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Original article

Falls in people prior to undergoing total hip or total knee replacement surgery: Frequency and associated factors

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ABSTRACT

Background: Total hip/total knee replacement (THR/TKR) surgery is becoming an increasingly common approach for the management of primarily lower limb osteoarthritis. A number of factors such as reducing mobility, structural joint changes, and pain may predispose those awaiting hip and knee surgery to falls, which may impact on pre- and postsurgery functions. The aim of this study was to identify the prevalence of falls in the year preceding THR/TKR surgery, and factors associated with falls.
Methods: Cross-sectional survey of patients scheduled for THR/TKR, including measures of joint disease severity, falls, falls efficacy, quality of life, pain, and depression. Comparisons across falls status (nonfaller, single faller, or multiple faller) and high/low disease severity for both THR and TKR groups were undertaken.
Results: A total of 282 people (mean age 67.3 years) completed surveys before the surgery (197 TKR). As much as 41% reported one or more falls in the preceding year, and participants reported that the affected joint contributed to the fall in 35% of the cases. TKR multiple fallers ($\geq$ 2 falls) had significantly lower falls efficacy, worse function, greater pain catastrophizing and depression, and poorer 36-Item Short Form Survey Mental Component Scores than nonmultiple fallers. For both THR and TKR groups, several measures were significantly worse for those with greater disease severity, including falls efficacy, depression, pain catastrophizing, self-rated health, and physical activity.
Conclusion: Falls are common in the 12 months preceding total hip or knee surgery. A number of factors are associated with risk of multiple falls and with joint disease severity. Strategies to reduce falls risk should be a priority in the year preceding lower limb joint surgery to optimize presurgery and postsurgery outcomes.

1. Introduction

Osteoarthritis of the hip and knee is a disabling condition that can cause severe pain and physical morbidity,[1] and is increasingly

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common in aging populations. Joint replacement surgery is often recommended for arthritis of the knee or hip, with over 86,000 hip and knee replacement procedures performed in Australia annually.[2] Patients may suffer increasing pain, functional limitation, and deterioration of quality of life for a number of years before undergoing surgery, with significant worsening for those who are on a waiting list for surgery.[3]

Physiological factors such as muscle weakness and impaired postural control and balance are strongly associated with risk of falls in older people[4–6] and these may be impaired further with lower limb osteoarthritis. Lower limb pain is also an important factor, often associated with osteoarthritis, contributing to increased risk of falls.[7,8] Falls can cause reduced independence and function, reduced mobility, loss of confidence in mobility, and reduced quality of life. For people with advanced lower limb arthritis, including those on waiting lists for joint replacement surgery, a fall may further exacerbate mobility impairment and dependence, and possibly necessitate a delay in planned surgery, and in some cases may negatively impact on subsequent outcomes postsurgery.

Despite extensive research investigating falls prevention for older people generally,[9] there has been little change over the past 15 years in countries like Australia on key national indicators such as rate of hospitalizations due to falls.[10] A Center for Disease Control report identified several key priorities for future research in order to improve falls prevention outcomes, including considering the unique characteristics and needs of important high falls risk subpopulations[11] rather than assuming generic approaches to falls prevention would be suitable across the heterogeneous population of older people. People with lower limb arthritis, including those with severe joint disease on waiting lists for surgery, may be an important subpopulation to investigate falls risk in greater detail, and several recent reviews have highlighted the importance of future research into understanding falls and fall risk factors in individuals with lower limb osteoarthritis.[12–14] However, few studies have explored falls in older people with lower limb arthritis.[15–19] Several of the studies conducted had samples with mixed arthritis diagnosis, and did not focus on those with more severe arthritis on surgical waiting lists.[15,18] Three studies have explored falls in the pre- or postjoint replacement surgery period,[16,17,19] but have been small ($n = 35$, 35, and 99, respectively), and all focused only on knee replacement surgery. Studies have generally been too small to investigate multivariate analyses of factors associated with falls, and none has investigated falls in the presurgical period for hip replacement surgery patients.

The aims of this study were to (1) identify the proportion of people waiting for total hip replacement (THR) or total knee replacement (TKR) surgery who fell in the 12 months preceding surgery, and the common circumstances of these falls; (2) determine factors associated with fall status (nonfaller, single faller, or multiple faller) in people waiting for THR/TKR surgery, and (3) determine factors (including falls) associated with disease severity.

