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Association of Fast Visual Field Loss With Risk of Falling in Patients With Glaucoma

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IMPORTANCE Patients with glaucoma and a history of fast visual field loss might be at an increased risk for falls compared with those with a history of slow visual field loss, but, to date, this association has not been previously investigated in the literature.

OBJECTIVE To evaluate the association between self-reported falls and past rate of visual field loss in a cohort of patients with glaucoma followed up over time.

DESIGN, SETTING, AND PARTICIPANTS This observational cohort study included patients diagnosed as having glaucoma who had been followed up at the Visual Performance Laboratory, University of California, San Diego, at 6-month intervals for a mean (SD) of 7.5 (2.6) years from January 1, 2005, through December 31, 2015. Self-reported number of falls during the past year was obtained at the last follow-up visit. Integrated binocular fields were estimated from the monocular fields. Linear mixed models were used to calculate rates of change in binocular mean sensitivity over time. Poisson models were used to evaluate the association between the self-reported number of falls and rates of visual field loss. The models adjusted for the current level of visual field damage and other confounding variables.

MAIN OUTCOMES AND MEASURES Association between rates of binocular visual field loss and self-reported number of falls.

RESULTS The study included 116 patients with glaucoma with a mean (SD) age of 73.1 (10.7) years (55 women [47.4%], 84 white individuals [72.4%], and 32 black individuals [27.6%]). Of the 116 patients, 29 (25.0%) reported at least 1 fall in the previous year. The mean rate of change in binocular mean sensitivity was faster for patients who reported a history of falls vs those who did not (−0.36 vs −0.17 dB/y; mean difference, 0.20 dB/y; 95% CI, 0.09-0.31 dB/y; $P < .001$). History of fast visual field loss was significantly associated with falls (rate ratio, 2.28 per 0.5 dB/y faster; 95% CI, 1.15-4.52 db/y; $P = .02$), even after adjusting for confounding factors.

CONCLUSIONS AND RELEVANCE The rate of visual field loss was associated with a self-reported history of falls in the past year even after taking into account the magnitude of visual field defect. However, although a positive association was found, further studies are necessary to establish whether a cause-and-effect relationship exists between rate of visual field loss and self-reported history of falls.

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Falls are a major cause of morbidity and mortality and the leading cause of injury-related hospitalization in elderly populations.[1] It is estimated that up to one-third of individuals older than 65 years will fall each year. Of those who fall, up to 15% may have severe injuries, such as hip fractures and traumatic brain injury.[2]

Patients with glaucoma are reported to be at higher risk of falling compared with individuals without the disease.[3-9] Cross-sectional studies[6-9] have found that more severe visual field loss is associated with increased risk of falls and fear of falling. However, besides the actual severity of visual field defect, it is also possible that the velocity at which the patient developed these defects may be an important factor that contributes to the risk of falling. It is conceivable that individuals with a recent history of fast visual field deterioration may not have had time to develop compensatory mechanisms to adjust for the loss of vision, potentially leading to increased risk of falling. In contrast, individuals with a similar degree of visual field loss, but in whom the defects have been stable for a relatively long period, may have developed compensatory strategies that would put them at a decreased risk of falling compared with those with fast visual field loss. Despite the potential significance of this association, to our knowledge, no study has yet evaluated the association between velocity of visual field loss and risk of falling in patients with glaucoma. In the current study, we report the association between self-reported falls and rate of visual field loss in a cohort of patients with glaucoma followed up longitudinally.

Key Points

Question Are rates of visual field loss associated with risk of falling in patients with glaucoma?

Findings In an observational cohort study of 116 patients diagnosed as having glaucoma followed up for a mean (SD) of 7.5 (2.6) years, each 0.5-dB/y faster rate of visual field loss was associated with history of self-reported falls, even after adjusting for confounding factors.

Meaning History of rapid visual field loss in patients with glaucoma was associated with risk of falls.

Methods

Participants from this study were included in a prospective longitudinal study performed from January 1, 2005, through December 31, 2015, designed to evaluate functional impairment in glaucoma conducted at the Visual Performance Laboratory, Department of Ophthalmology, of the University of California, San Diego. The institutional review board at the University of California, San Diego, approved the methods, and written informed consent was obtained from all participants. The study adhered to the laws of the Health Insurance Portability and Accountability Act, and all study methods complied with the Declaration of Helsinki guidelines for human subject research. Data were deidentified.

