Clinical and Epidemiologic Research

While We Waited: Incidence and Predictors of Falls in Older Adults With Cataract

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Purpose. Strong evidence indicates an increased fall risk associated with cataract. Although cataract surgery can restore sight, lengthy wait times are common for public patients in many high-income countries. This study reports incidence and predictors of falls in older people with cataract during their surgical wait.

Methods. Data from a prospective study of falls in adults aged ≥65 years who were awaiting cataract surgery in public hospitals in Australia were analyzed. Participants underwent assessment of vision, health status, and physical function, and recalled falls in the previous 12 months. Falls were self-reported prospectively during the surgical wait.

Results. Of 329 participants, mean age was 75.7 years; 55.2% were female. A total of 267 falls were reported by 101 (30.7%) participants during the surgical wait (median observation time, 176 days): an incidence of 1.2 falls per person-year (95% confidence interval [CI] 1.0–1.3). Greater walking activity (incidence rate ratio [IRR] 1.06, 95% CI 1.01–1.10; $P = 0.02$, per additional hour/week), poorer health-related quality of life (IRR 1.12, 95% CI 1.05–1.20; $P < 0.001$, per 5-unit decrease), and a fall in the prior 12 months (IRR 2.48, 95% CI 1.57–3.93; $P < 0.001$) were associated with incident falls. No visual measure independently predicted fall risk. More than one-half (51.7%) of falls were injurious.

Conclusions. We found a substantial rate of falls and fall injury in older adults with cataract who were awaiting surgery. Within this relatively homogenous cohort, measures of visual function alone inadequately predicted fall risk. Assessment of exposure to falls through physical activity frequency may prove valuable in identifying those more likely to fall during the surgical wait.

Keywords: cataract, falls, injury, visual disability, surgical wait

Falls represent a significant public health issue globally and disproportionately affect the older population.[1] Adults older than 65 years suffer the greatest burden of fatal falls, in addition to hospitalization for serious fall injuries including head trauma and hip fracture.[1] Vision impairment has long been recognized as a risk factor for falls[2,3] and cataract is a leading cause of vision impairment.[4] A review of hospitalized hip fracture patients in the United Kingdom found that almost one-half had uncorrected bilateral vision impairment, with cataract responsible in 50% of cases.[5]

Existing evidence suggests a 3-fold increase in fall risk in those with cataract.[3,6] Such studies have so far relied on retrospective falls information and there are limited robust prospective data of falls incidence in the older population awaiting cataract surgery. Additionally, the mechanisms of any increase in fall risk among those with cataract remain uncertain. Visual associations with fall risk have been widely reported and include reduced visual acuity[2] and contrast sensitivity,[7] impaired depth perception,[8] and visual field limitations.[9] However, despite a shift toward recognizing quality of life and visual disability as key indicators for surgical need,[10] public patients referred for cataract surgery in high-income countries remain commonly operated on a "first come, first served" basis and present with similar levels of vision loss.[11,12] As a result, there is a need to recognize both nonvisual and visual risk factors in delineating fall risk among older persons with cataract within these settings.

Further, although cataract surgery is a highly effective at restoring sight,[13] long waiting times for public cataract surgery are common.[14] In Australia, patients can wait up to 3 years for first eye surgery: an initial 2 years for outpatient ophthalmology assessment[15] followed by 12 months on the surgical waiting list.[14] Understanding who is more likely to fall during their wait for cataract surgery, and why, will facilitate identification and management of those at highest risk and may reduce fall injury in this already vulnerable population.

This study used prospective falls data from a longitudinal cohort study of older persons with bilateral cataract to examine the incidence of falls during the wait for first eye cataract surgery, and to identify factors associated with an increased fall risk.