2. Methods

Participants

This cross-sectional study obtained comprehensive survey data from people booked for hip or knee replacement surgery through three participating orthopedic surgeons' consulting rooms in Melbourne, Australia. The study was as inclusive as possible, and so all patients booked by the participating surgeons for hip or knee replacement surgery were approached for inclusion, except those aged under 30 years and those with limited ability to read and speak basic English.

Patients satisfying inclusion criteria were sent an information package by postal mail. This included the participant information and consent documentation and a prepaid reply envelope. Those consenting to the study returned the consent documentation to the researchers. A survey booklet containing the questionnaires was then sent to the consenting study participants. They were asked to complete the survey booklet 2–4 weeks prior to the surgery, and return it to the research team. If a survey was not received within 2–3 weeks preoperatively, a follow-up letter was sent. If the survey was still not received preoperatively, a follow-up phone call was placed to determine the participant's willingness to remain involved.

Questionnaires

A set of surveys was mailed to each participant. It was anticipated that survey completion would take between 45 minutes and 60 minutes. The survey kit included the following questionnaires/indexes:

(1) A questionnaire asking demographic information including age, sex, current and past health problems, and medications.
(2) Western Ontario and McMaster University Osteoarthritis (WOMAC) Index, which is used for assessing physical function, pain, and stiffness.[20,21] The WOMAC is a widely reported self-completed disease-specific measure of patients with osteoarthritis of the hip and knee. This index assesses severity of knee or hip pain during five daily activities (range, 0–500), stiffness (range, 0–200), and severity of impairment of lower-extremity function during 17 activities (range, 0–1700). The items were scored with the use of a 100-mm visual analog scale, where 0 represents no pain or difficulty with physical function and higher scores represent worse functional health. All three subcategories were summed to give a global WOMAC score (range, 0–2400).
(3) The 36-Item Short Form Survey (SF-36), version 2, which was used to assess self-perceived quality of life.[22] The SF-36 contains 36 items, comprising eight subscales: four subscales evaluating physical health dimensions [physical functioning (PF), role limitations due to physical problems (RP), bodily pain (BP), and general health (GH)] and the other four subscales evaluating mental health dimensions [vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH)]. Each scale is attributed a score from 0 to 100. The eight subscales are combined into two summary scores—physical health [Physical Component Score (PCS)] and mental health [Mental Component Score (MCS)].[22,23] The raw data were analyzed using the SF-36v2 software (QualityMetric, George Washington Highway, Lincoln, RI, USA) where a normalized *T* score for each dimension and the overall scores of the physical (PCS) and mental (MCS) components were generated.
(4) The Incidental and Planned Exercise Questionnaire (IPEQ) for older people, which was used to assess the physical activity level of the participants.[24] The IPEQ includes 10 questions that estimate physical activity level during the past week and covers the frequency and duration of planned activity (planned exercise and walks) and incidental activities (casual day-to-day activities). The score was derived by multiplying frequency score and duration score to create a total duration for incidental and planned activities as well as an overall total score. The total time spent was summed across all components and expressed as hours/week (see Delbaere and colleagues).[24]
(5) The Pain Catastrophizing Scale, which consists of 13 items describing different thoughts and feelings that individuals

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may experience when they are in pain.[25] The Pain Catastrophizing Scale gives a total score and subscale scores for rumination, magnification, and helplessness. Scores range from 0 to 52, with higher scores indicating greater catastrophizing thoughts.

(6) The Tampa Scale for Kinesiophobia, which is a 17-item questionnaire used to assess pain-related fear of movement.[26] Scores range from 17 to 68, with higher scores indicating greater fear of pain due to movement and activity.

(7) The Cardiac Depression Scale (CDS), which was used to assess level of depression. It contains 26 items, each rated on a Likert scale from 1 to 7, with four items being reverse scored, and a higher score indicating more severe depressed mood.[27] The CDS was originally developed for use in cardiac patients; however, it assesses generic rather than disease-specific aspects of depression, and has been used in other clinical groups (e.g., patients with chronic fatigue syndrome).[28]

(8) Details of falls in the preceding 12 months were sought (retrospective recall), using a questionnaire used in previous studies.[29] The questionnaire collected the following information for each fall reported: time of fall, location, circumstances of the fall, obstacles involved in the fall, glasses worn at the time of the fall, injuries, and whether medical attention was sought. An extra question was added for the purpose of this study: "Was the fall related to the painful joint?".