At each visit during follow-up, participants underwent a comprehensive ophthalmologic examination, including review of medical history, slitlamp biomicroscopy, intraocular pressure measurement using Goldmann applanation tonometry, corneal pachymetry, gonioscopy, dilated ophthalmoscopy, stereoscopic optic disc photography, and standard automated perimetry (SAP) using the 24-2 Swedish Interactive Threshold Algorithm (Carl Zeiss Meditec Inc). Visual acuity was measured using the Early Treatment Diabetic Retinopathy Study chart. Only patients with open angles on gonioscopy were included. Patients with coexisting retinal disease, uveitis, or nonglaucomatous optic disc neuropathy were excluded from the study. Patients who had eye surgery during the study period were not excluded from this study.

Glaucoma was defined by the presence of 2 or more consecutive abnormal SAP test results at baseline, defined as a pattern SD with $P < .05$ and/or glaucoma hemifield test results outside normal limits, and evidence of glaucomatous optic neuropathy based on masked assessment of stereophotographs. A patient was considered to have glaucoma if damage was present in at least 1 eye. During the follow-up period, visual field tests were performed at 6-month intervals. The study included a total of 1354 SAP visits, with a mean (SD) of 11.7 (4.6) visits per patient.

Monocular and Binocular Visual Fields

Monocular SAP was performed using the 24-2 Swedish Interactive Threshold Algorithm standard test. Only reliable tests (≤33% fixation losses and ≤15% false-positive results) were included. To evaluate binocular visual field loss, sensitivities of the monocular SAP examinations of the right and left eyes were used to calculate an integrated binocular visual field, according to a previously described method.[10] According to this model, the binocular sensitivity can be estimated using the following formula:

$$\text{Binocular Sensitivity} = \sqrt{Sr^2 + Sl^2},$$

with Sr and Sl indicating the monocular threshold sensitivities for corresponding visual field locations of the right and left eyes, respectively. To calculate the binocular sensitivity from this formula, light sensitivity had to be converted to a linear scale (apostilbs) and then converted back to logarithmic scale (decibels).

Evaluation of rates of visual field change was performed using the mean sensitivity (MS) of the binocular visual field. We also calculated the MS values for the inferior and superior hemifields of the integrated binocular field. In addition, we report rates of change according to the mean deviation (MD) values of the better and worse eyes, as defined from baseline visual fields.

History of Falls

History of falls was obtained using the Falls Screening and Referral Algorithm (FSRA)[11] administered at the last follow-up visit. The FSRA consists of the Elderly Fall Screening Test and the Multi-factor Falls Questionnaire. The questionnaires were administered in a printed version and asked about the number of falls the patient had during the past year. The single

Table 1. Rates of Visual Field Change for Patients With Glaucoma Who Reported a History of Falls vs Those Who Did Not

Parameter	Rate (95% CI) History of Falls (n = 29)	Rate (95% CI) No History of Falls (n = 87)	Rate (95% CI) Mean Difference Between Groups	*P* Value
Binocular MS, dB/y	-0.36 (0.34) (-1.50 to 0.02)	-0.17 (0.22) (-0.93 to 0.52)	0.20 (0.09 to 0.31)	<.001
Better eye MD, dB/y	-0.35 (0.42) (-1.66 to 0.07)	-0.13 (0.25) (-1.12 to 0.57)	0.22 (0.10 to 0.35)	<.001
Worse eye MD, dB/y	-0.42 (0.44) (-1.70 to 0.15)	-0.21 (0.30) (-0.83 to 0.75)	0.21 (0.05 to 0.31)	.006
Binocular MS inferior hemifield, dB/y	-0.35 (0.18) (-1.30 to 0.01)	-0.18 (0.20) (-0.75 to 0.34)	0.17 (0.07 to 0.27)	<.001
Binocular MS superior hemifield, dB/y	-0.37 (0.40) (-1.58 to 0.04)	-0.15 (0.28) (-1.45 to 0.72)	0.22 (0.09 to 0.35)	.001

Abbreviations: MD, mean deviation; MS, mean sensitivity.

question used for this study was, "Have you had any fall in the past 12 months?" A fall was considered when the individual found himself or herself suddenly on the ground, without intending to get there from a sitting or standing position.