Methods

Study Design

Presurgical data from participants of The FOCUS Study (Falls in Older people with Cataract, a longitudinal evalUation of impact and riSk) were used for these analyses. FOCUS is a longitudinal cohort study of fall risk in patients referred to public hospitals for cataract surgery in three Australian states, the protocol of which has been published elsewhere.[16] In brief, individuals with bilateral age-related cataract were recruited before first eye cataract surgery and, using monthly calendars, prospectively reported falls for a maximum 2-year enrollment period. The context and outcomes of any falls were determined by phone interview. A total of 329 participants from eight public hospitals in Sydney ($n = 222$), Melbourne ($n = 43$), and Perth ($n = 64$) underwent baseline assessment between October 2013 and August 2015.

Ethics approval for The FOCUS Study was granted by the NSW Population and Health Services Research Ethics Committee, and the human research ethics committees of Curtin University, Royal Perth Hospital, and the Royal Victorian Eye & Ear Hospital. The study adhered to the tenets of the Declaration of Helsinki and all participants provided written informed consent.

Participants

Surgical waiting lists of participating hospitals and outpatient ophthalmology clinic referral letters were reviewed to identify potentially eligible participants who were mailed a letter inviting study participation. A researcher then attempted phone contact with the patient 1 week later to elicit interest in participating and screen for eligibility (Table 1). Overall, 2247 of 3872 patients screened were excluded owing to not meeting inclusion criteria ($n = 1391$) or declining participation ($n = 1062$).

Table 1. Participant Eligibility Criteria

Inclusion criteria:
Aged 65 years and older
Referred by optometrist, general practitioner, or ophthalmologist for first eye cataract surgery
Exclusion criteria:
Cognitive impairment (Short Portable Mental Status Questionnaire score > 2)
Diagnosis of dementia, Parkinson's disease, or stroke
Unable to complete study assessments in English language
Significant ocular comorbidities, e.g., glaucoma, diabetic retinopathy, age-related macular degeneration
Planned combined ocular surgery, e.g., glaucoma and cataract
Residing outside metropolitan area (preventing completion of study visits)
Living in a residential/long-term care facility
Unable to walk (either aided or unaided)

Measurements

Primary Outcome: Falls. Participants recounted any fall in the previous 12 months and, following baseline assessment, self-reported falls prospectively by using monthly calendars.[17] Participants who reported falling were telephoned by a research assistant each month to determine fall circumstances, injuries sustained, and treatment received. Participants failing to return a completed falls calendar at the end of the month were also telephoned to ascertain whether a fall had occurred. A fall was defined by using the accepted definition of any unexpected event in which the participant comes to rest on the ground, floor, or lower level.[17]

Demographic Characteristics and Health. All participants were asked about age, sex, employment, and living arrangements. Current medical conditions and medications were self-reported and the Functional Comorbidity Index (FCI) was applied.[18] Quality of life (QoL) was assessed by the EQ-5D-5L,[19,20] producing both a QoL index and self-report visual analogue scale (VAS) score (a score of 0 is the worst health imaginable and 100 is the best). These indices were significantly correlated for the cohort ($r = 0.50$, $P < 0.001$); consequently the VAS QoL score (0–100) was used for all analyses. Fear of falling was assessed by using the Short Falls Efficacy Scale-International,[21] a seven-item questionnaire requiring participants to rate their level of concern about falling during a selection of common daily activities on a four-point scale. Presence of depressive symptoms was evaluated by the five-item Geriatric Depression Scale.[22]

Visual Assessment. Visual acuity was measured with habitual correction both binocularly and monocularly by using the high contrast Early Treatment Diabetic Retinopathy Study (ETDRS) chart at 3 m. Participants were asked to continue reading the chart until two adjacent letters were incorrectly identified; the number of correctly identified letters was converted to logMAR notation for analyses. Monocular and binocular contrast sensitivity were measured by using the Mars Letter Contrast Sensitivity Test at 50 cm.[23] Type of habitual spectacle correction was noted. Stereopsis was evaluated by the Titmus stereo test with Wirt circles, and ocular dominance determined by using the Miles test.[24]

Patient-reported visual disability was assessed by the Catquest-9SF, a nine-item instrument designed for the measurement of patient-reported outcomes in people with cataract.[25] Responses to the Catquest-9SF questionnaire were assessed by using Rasch analysis (Winsteps, Chicago, IL, USA) to create an overall person score for each participant, expressed in a log-odds metric, or logits. A higher person score indicates a greater level of visual disability.