(9) The Falls Efficacy Scale: International (Short Form) (Short FES-I), which was used to measure falls efficacy (confidence in performing specific activities without falling).[30] The FES-I consists of seven items rated using a Likert scale. The total score ranges from 7 (no concern) to 28 (severe concern).

(10) Activities-Specific Balance Confidence (ABC) Scale,[31] a 16-item self-report measure in which participants rate their balance confidence in performing activities. The items were rated on a scale that ranges from 0 to 100 where a score of zero represents no confidence, and a score of 100 represents complete confidence. The overall score was calculated by adding item scores and then dividing by the total number of items.

Ethics approval was received from the LaTrobe University Faculty of Health Sciences Human Research Ethics Committee (Melbourne, Australia).

Statistical analysis

Analyses were conducted with SPSS version 22 (IBM, Armonk, NY, USA). Descriptive analyses were conducted for all survey responses. Quantitative measures were investigated for distribution, with parametric measures reported for normally distributed data, and nonparametric measures for non-normally distributed data. Analyses were performed for the TKR participants and the THR patients separately.

Participants were grouped according to their falls status [non-faller, single faller, or multiple faller (≥ 2 falls)]. One-way analysis of variance was conducted between faller groups for both TKR and THR groups independently on the continuous outcomes measures, with *post hoc* Newman–Keuls tests used to determine the pairs between which the significant difference occurred. Participants within each of the hip and knee surgery groups were further divided into two subgroups based on severity of disease according to the WOMAC total score, with participants having low disease severity (scoring below the median WOMAC total score) compared with those having high disease severity (equal to or greater than the median WOMAC total score) using independent group *t* tests. Pearson correlation analysis was used to identify the level of association between WOMAC pain scores and physical activity (IPEQ), falls efficacy scores (FES-I and ABC scales), and depression (CDS).

3. Results

A total of 643 people listed for surgery received further information about the project from the researchers, among which 309 people consented to being involved in the study (response rate 48%). Of these 309 people, 18 did not return the survey, eight had their surgery cancelled or postponed, and one completed the survey after their surgery by mistake. A total of 282 people completed the survey preoperatively [median of 2.1 weeks (interquartile range = 3)] and were included in this study (mean age 67.3 years, minimum 33 years, maximum 88 years). No data were available from those who received the survey but did not return it.

Of these 282 participants, 197 were undergoing knee replacement surgery (69.9%), whereas the remaining 85 participants were undergoing hip replacement surgery (31.1%). The participant profile is presented in Table 1. Participants had an average age of 67.3 years [standard deviation (SD) 9.1], 55% were female, and were taking on average 2.4 (SD 1.3) medications, with most common medications being antihypertensive medications (53.5%) and anti-inflammatory medications (37.6%). There was a small but significantly greater number of medications being taken by the group undergoing knee replacement surgery, compared with those undergoing hip replacement surgery ($p < 0.005$). There were no other significant differences on these measures between the hip and knee surgery groups.

Self-reported difficulty in performing activities of daily living is also reported in Table 1 (WOMAC activities of daily living section). For participants undergoing knee replacement surgery, activities reported as most difficult were going down stairs (WOMAC score 61.1), and going up stairs (WOMAC score 53.1), whereas for the participants undergoing hip replacement surgery, the most difficult activities were putting on socks or stockings (63.6), getting in/out of a car or on/off a bus (58.5), and bending to the floor to pick something up (56.7). There were significant differences between the surgery groups in self-reported difficulty for the items—patients undergoing TKR reported going down stairs as significantly more difficult than the THR group, whereas the THR group reported significantly more difficulty in bending to pick something off the floor, getting in or out of a car or on or off a bus, going shopping, and putting on socks or stockings.

