Visual impairment as an independent risk factor for falls in hospitalized patients

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ABSTRACT ●

Objective: To investigate the association between visual impairment and the risk of falls in hospitalized patients.

Design: Individually matched case–control study.

Methods: The medical records of patients who fell while hospitalized at Juntendo Tokyo Koto Geriatric Medical Center (JTKGMC) from January to December 2014 were reviewed retrospectively. Among them, 36 patients who were recorded as visiting the Ophthalmology Outpatient Clinic from 1 year before to 1 year after the fall were included as cases. As the control subjects, 36 individually matched patients were chosen who were hospitalized in the same beds in the same hospital wards. Visual impairment and blindness were defined according to U.S. criteria. Conditional logistic regression analysis was used for both univariate and multivariate analyses. Based on previous reports, multivariate analysis was performed with adjustment for age, sex, a history of falls, and use of walking aids. This study was approved by the institutional review board of JTKGMC and was performed according to the tenets of the Declaration of Helsinki.

Results: The crude odds ratio (OR) for visual impairment was 6.0 (95% confidence interval [CI]: 0.72–49.83). For a history of falls and use of walking aids, the crude OR (95% CI) was 2.5 (0.97–6.44) and 2.8 (0.88–8.64), respectively. After adjustment for age, sex, a history of falls, and use of walking aids, the association between falls and visual impairment was significant (OR: 13.9; 95% CI: 1.0004–194.41).

Conclusion: These findings suggest that visual impairment could be an independent risk factor for falls among hospitalized patients.

According to a report by the WHO, falls are the second highest cause of deaths because of accidental or unintentional injury worldwide, and 28%–35% of older people (aged ≥65 years) fall each year, with the prevalence of falls increasing as they age.[1] In addition, falls are fourth highest cause of people requiring long-term care in Japan, after stroke, dementia, and frailty,[2] and preventing falls is one of the most important factors for extending the healthy life expectancy of the elderly.

Falls occur as a result of a complex interaction among various risk factors that can be classified as biological, behavioural, environmental, and socioeconomic factors.[1] Among biological factors, visual impairment was reported to be a significant risk factor for falls and fall-related injuries,[1] and previous studies have identified an association between visual impairment and the incidence of falls among community dwelling elderly persons.[3–9]

Falls are also a common problem in hospitals, and previous observational studies have revealed that the incidence of falls is 3.8–12.6 per 1000 patients/day among hospital inpatients.[10,11] Although falls in the community and nursing home settings have been relatively well studied, less is known about prevention of falls in hospital.[12] In acute hospital patients, falls can result in prolonged hospitalization, higher medical costs, and increased demand for human resources. Thus, identifying patients with an increased risk of falling while in hospital is an important issue.

The risk of falling during hospitalization is profoundly influenced by the hospital environment, especially the ward and the patient's room. In addition, several studies[10,13] have found a positive association between inpatient falls and visual impairment, although others[11,14,15] reported a negative association. However, none of these studies controlled the hospital environment. Therefore, this study was performed to investigate the association between visual impairment and the risk of falling among hospital inpatients in a controlled hospital environment.

Materials and Methods

This was an individually matched case–control study. Patients who had fallen after admission to Juntendo Tokyo Koto Geriatric Medical Center (JTKGMC) were identified by searching the incident reporting system for hospitalized patients. JTKGMC is a 348-bed hospital affiliated with Juntendo University Graduate School of Medicine (Tokyo, Japan) that provides specialized medical services for the elderly. Patients who fell in JTKGMC from January 2014 to December 2014 were reviewed retrospectively, and those who had also consulted the ophthalmology clinic were included in this study.

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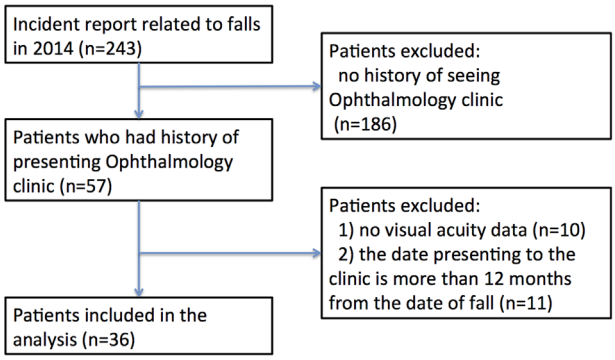

Fig. 1—Flow chart of inclusion and exclusion criteria.