Physical Function and Activity. Physical function was evaluated by the three mobility tasks of the Short Physical Performance Battery (SPPB): sit-to-stand five times, standing balance for five foot positions, and a 4-m walk (gait speed).[26] A SPPB summary performance score (range, 0 worst–12 best) summed the category scores for each of the three mobility tasks. Participants' average weekly physical activity levels over the last 3 months were self-reported by using the Incidental and Planned Exercise Questionnaire (IPEQ).[27,28] Use of a walking aid for daily tasks of mobility was also ascertained.

Statistical Analysis

Descriptive statistics were used to describe participant characteristics. The *t*-test (for continuous variables) and χ^2 test (for categorical variables) were used to compare characteristics of "fallers" and "nonfallers" with a significance level of $P = 0.05$. The incidence of falls per person-year (primary outcome), and its 95% confidence interval (CI), was calculated by using a Poisson log-linear regression model with an offset equal to the logarithm of the time of observation (in years) before first eye cataract surgery.

Univariate analysis using negative binomial regression for count data was conducted initially to assess associations with an increased fall risk; the logarithm of the time of observation before first eye cataract surgery was again used as an offset in the model. A significance level of $P < 0.25$ on univariate analysis determined inclusion in the baseline multivariable model; more stringent significance levels can lead to the exclusion of potentially useful predictor variables. A backwards elimination technique, whereby the least significant variable in the model is removed in a stepwise manner, was then implemented to refine an age- and sex-adjusted multivariable model (significance set at $P < 0.05$) using complete cases only. The selection of the final model was informed by assessment of Akaike Information Criterion. Analyses were repeated to exclude those who were not recommended for cataract surgery following further ophthalmic assessment. To determine factors predicting vulnerability to repeated falls, we then restricted our data set to include only those who had fallen during the surgical wait and conducted modified Poisson regression using a binary outcome of single faller versus more multiple faller, with a significance level of $P < 0.05$. All statistical analyses were completed by using SAS Enterprise Guide version 5.1 (SAS Institute, Inc., Cary, NC, USA). Study results were reported in accordance with the STROBE statement for observational studies.[29]

Results

Of the 329 participants undergoing baseline assessment, 2 died during their wait for first eye cataract surgery, 10 withdrew ($n = 8$) or were withdrawn by a researcher owing to no longer meeting study criteria ($n = 2$), and 2 were lost to follow-up. All of these contributed at least 1 month of falls data before dropout and so contributed to the analysis. Twenty-five participants were not recommended for cataract surgery following additional ophthalmic assessment but continued to report falls for a maximum 2-year enrollment period. Participants' median time of observation from baseline was 176 days (range, 30–730 days); observation times greater than 365 days occurred for participants recruited from outpatient ophthalmology clinic referral letters (including those not recommended for surgery) and those with unintended surgery delays due to ill health.

The mean age of participants was 75.7 years (standard deviation [SD] 5.3 years) and 55.2% were female. Bilateral visual acuity was a mean of 0.26 (SD 0.21) logMAR (Snellen equivalent of $20/40^{+1}$) and mean (SD) bilateral contrast sensitivity was 1.48 (0.21) log units. Overall, 30.4% of participants ($n = 100$) had mild and 17.0% ($n = 56$) moderate visual impairment (better eye visual acuity > 0.3–0.5 and > 0.5–1.0 logMAR, respectively); the remaining participants were not vision impaired (i.e., better eye visual acuity < 0.3 logMAR). Patient-reported visual disability averaged 0.98 logits (SD 1.40 logits). In all, 40.2% ($n = 129$) of participants reported having fallen in the 12 months before study entry. Complete baseline characteristics of the cohort are presented in Table 2.