The level of physical activity was investigated as a potentially confounding variable using the Physical Activity Scale for the Elderly (PASE) questionnaire, where higher scores indicate a greater level of physical activity.[12,13] Personal and anthropomorphic information collected included age, sex, race, height, and weight. Body mass index (BMI) was calculated as the weight in kilograms divided by height in meters squared. Data on the presence of the following comorbidities were also collected: diabetes, arthritis, high blood pressure, heart disease, chronic pulmonary obstructive disease, stroke, and cancers. A simple summation score was used to create a comorbidity index.[14]

Statistical Analysis

The main outcome variable was the rate of falls as obtained by the FSRA questionnaires administered during the last follow-up visit. We then analyzed the association between rate of falls and the current status of visual field loss, as indicated by the integrated binocular MS of the visual field test closest to the date of questionnaire administration. In addition, we calculated the rates of visual field loss using visual field data from the period that preceded the administration of the falls questionnaire. All reliable visual field tests performed during the study period were used to calculate the rates of loss. This approach allowed us to investigate whether the number of self-reported falls was associated with history of fast visual field loss, adjusting for the current level of visual field damage, according to our hypothesis.

Rates of visual field loss were obtained by linear mixed models and reported using the MS of the integrated binocular visual field data. Ability to predict history of falls was investigated with Poisson regression models, where the number of falls during the previous year was used as the dependent variable and visual field results as the independent variables. Age, sex, BMI, PASE score, comorbidity index, and visual acuity were considered potentially confounding variables in multivariable analyses. Results of the Poisson models were given as the effect of the variables on the rate ratio (RR).

All statistical analyses were performed with STATA software, version 13 (StataCorp).

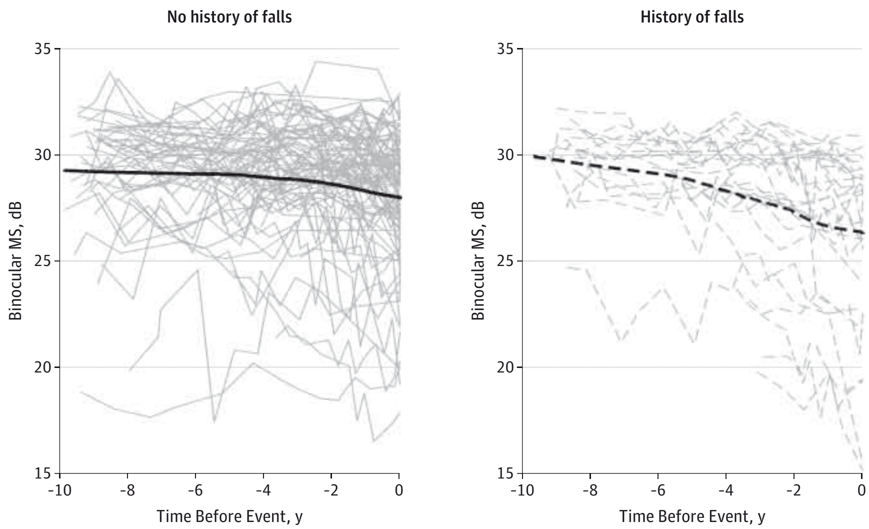
Results

The study included 116 patients with glaucoma with a mean (SD) age of 73.1 (10.7) years at the date of administration of the FSRA questionnaires (55 women [47.4%], 84 white individuals [72.4%], and 32 black individuals [27.6%]). Of the 116 patients, 29 (25.0%) reported at least 1 fall in the previous year. Of the 29 patients who reported falling, 15 (51.7%) had 1 fall, 8 (27.6%) had 2 falls, 4 (13.8%) had 3 falls, and 2 (6.9%) had 4 falls. The eTable in the Supplement gives the demographic and clinical variables for patients with a history of falls vs those without at the time of administration of the questionnaire. Patients with a history of falls were older than those without a history of falls (mean [SD] age, 77.8 [7.1] vs 71.5 [11.3] years; $P = .006$). In addition, patients with a history of falls had a lower level of physical activity as indicated by the PASE score (mean [SD], 123.2 [65.8] vs 168.6 [96.2]; $P = .02$).