Forty-one percent of participants reported one or more falls in the past 12 months, but there was no difference in the proportion of fallers between the two surgery groups ($p = 0.231$; Table 1). A higher proportion of participants undergoing knee surgery reported multiple (≥ 2) falls in the preceding 12 months (24.3% vs. 16.5%), although this difference was not significant ($p = 0.160$). Circumstances of all first falls are detailed in Table 2 (i.e., 2nd or subsequent falls in the past 12 months are not reported here). Most falls occurred outdoors [outside at home (33.9%) or outside away from home (36.5%)]; almost half were the result of a trip, with slippery surfaces, steps, and uneven footpaths being the most common obstacles causing falls. Ten percent of fallers usually wore glasses but were not using them at the time of the fall. Thirty-five percent of respondents considered their painful joint (hip or knee) to be related to the fall. Three falls resulted in fractures, and 56% caused mild to moderately severe injuries such as bruising, cuts, grazes, sprains, swelling, or pain. Only 10.8% sought medical attention, most commonly a review by the general practitioner.

Overall, participants reported mild loss of confidence in performing activities without falling [reduced falls efficacy, assessed using the FES-I (mean 11.9), with a score similar to those reporting

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Table 1
Profile of participants according to the proposed surgery type.

	Knee replacement (TKR) patients ($n = 197$)	Hip replacement (THR) patients ($n = 85$)	Total patients ($n = 282$)	p (between TKR & THR)
Age, mean (SD)	67.9 (9.3)	65.7 (8.6)	67.3 (9.1)	0.062
Sex (female), *n* (%)	107 (54.3)	48 (56.5)	155 (55.0)	0.795
Number of prescription medications, mean (SD)	2.5 (1.3)	2.1 (1.3)	2.4 (1.3)	0.015
Commonly used prescription medication types, *n* (%)				
Pain-relieving medications (e.g., paracetamol, panadeine, codeine)	41 (20.8)	13 (15.3)	54 (19.1)	0.325
Antihypertensives	112 (56.9)	39 (45.9)	151 (53.5)	0.093
Cholesterol-lowering medications	68 (34.5)	20 (23.5)	88 (31.2)	0.071
Anti-inflammatory medications (e.g., CELEBREX, Mobic, Voltaren)	75 (38.1)	31 (36.5)	106 (37.6)	0.894
WOMAC difficulty in performing daily activities items (mm), mean (SD) [a]				
Going down stairs	61.1 (22.5)	46.3 (25.5)	56.6 (24.4)	<0.001
Going up stairs	53.1 (23.6)	54.9 (24.8)	53.7 (24.0)	0.583
Standing after sitting	51.6 (24.4)	54.1 (23.6)	52.3 (24.1)	0.433
Standing (in one position)	47.5 (24.8)	44.9 (24.5)	46.7 (24.7)	0.411
Bending to the floor to pick something up	38.1 (26.2)	56.7 (26.0)	43.7 (27.4)	<0.001
Walking on a flat even surface	35.6 (22.1)	40.3 (22.8)	37.0 (22.4)	0.106
Getting in or out of a car, or on or off a bus	48.3 (22.3)	58.5 (23.7)	51.4 (23.2)	0.001
Going shopping	44.1 (25.2)	52.5 (24.3)	46.7 (25.2)	0.011
Putting on your socks or stockings	37.5 (26.6)	63.6 (26.6)	45.3 (29.1)	<0.001
History of falls				
Nonfallers (past 12 mo), *n* (%)	115 (58.4)	51 (60.0)	166 (58.9)	0.231
Single fallers (past 12 mo), *n* (%)	34 (17.3)	20 (23.5)	54 (19.1)	
Multiple fallers (past 12 mo), *n* (%)	48 (24.3)	14 (16.5)	62 (22.0)	

SD = standard deviation; THR = total hip replacement; TKR = total knee replacement; WOMAC = Western Ontario and McMaster University Osteoarthritis Index.
[a] Higher score indicates greater difficulty.

Table 2
Circumstances of falls in the preceding 12 months reported by participants (only first fall reported in case of multiple falls).

