-specific functioning using Rasch analysis. Am J Ophthalmol 2012;154(1):29-38.
3. Desapriya E, Subzwari S, Scime-Beltrano G, Samayawardhena LA, Pike I. Vision improvement and reduction in falls after expedited cataract surgery Systematic review and meta-analysis. J Cataract Refract Surg 2010;36(1):13-19.
4. Polack S, Kuper H, Wadud Z, Fletcher A, Foster A. Quality of life and visual impairment from cataract in Satkhira district, Bangladesh. Br J Ophthalmol 2008;92(8):1026-1030.
5. Polack S, Eusebio C, Fletcher A, Foster A, Kuper H. Visual impairment from cataract and health related quality of life: results from a case-control study in the Philippines. Ophthalmic Epidemiol 2010;17(3):152–159.
6. Lopez D, McCaul KA, Hankey GJ, Norman PE, Almeida OP, Dobson AJ, et al. Falls, injuries from falls, health related quality of life and mortality in older adults with vision and hearing impairment-is there a gender difference? Maturitas 2011;69(4):359-64.
7. Kuang TM, Tsai SY, Hsu WM, Cheng CY, Liu JH, Chou P. Visual impairment and falls in the elderly: the Shihpai Eye Study. J Chin Med Assoc 2008;71(9):467-72.
8. Hu J, Xia Q, Jiang Y, Zhou P, Li Y. Risk factors of indoor fall injuries in community-dwelling older women: A prospective cohort study. Arch Gerontol Geriatr 2015 Mar;60(2):259-64.
9. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. Maturitas 2013;75(1):51-61.
10. Horak FB. Postural orientation and equilibrium: what do we need to know about neural control

of balance to prevent falls? Age Ageing 2006;35 (Suppl 2):ii7-ii11.

11. Riemann BL, Lephart SM, Scott M. Lephart. The Sensorimotor System, Part II: The Role of Proprioception in Motor Control and Functional Joint Stability. J Athl Train 2002;37(1):80-4.

12. Phoenix C, Griffin M , Smith B. Physical activity among older people with sight loss: a qualitative research study to inform policy and practice. Public Health 2015;pii: S0033-3506(14)00256-X.

13. Gleeson M, Sherrington C, Keay L. Exercise and physical training improve physical function in older adults with visual impairments but their effect on falls is unclear: a systematic review. J Physiother 2014;60(3):130-5.

14. Bugnariu N, Fung J. Aging and selective sensorimotor strategies in the regulation of upright balance. J NeuroEng Rehabil 2007;4:19.

15. Lord SR, Menz HB. Visual contributions to postural stability in older adults. Gerontology 2000;46(6):306–10.

16. Freeman EE, Mu˜ noz B, Rubin G, West SK. Visual field loss increases the risk of falls in older adults: the Salisbury eye evaluation. Invest Ophthalmol Vis Sci 2007;48(10):4445-50.

17. Ivers RQ, Cumming RG, Mitchell P, Attebo K. Visual impairment and falls in older adults: The Blue Mountains Eye Study. Jam Geriatr Soc 1998;46(1):58–64.

18. Coleman AL, Stone K, Ewing SK, Nevitt M, Cummings S, Cauley JA, et al. Higher risk of multiple falls among elderly women who lose visual acuity. Ophthalmology 2004; 111(5):857-862.

19. Reed-Jones RJ, Solis GR, Lawson KA, Loya AM, Cude-Islas D, Berger CS. Vision and falls: a multidisciplinary review of the contributions of visual impairment to falls among older adults. Maturitas 2013; 75(1):22-8.

20. de Boer MR, Pluijm SM, Lips P, Moll AC, Völker-Dieben HJ, Deeg DJ, et al. Different aspects of visual impairment as risk factors for falls and fractures in older men and women. J Bone Miner Res 2004; 19(9):1539–47.

21. Lord SR, Clark RD, Webster IW. Visual acuity and contrast sensitivity in relation to falls in an elderly population. Age Ageing 1991; 20: 175–81.

22. Lamoureux E, Gadgil S, Pesudovs K, Keeffe J, Fenwick E, Dirani M, Salonen S, Rees G. The relationship between visual function, duration and main causes of vision loss and falls in older people with low vision.Graefes Arch Clin Exp Ophthalmol 2010; 248:527-533.

23. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc 1991 Feb; 39(2):142-8.

24. Elliott DB, Bullimore MA, Patla AE, Whitaker D. Effect of a cataract simulation on clinical and real world vision. Br J Ophthalmol 1996;80:799–804.

25. Helbostad JL, Vereijken B, Hesseberg K, Sletvold O. Altered vision destabilizes gait in older persons. Gait Posture 2009;30(2):233-8.

26. Sleeuwenhoek HC, Boter RD, Vermeer A. Perceptual motor performance and the social development of visually impaired children. J Vis Impair Blin 1995;89:359–67.

27. Ray CT, Horvat M, Croce R, Mason RC, Wolf SL. The impact of vision loss on postural stability and balance strategies in individuals with profound vision loss. Gait Posture 2008 l;28(1):58-61.

28. Cohen H, Blatchly CA, Gombash LL. Phys Ther. 1 A study of the clinical test of sensory interaction and balance 1993 Jun;73(6):346-51.

29. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. Phys Ther 2000;80(9):896-903.

30. Nunes BP, de Oliveira Saes M, Siqueira FV, Tomasi E, Silva SM, da Silveira DS, et al. Falls and self-assessment of eyesight among elderly people: a population-based study in a south Brazilian municipality. Arch Gerontol Geriatr 2014 Jul;59(1):131-5.

31. Almeida ST, Soldera CL, Carli GA, Gomes I, Resende Tde L. Analysis of extrinsic and intrinsic factors that predispose elderly individuals to fall. Rev Assoc Med Bras 2012;58(4):427-33.

32. Ray ChT, Wolf SL. Gender differences and the risk of falls in individuals with profound vision loss. Journal of Visual Impairment & Blindness 2010; 104,5:311-16.

33. Nodehi-Moghadam A, Taghipour M, Goghatin Alibazi R, Baharlouei H. The comparison of spinal curves and hip and ankle range of motions between old and young persons. Med J Islam Repub Iran 2014;28:74.