A total of 267 falls were reported by 101 (30.7%) participants during their wait for first eye surgery; a fall incidence of 1.2 per person-year (95% CI 1.0–1.3). Compared to nonfallers, those who fell had a greater number of comorbidities ($P < 0.001$), took more medications ($P = 0.04$), had a lower QoL ($P < 0.001$), and exhibited higher fear of falling ($P < 0.001$). Fallers also achieved a worse (lower) overall SPPB score than nonfallers: the mean (SD) SPPB score was 7.5 (2.9) for those who fell, versus 8.4 (2.8) for nonfallers ($P = 0.005$) (Table 2).

Table 3 presents results of both the unadjusted negative binomial regression analysis and adjusted multivariate model assessing associations with an increased rate of falls. Poorer contrast sensitivity (incidence rate ratio [IRR] 0.90, 95% CI 0.79–1.04), greater visual disability (IRR 1.14, 95% CI 0.97–1.34), lower QoL (IRR 1.11, 95% CI 1.01–1.19, per 5-unit decrease), more comorbidities (IRR 1.13, 95% CI 1.01–1.26), increased walking activity (IRR 1.03, 95% CI 0.98–1.08, per additional hour/week), higher fear of falling (IRR 1.07, 95% CI 1.01–1.13), lower body mass index (IRR 0.96, 95% CI 0.92–1.01), and a fall in the prior 12 months (IRR 2.24, 95% CI 1.41–3.56) were predictive of an increased rate of falls in unadjusted models. Increased walking activity (IRR 1.06, 95% CI 1.01–1.10; $P = 0.02$, per additional hour/week), lower QoL (IRR 1.12, 95% CI 1.05–1.20; $P < 0.001$, per 5-unit decrease), and a fall in the prior 12 months (IRR 2.48, 95% CI 1.57–3.93; $P < 0.001$) remained independently associated with an increased rate of falls in the final age- and sex-adjusted multivariate model. These findings remained unchanged when the 25 participants who were not recommended for cataract surgery were removed from the data set and regression analyses repeated.

Multiple falls (range, 2–31 falls) were experienced by 49 (14.9%) participants and 51.0% were female. Modified Poisson regression analysis found that, among the 101 participants who fell during the wait for cataract surgery, the risk of falling more than once was associated with poorer performance on both the standing balance test (risk ratio [RR] 1.13, 95% CI 1.05–1.21; $P = 0.001$, per 5-second reduction) and sit-to-stand assessment (RR 1.29, 95% CI 1.21–1.37; $P < 0.001$), and a lower QoL at baseline (RR 1.07, 95% CI 1.01–1.14; $P = 0.02$, per 5-unit decrease).

More than one-half ($n = 138$, 51.7%) of falls were injurious, including 15 head injuries and 2 fractures (Table 4). The incidence of injurious falls was 0.60 per person-year (95% CI 0.51–0.71). Risk factors for injurious falls were the same as all falls, that is, greater walking activity (IRR 1.07, 95% CI 1.02–1.13; $P = 0.01$, per additional hour/week), poorer QoL (IRR 1.13, 95% CI 1.05–1.22; $P = 0.001$, per 5-unit decrease), and a fall in the prior 12 months (IRR 3.53, 95% CI 2.07–6.02; $P < 0.001$). Indoor falls ($n = 148$, 55.4%) were more frequent than outdoor falls, with walking (121 falls; 44.3%), stepping up or down (49 falls; 18.4%), and standing (34 falls; 12.7%) the three most common activities at time of fall in both environments. A trip was the most common reported reason for falling (109 falls; 40.8%) followed by a loss of balance (82 falls; 30.7%). Twenty-two (8.2%) falls lead to a visit to the general practitioner, 10 (3.7%) falls presented to the hospital emergency department and 6 (2.2%) resulted in hospital admission.

Discussion

The findings of this prospective cohort study demonstrate a substantial rate of falls and fall injury in older adults with cataract who were waiting for surgery, and provide insight into associations with increased fall risk. Within this relatively homogeneous group of participants with clinically significant cataract, objective measures of vision inadequately predicted fall risk. Instead, more weekly walking hours, along with a history of falls and a lower QoL, served as the greatest risk factors for falling during the surgical wait. These data suggest that measures of exposure to falling (i.e., walking activity) may prove key to delineating fall risk in the older population during their wait for cataract surgery. Specifically, an active older person with cataract may fall more by virtue of increased opportunity for falls.