Patients who reported a history of falls had worse visual field test results at the time of questionnaire administration (eTable in the Supplement). The mean MD in the better eye was −4.6 and −2.8 dB in those with and without a history of falls, respectively ($P = .02$). Corresponding numbers for MD in the worse eye were −9.1 vs −6.3 dB ($P = .04$), respectively. For binocular MS, corresponding numbers were 26.1 and 27.9 dB ($P = .01$), respectively. For binocular inferior hemifield MS, the differences were 26.7 and 28.7 dB, and for the binocular superior hemifield MS, the differences were 25.4 and 27.1 dB, respectively, in those with and without a history of falls (eTable in the Supplement).

The patients included in the study had been followed up for a mean (SD) of 7.5 (2.6) years (range, 2.0-10.0 years) before assessment of falls. **Table 1** gives the rates of visual field loss for patients who reported a history of falls vs those who did not. Mean rate of change in binocular MS was faster for patients who reported a history of falls vs those who did not (−0.36 vs −0.17 dB/y; mean difference, 0.20 dB/y; 95% CI of difference, 0.09-0.31 dB/y; $P < .001$). **Figure 1** illustrates the time course of changes in binocular MS for patients with and without a history of falls. It can be seen that more rapid visual field loss occurred in those who reported a recent history of falls compared with those who did not. Differences in mean rates of change were also found for the other visual field parameters evaluated.

Figure 1. Time Course of Changes in the Mean Sensitivity (MS) of the Integrated Binocular Field in Patients With and Without a History of Falls



Time zero corresponds to the date of administration of the questionnaire (Falls Screening and Referral Algorithm, see History of Falls subsection of Methods section) for assessment of falls. Patients with glaucoma who reported a history of at least 1 fall in the previous year had greater changes in binocular MS than those who did not report history of falls.

Table 2. Results of Univariable and Multivariable Poisson Regression Models Investigating Factors Associated With History of Falls in Patients With Glaucoma[a]

	Univariable		Multivariable	
Factor	Rate Ratio (95% CI)	*P* Value	Rate Ratio (95% CI)	*P* Value
Rate of change in binocular MS per 0.5-dB/y faster rate of visual field loss	2.07 (1.45-2.96)	<.001	2.28 (1.15-4.52)	.02
Rate of change in binocular MS inferior hemifield per 0.5-dB/y faster rate of visual field loss	2.24 (1.51-3.30)	<.001	2.47 (1.26-4.84)	.009
Rate of change in binocular MS superior hemifield per 0.5-dB/y faster rate of visual field loss	1.67 (1.24-2.26)	.001	1.90 (1.01-3.54)	.04
Rate of change in better eye MD per 0.5-dB/y faster rate of visual field loss	1.79 (1.34-2.41)	<.001	1.81 (1.08-3.03)	.02
Rate of change in worse eye MD per 0.5-dB/y faster rate of visual field loss	1.69 (1.25-2.28)	.001	1.57 (1.05-2.34)	.03
Binocular MS at time of questionnaire per 5 dB lower	1.67 (1.18-2.36)	.004	1.64 (1.08-2.50)	.02
Binocular MS inferior hemifield at time of questionnaire per 5 dB lower	1.54 (1.15-2.09)	.004	1.65 (1.11-2.44)	.01
Binocular MS superior hemifield at time of questionnaire per 5 dB lower	1.40 (1.06-1.84)	.02	1.33 (0.96-1.82)	.09
Better eye MD at time of questionnaire[b] per 5 dB lower	1.57 (1.17-2.11)	.003	1.69 (1.18-2.41)	.004
Worse eye MD at time of questionnaire p er 5 dB lower	1.21 (0.99-1.47)	.06	1.25 (0.98-1.59)	.07
Age per 10 years older	1.48 (1.09-2.02)	.01	1.18 (0.84-0.66)	.34
Female sex	1.58 (0.91-2.76)	.11	1.46 (0.77-2.78)	.25
Body mass index per 1 unit higher	0.98 (0.94-1.04)	.52	0.97 (0.91-1.03)	.35
PASE score per 100 points lower	1.71 (1.19-2.46)	.004	1.40 (0.94-2.10)	.10
Comorbidity index per 1 unit higher	1.16 (0.91-1.48)	.23	1.25 (0.92-1.70)	.16
Visual acuity per 0.1 logMAR lower	1.19 (0.94-1.51)	.14	1.02 (0.77-1.35)	.89

