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REVIEW

CORRELATIONS BETWEEN OPHTHALMOLOGY AND ORTHOPEDICS

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Abstract
Although orthopedics and ophthalmology seem to be two different medical specialties, numerous studies that have been conducted in the past 35 years have shown a tight connection between several ocular pathologies and an increased risk of hip fractures due to falling. This article aims to review the ocular pathologies that have been proven to be associated with an increased risk of falling, to integrate the results of several studies showing a direct relationship between ocular pathologies and an increased risk of falling and finally to suggest ways in which the incidence of traumatic orthopedic injuries can be reduced by applying ophthalmologic principles.
Keywords: hip fractures, visual acuity, contrast sensitivity, field of view, depth perception

Introduction

Eye diseases such as cataract, glaucoma and macular degeneration are common among the elderly [**1-6**]. These ocular pathologies, among many others, which produce significant vision problems, have been associated with an increased risk of falling by mechanism of tripping or lack of spotting the causative agent of the fall [**1,7-12**]. It is important to note that the number of falls is continuously growing and that almost one third of the people with ages 65 and over fall at least once every year [**13,14**]. Half of those who fall once are at a higher risk to fall again [**15**].

This high incidence of falls, in combination with the fact that over 30% of older women have a variable degree of osteoporosis has led to a progressive increase in the number of fractures [**15-17**]. This fact explains why 75% of the major trauma associated with falls among elderly women is bone fracture and why 90% of all hip fractures are due to falls [**14,15,18-21**]. The vast majority of elderly patients who have suffered a hip fracture, report that they could not return to normal pre-fracture activity levels after the orthopedic treatment; therefore, orthopedic specialists should consider using fall prevention methods among older patients and implement them with as much seriousness as the treatment of the fracture itself [**15**].

Although a small number of orthopedic specialists still refer elderly patients with vision defects to an ophthalmologist to prevent a fall, this practice is becoming scarcer. For this reason, this article hopes to revitalize the interest in this subject and propose interdisciplinary methods between ophthalmology and orthopedics for the

prevention of fall related fractures among the elderly population.

Methods

To find the most frequent vision defects that have an increased risk of leading to a fall, several large cohort studies have been conducted in numerous countries of the world. So, to confirm or infirm the reproducible results of these studies, we have evaluated the results of the studies conducted in Australia, U.S.A., Great Britain, Finland and New Zeeland. The first study entitled The Blue Mountain Eye Study was conducted in Sydney, Australia and tried to examine the relationship between vision defects and the frequency of falls among older patients [**7,15**]. This study evaluated a number of 3,654 patients and concluded that poor visual acuity and low contrast sensitivity are the two most important factors associated with falls [**7,15**]. The same study showed that the presence of sub-capsular cataract was associated with one or more falls [**7,15**]. Nevertheless, the presence of macular degeneration or diabetic retinopathy did not significantly increase the risk of falling [**7,15**].

The second study with a cohort of 2,477 patients was entitled The Framingham Eye Study and was conducted in the U.S.A. The results of this study showed that different visual acuity for each individual eye was associated with an increased risk of hip fracture [**1,22**]. The authors have thus concluded that reduced stereoscopic vision is a major risk factor in producing falls [**1,22**].

A third study conducted in Auckland, New Zeeland, has monitored 1,774 elderly patients for a period of 2 years in which time the patients sustained a cumulative of 1,832 hip fractures [**1**]. Although this study confirmed that reduced stereoscopic vision was associated with an increased risk of falling, the results of these studies infirmed the fact that different visual acuity for each eye is a risk factor [**1**]. The authors state that reduced visual acuity is a risk factor only when it is very severe in both eyes [**1**]. The same study showed that both poor vision reported directly by the patient and the absence of periodic ophthalmologic consults once at every two years constitutes a risk factor for falling [**1**].

A 4th study conducted in Finland has monitored 979 patients for 2 years and has tried to find additional risk factors for fall-related fractures among patients aged 70 or older [**23**]. Among the numerous non-ophthalmologic risk factors found, the major ocular risk factor proved to be reduced visual acuity [**23**].