Table 2. Comparison of Baseline Characteristics of 101 "Fallers" and 228 "Nonfallers" ($n = 329$)

Characteristics	Overall, n = 329	Faller, n = 101	Nonfaller, n = 228	P Value
Sociodemographic				
Age, y	75.7 (5.3)	76.0 (5.6)	75.6 (5.2)	0.51
Female, n (%)	182 (55.3)	56 (55.4)	126 (55.3)	0.98
Living arrangements, n (%)				0.45
Alone	98 (29.8)	32 (31.7)	66 (28.9)	
Partner ± children	180 (54.7)	54 (53.5)	126 (55.3)	
Child, relative, or friend	50 (15.2)	14 (13.9)	36 (15.8)	
Other	1 (0.3)	1 (1.0)	0 (0.0)	
Employment status, n (%)				0.75
Retired on pension	297 (90.6)	92 (91.1)	205 (89.9)	
Retired self-funded	17 (5.2)	4 (4.0)	13 (5.7)	
Employed	14 (4.3)	5 (5.0)	9 (3.9)	
Visual function				
Bilateral habitual visual acuity, logMAR	0.26 (0.21)	0.25 (0.21)	0.27 (0.20)	0.55
Dominant eye visual acuity	0.38 (0.23)	0.40 (0.23)	0.37 (0.23)	0.40
Bilateral contrast sensitivity, log units	1.48 (0.21)	1.48 (0.21)	1.48 (0.20)	0.99
Dominant eye contrast sensitivity	1.32 (0.25)	1.32 (0.26)	1.31 (0.25)	0.94
Gross stereopsis (<1200″), n (%)	164 (49.9)	45 (44.6)	119 (52.2)	0.20
Habitual multifocal, n (%)	136 (41.3)	41 (40.6)	95 (41.7)	0.86
Visual disability, Catquest-9SF, logits	−0.98 (1.40)	1.19 (1.34)	0.89 (1.43)	0.07
Health status				
Comorbidities	4.3 (2.2)	4.8 (2.3)	4.0 (2.1)	0.001
Medications, total	4.6 (3.6)	5.2 (3.9)	4.3 (3.5)	0.04
≥5 medications, n (%)	140 (42.6)	50 (49.5)	90 (39.5)	0.09
≥10 medications, n (%)	33 (10.0)	16 (15.8)	17 (7.5)	0.02
Antidepressant use, n (%)	39 (11.9)	16 (15.8)	23 (10.1)	0.14
Depressive symptoms, GDS-5 score >2, n (%)	94 (28.6)	35 (34.7)	59 (25.9)	0.10
QoL index	0.80 (0.21)	0.74 (0.24)	0.83 (0.18)	0.001
QoL, VAS: 0 worst–100 best	76.4 (17.9)	72 (19)	78 (17)	0.004
Physical activity and function				
Weekly physical activity, h	42.8 (24.2)	44.0 (24.5)	42.2 (25.1)	0.54
Planned activity	3.3 (4.3)	3.4 (4.8)	3.3 (4.1)	0.75
Incidental activity	39.5 (23.4)	40.6 (23.7)	38.9 (23.3)	0.56
Walking activity	3.5 (4.9)	4.0 (5.7)	3.3 (4.6)	0.29
Physical function, SPPB score: 0 worst–12 best	8.1 (2.8)	7.5 (2.9)	8.4 (2.8)	0.005
Gait speed, m/s	0.9 (0.3)	0.8 (0.3)	0.9 (0.3)	0.55
Standing balance, s, 0–60	50.3 (12.9)	46.3 (14.0)	52.1 (11.9)	<0.001
Sit-to-stand 5x, stands/s	0.3 (0.6)	0.4 (1.1)	0.5 (0.2)	0.50
Body mass index	27.8 (5.8)	27.6 (5.7)	27.9 (5.9)	0.65
Walking aid use, n (%)	27 (8.2)	11 (10.9)	(7.0)	0.24
Fear of falling, SFES-I: 7 least–28 most	11 (4)	12 (5)	10 (4)	<0.001
Fallen in prior 12 months, n (%)	129 (40.2)	63 (62.4)	66 (28.9)	<0.001