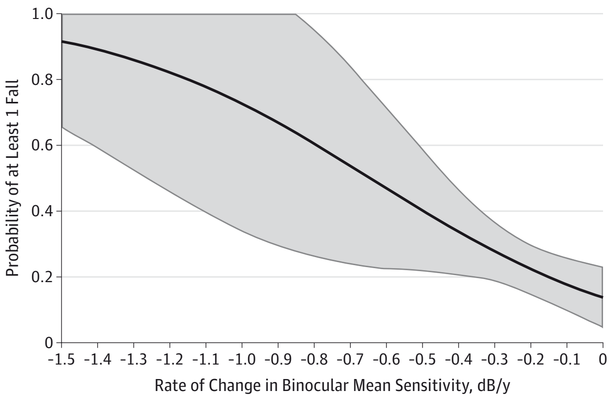
Abbreviations: MD, mean deviation; MS, mean sensitivity; PASE, Physical Activity Scale for the Elderly.

[a] Multivariable models adjusted for age, sex, body mass index, PASE score, comorbidity index, visual acuity, and disease severity in the corresponding visual field area at the time of falls questionnaire assessment. For these variables, rate ratios are only reported for the model evaluating binocular MS.

[b] Falls Screening and Referral Algorithm. See History of Falls subsection of Methods section.

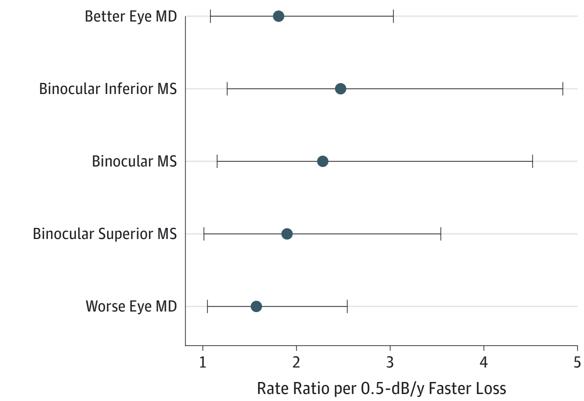
Table 2 gives the results of univariable Poisson regression models investigating factors associated with the rate of falls. The severity of visual field defect as measured by the binocular MS at the time of questionnaire administration was associated with falls (RR, 1.67 per 5 dB lower; 95% CI, 1.18-2.36; $P = .004$). The rate of change in binocular MS was also associated with falls. Each 0.5-dB/y faster rate of visual field loss was associated with a more than 2 times higher rate of falls (RR, 2.07 per 0.5-dB/y faster rate of visual field loss; 95% CI, 1.45-2.96; $P < .001$). Table 2 also gives the results of the multivariable Poisson models that investigated factors associated with falls after adjusting for confounding variables. The association between rate of change and history of falls persisted after adjustment for disease severity at the time

Figure 2. Predicted Probability of Having at Least 1 Fall According to Different Rates of Change in Integrated Binocular Mean Sensitivity



Patients with glaucoma and fast rates of visual field loss had a higher probability of reporting a history of falls than those with slower visual field changes.

Figure 3. Rate Ratios for the Association With Falls for the Rates of Visual Field Loss in the Different Parameters Investigated



Association of different parameters for visual field loss over time with self-reported falls expressed as rate ratios derived from multivariable models adjusting for age, sex, body mass index, physical activities, comorbidity index, and visual acuity. Error bars indicate 95% CIs. Rate ratios are per 0.5-dB/y faster rate of visual field loss.

of questionnaire assessment and the other potentially confounding variables (RR, 2.28 per 0.5-dB/y faster rate of visual field loss; 95% CI, 1.15-4.52; *P* = .02). **Figure 2** illustrates the association between the probability of falling and rates of change in MS.

When rates of change were considered by hemifield, rates of change in the binocular inferior hemifield had a stronger association with a history of falls (RR, 2.47 per 0.5-dB/y faster rate of visual field loss; 95% CI, 1.26-4.84; *P* = .009) than those from the binocular superior hemifield (RR, 1.90 per 0.5-dB/y faster rate of visual field loss; 95% CI, 1.01-3.54; *P* = .04), after adjustment for confounding variables (*P* = .03 for comparison between RRs) (Table 2). **Figure 3** illustrates the RRs for association with falls for rates of visual field loss for the different parameters investigated.