The inclusion criteria for the cases (falls group) were (*i*) patients with a history of falling while hospitalized, and (*ii*) patients who underwent visual acuity testing at the ophthalmology clinic within 12 months before or after the date of the fall. Exclusion criteria were (*i*) no ophthalmology clinic visit within 12 months before or after the date of the fall, and (*ii*) no visual acuity test recorded in the medical chart. The control group comprised individually matched subjects assigned to the same beds of the same rooms as the case subjects within 6 months before or after the date of falling who had also attended the ophthalmology clinic. For case subjects who were hospitalized in private rooms, control subjects were chosen who were assigned to either the same room or to an adjacent private room.

In this study, a fall was defined according to the WHO definition as "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level."

The following information was retrieved from the medical records: age, sex, visual acuity, reason for hospitalization, history of falls, and use of walking aids. Based on the U.S. criteria, low vision was defined as best-corrected visual acuity (BCVA) $<20/40$ and above 20/200, whereas blindness was BCVA $\leq 20/200$ (both in the better eye). Visual impairment was defined as either low vision or blindness. The reason for the hospitalization was classified according to ICD-10.

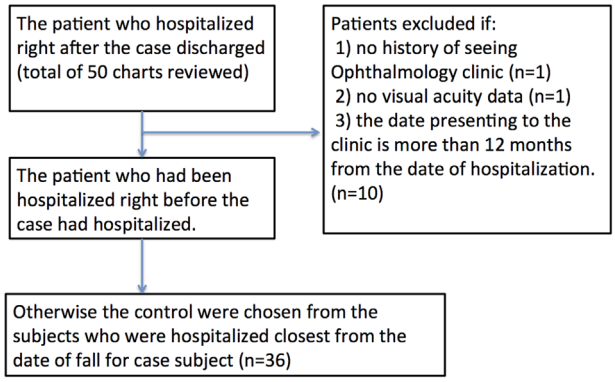

Fig. 2—Flow chart of choosing control subjects.

Table 1—Clinical characteristics of the study population

	Fall Group (n = 36)	Control Group (n = 36)
Mean age (SD), years	75.7 (12.0)	75.1 (10.8)
Sex (female %)	24 (66.7%)	25 (69.4%)
Visual impairment	6 (16.7%)	1 (2.8%)
Low vision	3 (8.3%)	1 (2.8%)
Blindness	3 (8.3%)	0 (0%)
History of fall	23 (63.9%)	14 (38.9%)
Walking aid use	26 (72.2%)	19 (52.8%)

For continuous variables, mean values were calculated for the case and control groups and then were compared by the paired *t* test. For categorical variables, proportions were calculated in the case and control groups and then compared using McNemar's test. Conditional logistic regression models were used to estimate the odds ratio (OR) and 95% confidence interval (CI) for both univariate and multivariate analyses. Based on a previous meta-analysis,[16] multivariate analysis was performed with adjustment for age, sex, a history of falls, and use of walking aids to obtain adjusted ORs. All statistical analyses were conducted with STATA/IC 12.1 for Mac software (Stata Corp, College Station, TX) and $p < 0.05$ was considered to be statistically significant.

This study was approved by the institutional review board of JTKGMC and was performed according to the tenets of the Declaration of Helsinki.

Results

A total of 315 incident reports related to falls were identified. After 18 reports were excluded because they were for outpatients, 297 reports remained for 243 inpatients. Among them, 36 patients had attended the ophthalmology clinic and visual acuity data were available in the medical record. These 36 patients were assigned to the case group (falls group), whereas another 36 individually matched patients formed the control group. The disposition and handling of the patients is summarized in Figures 1 and 2.

Table 1 lists the characteristics of the subjects. The mean age of the falls group and the control group was 75.7 $\pm$ 12.0 years and 75.1 $\pm$ 10.8 years, respectively, and there were 24 women (66.6%) in the falls group and 25 women (69.4%) in the control group. Six patients (16.7%) had visual impairment in the falls group versus 1 patient (2.8%) in the control group. With regard to confounding factors, both a history of falls and use of walking aids were more common in the falls groups than in the control group.

Table 2 shows the reasons for hospitalization classified according to ICD-10. There were no significant differences of the reasons for hospitalization between the falls group and the control group ($p = 0.27$, χ^2 test).