Values are presented as mean (standard deviation) if not stated otherwise. P values for comparison of group characteristics are derived from the t-test for continuous variables, and χ^2 test for categorical variables. GDS-5, five-item Geriatric Depression Scale; QoL, quality of life (self-rated by using EQ-5D-5L visual analogue scale [VAS]); SFES-I, Short Falls Efficacy Scale-International.

Although associations between physical activity levels and falls in the older population are well explored, findings vary and studies of vision-impaired populations or those with age-related eye conditions are limited. A single study of adults aged ≥60 years with low vision has found that self-reported physical inactivity was independently associated with a fall in the previous 12 months.[30] Within the general older population, Tromp et al.[31] have also reported links between physical inactivity, falls, and fractures, and Klenk et al.[32] have shown an increased rate of falls in older adults walking less than 1 hour per day. In contrast, and mirroring the findings of the present study, Mohler et al.[33] have found that longer walking episodes were a sensitive predictor of prospective falls in pre-frail and frail community-dwelling older adults. While our study makes an important contribution to understanding how physical activity may influence fall risk in those with cataract, further work is required to confirm these associations and exploration of the interplay of physical activity and falls in other vision-impaired populations is necessary. Objective physical activity measures, including actigraphy and GPS tracking devices, have been used to assess activity and daily movement patterns in those with age-related macular degeneration[34] and glaucoma,[35] providing foundation for their application in studies of fall risk in those with vision impairment. Importantly, our findings and those of others highlight the value of using activity levels as a functional measure of fall risk and suggest validity of "falls per hours walked" in both assessing risk and characterizing fall incidence.[32]

We found that 31% of participants experienced a fall during their surgical wait and this is similar to the proportion of fallers in the general population of the same age.[36–38] The annual incidence of 1.2 falls per person was somewhat higher than

Table 3. Factors Associated With Falls in Participants Waiting for Cataract Surgery ($n = 305$)

Predictor Variables	Univariate Model IRR	Univariate Model 95% CI	Univariate Model P Value	Multivariate Model IRR	Multivariate Model 95% CI	Multivariate Model P Value
Age, per 5-y increase	0.87	0.69–1.08	0.21			
Female	1.03	0.64–1.66	0.89			
Visual acuity, bilateral, logMAR	1.13	0.38–3.31	0.83			
Anisometropia, ≥2-diopter difference	0.79	0.45–1.37	0.40			
Contrast sensitivity, bilateral, log units*	0.90	0.79–1.04	0.16			
Gross stereopsis, <1200"	1.01	0.62–1.66	0.95			
Multifocal/bifocal habitual use	0.87	0.54–1.39	0.56			
Visual disability, Catquest-9SF, logits	1.14	0.97–1.34	0.12			
Physical activity, h/wk	1.00	0.99–1.01	0.68			
Planned activity, h/wk	1.02	0.96–1.07	0.58			
Walking activity, h/wk	1.03	0.98–1.08	0.22	1.06	1.01–1.10	0.02
Physical function, SPPB total score	0.95	0.87–1.03	0.19			
Gait speed, m/s	0.66	0.31–1.39	0.27			
Standing balance, s, 0–60	0.99	0.97–1.00	0.16			
Sit-to-stand 5x, stands/s	0.20	0.88–1.63	0.25			
Walking aid use	1.32	0.61–2.87	0.48			
Body mass index	0.96	0.92–1.01	0.10			
Comorbidities, FCI	1.13	1.01–1.26	0.03			
Total medications	1.01	0.94–1.07	0.84			
≥5 medications	0.87	0.54–1.39	0.55			
≥10 medications	1.39	0.67–2.88	0.38			
Depressive symptoms, GDS-5 ≥ 2	1.18	0.71–1.94	0.52			
Antidepressant use	1.78	0.89–3.53	0.10			
Quality of life, EQ-5D-5L VAS, 0–100, per 5-unit decrease	1.11	1.01–1.19	<0.001	1.12	1.05–1.20	<0.001
Lives alone	0.85	0.50–1.43	0.54			
Fear of falling, SFES-I	1.07	1.01–1.13	0.01			
Fallen in prior 12 months	2.24	1.41–3.56	<0.001	2.48	1.57–3.93	<0.001