Discussion

In the current study, we found that history of fast visual field loss was significantly associated with risk of falling in patients with glaucoma. Such an association was present even after adjustment for the degree of disease severity closest to the date of assessment of falls. This finding suggests that not only the amount of visual field damage but also the rate at which it has occurred may have an effect on explaining the risk of falling in patients with glaucoma. These findings may have implications for the understanding of risk factors for falls in patients with glaucoma. In addition, they underscore the importance of evaluating rates of visual field change in the functional rehabilitation of patients with glaucoma.

Patients who reported falling had rates of visual field loss that were a mean of more than 2 times faster than in those who did not report a history of falls. As Figure 2 shows, in patients with a history of fast visual field loss, the risk of falls would be much higher than in those with slower loss. For example, a patient with a rate of change of −1.0 dB/y would have a probability of falling of approximately 70% compared with less than 20% for a patient with a rate of change of −0.1 dB/y. Notably, a rate of loss of 1 dB/y in the binocular field corresponds to a devastating loss, leading to substantial functional damage because the binocular field is in general dominated by the better eye of the patient.[10]

The association between rates of visual field change and falls was even stronger when the inferior hemifield of the integrated binocular field was considered. This finding is not surprising considering the presumed greater importance of the inferior field in navigation and obstacle avoidance.[5,15-17] A study by Black et al[6] found that the severity of inferior visual field loss in the integrated binocular field had greater association with risk of falls than measurements from the superior field. They found that a 5-dB lower sensitivity of the inferior integrated binocular field was associated with a RR of 1.56. In fact, our RR was very similar to the one reported by Black et al,[6] with an RR of 1.65 for a 5-dB lower MS of the inferior binocular field. However, the study by Black et al[6] used only cross-sectional visual field assessment. Our study found that in addition to the severity of visual field loss at the time of falls, the velocity that the loss occurred was a major determinant of the risk of falling. For the inferior binocular MS, each 0.5-dB/y faster rate of visual field loss was associated with an RR of falling of 2.47. For the superior binocular MS, the association was weaker, with each 0.5-dB/y faster rate of visual field loss associated with an RR of 1.90.

The fact that the association between rate of field loss and falls persisted despite adjustment for the amount of field damage at the time of falls is interesting. In principle, one would think that the risk of falls would depend essentially on how severe the visual field defect is at a given moment. However, our results revealed that for 2 patients with the same disease severity, the patient who has been worsening faster would have higher risk of falling. This finding might be related to the mechanisms used by patients to compensate for the field losses. Patients in whom the disease has worsened slowly might be

able to develop compensatory mechanisms to overcome the limitations caused by their field defects. On the other hand, those in whom the disease worsens fast, particularly affecting the better eye (and consequently the binocular field), might not have enough time to work out these compensatory mechanisms and would be at increased risk for falling. It is possible, for example, that postural adjustments in patients with rapid loss of the inferior field, such as turning the head down to use assistance from the superior field when walking, could cause loss of balance and predispose patients to falls. Although patients with inferior field loss who worsened slowly may also use head movements to compensate for the field defects, it is possible that other body adjustments may have taken place over time to compensate for the imbalance caused by head movement. The mechanisms that explain our findings, however, are still not clear and should benefit from further research. Of note, previous studies[14,18-20] have found that rapid worsening of visual fields is associated with decreases in quality of life and depression, as assessed by self-reported questionnaires. Patients with fast visual field loss report more difficulty with driving, climbing stairs, or seeing objects on the side, even after adjustment for the level of disease severity.[14,18,20] It is also possible that instead of developing compensatory mechanisms, patients with more gradual visual field loss had fewer falls because they were less mobile and had decreased their life space over time.[21]