A 5th study conducted in Liverpool, Great Britain, analyzed 200 older patients admitted to the hospital with various acute illnesses and found that 76% were admitted due to fall related injuries [**15**]. 101 patients (50.5%) had a variable degree of vision defects among which: 40% showed signs of correctable refractive errors, 37% had cataract and 14% showed signs of senile macular generation [**15**]. Among this group of patients, a vast majority presented with correctable vision problems which, if treated earlier, could have prevented the fall of the patient [**15,24**].

The last large study was titled the Study of Osteoporotic Fractures, was conducted in San Francisco, California, U.S.A., has monitored a number of 9,516 Caucasian women for 4.1 years, and has tried to find potential risk factors for fall related-fractures [**25**]. Among the principal risk factors for falls was the low contrast sensitivity and reduced depth perception [**25**].

Results

Although all of the above-mentioned studies have confirmed the fact that reduced visual ability multiplies or even compounds the number of falls, not all the authors agree on the principal ocular causes that determine these falls [**15,24**]. For example, Koshi K. et al. suggested that reduced visual acuity represents an important risk factor in causing falls [**15,23**]. Nevertheless, Cummings et al., who have conducted the Study of Osteoporotic Fractures, affirmed that reduced contrast sensibility and reduced depth perception are the most important factors in determining falls, not reduced visual acuity [**15,25**]. This hypothesis was further confirmed by Lord SR. et al. who further added that the presence of low visual acuity in conditions of reduced contrast could be a risk factor [**15,26**].

Though a number of conflicting opinions exist on this matter, the accumulated results of over 35 years of research in numerous countries of the world have shown that there are 7 main

potential risk factors of ocular origin that can lead to a fall-related fracture: reduced visual acuity, reduced contrast sensibility, reduced visual field, reduced depth perception, low vision reported directly by the patient, old or inappropriate prescription glasses and the absence of a regular ophthalmologic consult once every two years [**7,10,24,27,28**].

Discussion

To evaluate the risk of falls among elderly patients, it is useful to use the Activities of Daily Vision Scale both in orthopedic departments as well as in ophthalmologic departments [**15**]. This practice has proven to be efficient in evaluating the risk of falls among patients with glaucoma, diabetic retinopathy and cataract [**15,29**]. The time necessary to complete the test ranges for 6 to 20 minutes [**15**]. Also, the use of the above mentioned scale has proven to be more efficient than using a standard Snellen chart since the Snellen chart only evaluates visual acuity thereby omitting other visual parameters.

Conclusion

Since vision defects constitute an important independent risk factor for fall-related hip fractures among elderly patients, a tight collaboration between ophthalmologic specialists, orthopedic specialists and the patient is needed for the prevention of fall-related hip fractures.

Furthermore, through a complete anamnesis of the patient both the ophthalmologic specialist and the orthopedic specialist can dramatically increase the quality of care perceived by the patient and thus contributes to a better patient-physician relationship. For example, Theodore J. Clarke, MD, wrote in his article "Avoiding a lawsuit, lessons from the never sued" that successful physicians are uniformly concerned with all aspects of the patients' health [**30,31**]. In an example forwarded by Dr. Clarke, a patient who underwent surgery for anterior/ posterior lumbar fusion became blind as a result. The patient sued the anesthetist, the general surgeon and the hospital but did not sue the orthopedic surgeon because, as the patient reported, "he has always taken care of me" [**31**].

To improve the quality of health care provided and reduce the incidence of falling, an interdisciplinary approach is needed. Therefore, the risk of fall-related fractures among elderly patients should be evaluated in ophthalmology departments before prescribing the final treatment. Also, routine evaluation of vision defects in elderly patients presenting with hip fractures in orthopedic departments should be included in the anamnesis of the patient. For the prevention of falls and fall-related trauma, it is vital that the orthopedic specialist observes one or more ocular risk factors in an elderly patient and refer the patient to an ophthalmologist.

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