Complete case analysis of 305 participants. Missing data: bilateral contrast sensitivity (2); physical activity (2); SPPB total score (2); body mass index (3); number of medications (3); quality of life (2); fear of falling (5); fallen in previous 12 months (8). The final age- and sex-adjusted multivariate model contained the following variables: walking activity, quality of life, and fallen in prior 12 months. VAS, visual analogue scale of the EQ-5D-5L.

* Clinically significant change of 0.12 log units.

rates arising from studies of the older community-dwelling population (an annual incidence of 0.4–0.6 falls per person in those aged ≥65 years in the United States has been recently reported).[39] Few studies have used prospective falls reporting to estimate incidence, however, and variations in study designs as well as target population make direct comparisons difficult. Fifty-two percent of falls in the present study were injurious; although minor injuries such as bruising, cuts, and grazes occurred most frequently, the significance of these should not be overlooked as any fall-induced injury in an older person has significant consequences for health service use, risk of future fracture, and functional decline.[40] Almost one-half (49%) of all fallers fell more than once, a proportion similar to that found within the prospective study by Lord[7] of community-dwelling adults, and poorer physical function measures and lower QoL discriminated recurrent versus single fallers. Mobility problems have been reported as key intrinsic risk factors for recurrent falling,[38,41,42] and both standing balance and sit-to-stand abilities predicted risk of multiple falls among our participants. Participants in this study were potentially the more mobile and physically able of those awaiting cataract surgery, given their willingness to attend a clinic-based study assessment. As a result these findings unlikely capture the full extent of mobility-related fall risk within this older population.

Measures of visual acuity, contrast sensitivity, and stereopsis were not significantly associated with an increase rate of falls. Nor were refractive measures including anisometropia and the habitual use of multifocal or bifocal spectacles. These findings differ from population-based studies elsewhere[3,43]: contrast sensitivity in particular has been consistently reported as a strong risk factor for falls in the older population.[7] It should be noted that greater than 70% of participants had no to mild vision impairment (visual acuity ≤ 0.5 logMAR [i.e., better than 20/60 Snellen] in the better eye), and it is feasible that a floor effect in visual acuity may explain its lack of association with falls in this cohort. Additionally, stereopsis was assessed here at near range by Titmus Fly and Wirt circles and may not adequately reflect functional depth perception during daily mobility tasks. Although shifts in depth perception associated with the use of multifocal spectacles have been previously associated with falls,[8] the lack of association between habitual multifocal use and falls in this cohort is not unexpected. Pragmatic trials indicate that a change in spectacle correction may be a greater risk factor for increasing incident falls,[44] and benefits to shifting long-term multifocal wearers to single vision spectacles are limited to more active individuals.[45] These have important implications for postcataract surgery fall risk, where both refractive and spectacle changes are common and magnification effects are likely to impact visual comfort, depth perception, and balance. Among those awaiting cataract surgery, however, our findings highlight visual homogeneity and reinforce the need to consider nonvisual factors when assessing fall risk during this period.