Our study has limitations. The primary outcome measure of the self-reported number of falls was obtained at only 1 time point, which may have underestimated the true incidence of falls. A previous study[22] found that elderly persons often do not recall falls that occurred within this period. However, a retrospective recall of falls has high specificity compared with a prospective ongoing collection of falls data, despite a lower level of sensitivity.[23] It is therefore possible that a prospective collection of falls data may reveal an even stronger association between the number of falls and the rate of visual field loss, although future studies are required to examine this. We were careful to adjust our analyses to the current level of field defects and other confounding variables and found clinically relevant associations that should serve to motivate further prospective longitudinal studies investigating these issues. Another limitation of our study was that we did not measure field loss and rates of change in regions extending beyond the central 60º. However, although field defects that affect more peripheral field regions could also contribute to risk of falls, a previous study[6] suggested that the integrated binocular field is as good as strategies that test more peripheral points in identifying patients with glaucoma at risk for falling. Our study did not collect information on depressive symptoms, which is a risk factor for falls.[24] Because a previous study[21] found the rate of visual field loss was associated with the worsening of depressive symptoms in patients with glaucoma, future studies are required to elucidate whether both these factors contribute independently to the risk of falls. Our findings should be tempered by recognition that they are based on an association but do not necessarily imply a cause-and-effect relationship between rate of visual field loss and a recent self-reported history of falls.

Conclusions

Rate of visual field loss was associated with risk of falling in patients with glaucoma. A history of fast visual field loss in the inferior integrated binocular field had a major effect on risk of falls in our cohort. Given the potentially serious consequence of falls, our work suggests the need for careful assessment of rates of visual field loss that affect the inferior field in patients with glaucoma. Further studies should clarify the mechanisms potentially explaining the associations uncovered in the present work.

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Study concept and design: Diniz-Filho, Medeiros.
Acquisition, analysis, or interpretation of data: All authors.
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Invited Commentary

Velocity of Visual Field Progression Implicated in Falls

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Falls in elderly individuals are relatively common and affect 1 in 3 community-living elderly adults annually. Of those who fall, 20% to 30% experience moderate to severe injuries, such as head or hip injuries. Serious falls are associated with increased morbidity and hospitalization and account for 70% of unintentional deaths in persons 75 years and older.[1] Falls can also have a detrimental psychological effect, resulting in fear of falling, self-restriction of daily activities, reduced mobility, and increased dependence.[2] Moreover, fall injuries are expensive to treat, with the direct medical costs in the United States totaling $34 billion in 2013.[1]

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Poor vision has frequently been identified as an important risk factor for falls, with visually impaired persons having nearly twice the likelihood of falling compared with their normally sighted counterparts. In particular, glaucoma, one of the leading causes of visual impairment globally, is a major risk factor of falls in population-based and clinical studies. For example, in a large Asian population–based study, Lamoureux et al[3] reported that having glaucoma was associated with a 4-fold risk of falling, independent of visual acuity and with the severity of visual field (VF) loss implicated as the driving factor behind this elevated risk of falls.

Intriguingly, the velocity of VF progression may also play an important role in the cause of falls. In a longitudinal cohort of 116 patients diagnosed as having glaucoma, Baig et al[4] in this issue of *JAMA Ophthalmology* found that more rapid VF progression was independently associated with falls even after accounting for the magnitude of VF defects. In particular, patients with glaucoma had more than double the risk of falling with every 0.5-dB/y faster loss of binocular integrated VF mean sensitivity. This result suggests that it is not only the severity of VF loss but also the rate of VF change that may be important in the management of glaucoma.

Although the results of this study are novel and interesting, caution is required because the study was conducted in an elderly population (mean [SD] age, 73.1 [10.7] years) and the authors did not account for covariates, such as contrast sensitivity, frailty, gait, and comorbidities, including cerebrovascular events, dementia, and Parkinson's disease, in their analyses, all of which are associated with falls. Therefore, it is possible that the observed strong association between rate of VF progression and falls may attenuate in the presence of these other factors. In addition, the retrospective assessment[1] of falls using a single question at a single data point is problematic because it correlates poorly in elderly individuals. Future studies could consider collecting data on falls prospectively to mitigate the effect of recall bias by using monthly fall diaries in conjunction with frequent reminders to complete them. Moreover, a recent article by Sun et al[5] reported that persons with glaucoma and central VF defects in the better eye were more likely to experience reductions in functional vision and quality of life compared with individuals with VF loss in other quadrants (ie, inferior, superior, nasal, temporal), suggesting that the location of VF loss may be another important factor