Wait time for public patients requiring first eye cataract surgery in Australia remains significant for many, and the contribution of surgical delays to fall risk cannot be overlooked. In the single randomized controlled trial of expedited cataract surgery conducted to date, Harwood et al.[46] have

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Table 4. Characteristics of Falls and Fall Injuries During the Wait for Cataract Surgery

Fall Characteristics	*n*	%
All falls	267	100
Injurious falls	138	51.7
Injury sustained		
Bruising	88	33.0
Cuts/grazes	56	21.0
Head injury	15	5.6
Sprain	10	3.7
Muscle strain	7	2.6
Fracture	2	0.7
Other*	4	1.5
Interventions		
General practitioner visit	22	8.2
Bandaging/suturing	13	4.9
Emergency department visit	10	3.7
X-ray	9	3.4
Ambulance called	8	3.0
Hospital admission	6	2.2
Surgery	1	0.4
Fall location		
Inside own home	126	47.2
Inside elsewhere	22	8.2
Outside at own home	51	19.1
Outside elsewhere	68	25.5
Cause of fall		
Trip	109	40.8
Loss of balance	82	30.7
Unexplained	24	9.0
Dizzy/faint	18	6.7
Slip	14	5.2
Legs gave away	10	3.7
Other*	4	1.4
Not specified	6	2.2

* Other injuries sustained include nose bleed, eye injury, and back/spinal pain (2). Other causes of falls include dismounting bicycle, panic attack, roll from bed, and shock.

found a 34% reduction in falls resulting from the provision of cataract surgery within 1 month of referral compared to a routine 12-month wait. Applying this 34% reduction to our own cohort suggests the burden of falls may be significantly reduced if wait times are curtailed, that is, an estimated 91 falls potentially avoided. However, despite a shorter wait time being linked to the reduction of fall events, the impact of cataract surgery itself on fall risk remains uncertain. McGwin et al.[47] in the United States have found no difference in a 12-month falls incidence between older patients with cataract who underwent surgery and those who did not (risk ratio 0.96, 95% CI 0.6–1.4). In contrast, To et al.[48] have reported a 78% reduction in the proportion of fallers in Vietnam in the year after first eye cataract surgery, compared to the prior year. Both studies relied on retrospective falls data and patient recall. An Australian investigation of hospital administrative data sets has found that the risk of an injurious fall requiring hospitalization more than doubled in the period after first eye surgery, compared to the 2 years before surgery.[49] Falls requiring hospitalization comprise only a proportion of all falls (2% of falls within our study required hospital admission), and characterizing both noninjurious falls and injurious falls not requiring hospitalization is important to assess the full pre- and postsurgery falls burden. Further confirmation of the impact of cataract surgery, including expedited surgery, on fall risk is needed.

This study was unique in its application of longitudinal, prospective falls reporting and recording of injury events, and these were significant strengths. Additionally, we used validated measures to explore associations between a wide variety of both visual and nonvisual factors and falls in an older person with cataract. Our findings, however, should be interpreted in the context of the following limitations. Participants were more likely to be confident in their mobility (volunteering to attend a hospital-based assessment), suggesting a reasonable level of physical function and activity, which is not representative of all older persons with cataract. Activity levels were elicited via the IPEQ questionnaire and, while providing a useful estimate of both planned and incidental weekly exercise, the potential for recall bias is likely to overestimate total active hours. The application of objective physical activity measures, such as accelerometers and actigraphy, is recommended for future investigation of falls in this population. Although there are inherent limitations with the use of self-report for falls history, the association between prior falls and prospective fall risk is well established. Regardless, the degree of association between prior and future falls reported here should be interpreted with some caution. The recruitment rate of 24% is not unexpected for this type of research where participants are recruited by letter and telephone, and volunteer their time for additional hospital visits to complete study assessments. Nevertheless, the potential impact of nonresponse bias should be acknowledged. Finally, the eligibility criteria of FOCUS limit participation to English speakers and excludes participants with mild to severe cognitive impairment. Consequently, these findings may not reflect the experience of those with greater dependence on others for accessing surgical services.

In summary, this study found that one in three patients waiting for cataract surgery will experience a fall, and that those with a history of falls in the prior year and who walk more during their surgical wait are at greatest risk. Further, more than one-half of all falls experienced by an older person with cataract were injurious. Delays in receiving first eye cataract surgery place patients at risk of falls and fall injury, and the identification of key risk factors has relevance for early recognition and management of those most susceptible. Assessment of exposure to falls through physical activity frequency may prove valuable in identifying those more likely to fall during the surgical wait.

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