Circumstances of fall	*N* (%)
Time of fall	
Midnight to 11.59 AM	47 (40.9)
Noon to 5.59 PM	44 (38.3)
6.00 PM to 11.59 PM	11 (9.6)
Not recorded/unsure	13 (11.2)
Where the fall occurred	
Home inside	26 (22.6)
Home outside	39 (33.9)
Not at home inside	8 (7.0)
Not at home outside	42 (36.5)
Was the fall circumstance related to the painful knee or hip?	
Yes	40 (35.1)
How did the fall occur?	
Trip	57 (49.6)
Slip	27 (23.5)
Legs gave way	18 (15.7)
Dizziness	1 (0.8)
Other	12 (10.4)
Were any specific obstacles involved?	
Nil	17 (14.8)
Step	16 (13.9)
Curb	3 (2.6)
Uneven footpath	15 (13.0)
Slippery surface	19 (16.5)
Slippery object	4 (3.5)
Indoor obstacle (e.g., cord, loose mat)	11 (9.6)
Other	30 (26.1)
Using any glasses/spectacles at the time of the fall	
No, do not usually use any	53 (45.7)
Usually use, but not worn at the time of the fall	11 (9.5)
Reading glasses worn at the time of the fall	2 (1.7)
Normal distance glasses worn at the time of the fall	11 (9.5)
Bifocals worn at the time of the fall	13 (11.2)
Trifocals/multifocals worn at the time of the fall	26 (22.4)
Medical attention sought	
None	99 (89.2)
Local general practitioner	7 (6.3)
Emergency department	1 (0.9)
Hospitalization	4 (3.6)

"a little" fear of falling in a validation study of this scale[30] and the ABC Scale (mean 69.3)], although 45 participants (16.0%) rated at least one of the seven items of the FES-I as "very concerned". For participants undergoing knee replacement surgery, there was a small but significant increase in FES-I for multiple fallers compared with the single and nonfallers ($p = 0.005$); however, this difference was not evident for those participants undergoing hip surgery (Table 3). A similar pattern was evident in the ABC Scale, although the difference in the participants undergoing knee surgery did not reach statistical significance ($p = 0.051$). There were no significant differences in the ABC Scale between nonfallers, single fallers, and multiple fallers undergoing hip replacement surgery (Table 3).

Falls status (being a nonfaller, single faller, or multiple faller in the preceding 12 months) was also significantly different for a number of other measures for the group undergoing knee surgery, including WOMAC function, the Pain Catastrophizing Scale, the CDS, and the SF-36 MCS, with worse scores in the multiple faller group (Table 3; $p < 0.05$). There were no significant differences in the hip surgery group between nonfallers, single fallers, and multiple fallers on these measures.

The effect of disease severity on the questionnaire measures was compared for the two surgery groups, by comparing those with low severity (below the median total WOMAC score) or high severity (equal to or greater than the average WOMAC score; Table 4). For both hip and knee surgery groups, patients with greater disease severity had a small but nonsignificant increase in the proportion reporting one or more falls in the past 12 months. In addition, patients undergoing knee replacement surgery with higher than the median WOMAC total score rated themselves significantly worse on both the PCS and MCS of the SF-36, the Pain Catastrophizing Scale, falls efficacy (FES-I and ABC Scale), CDS, and the planned activity component of the IPEQ than those with lower than median WOMAC total scores. The Pain Catastrophizing Scale, the PCS of the SF-36, Tampa Scale for Kinesiophobia, falls efficacy (FES-I and the ABC Scale), the CDS, and the planned and total activity scores of the IPEQ were significantly worse in the high WOMAC score group in the hip surgery group ($p < 0.05$). For the overall sample, there were significant negative correlations between

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Table 3
Comparison of measures between nonfallers, single fallers, and multiple fallers for patients on wait-list for knee replacement surgery or hip replacement surgery.

	Knee replacement patients ($n = 197$)				Hip replacement patients ($n = 85$)			
	No falls, mean (SD)	Single fall, mean (SD)	Multiple fall, mean (SD)	p	No falls, mean (SD)	Single fall, mean (SD)	Multiple fall, mean (SD)	p
WOMAC pain	398.0 (398.5)	424.6 (440.2)	463.2 (457.9)	0.664	657.9 (588.3)	765.5 (583.2)	625.4 (648.7)	0.743
WOMAC stiffness	94.1 (49.3)	100.8 (46.2)	104.6 (41.0)	0.396	108.1 (43.4)	98.6 (57.2)	117.1 (48.8)	0.532
WOMAC function	671.7 (280.0)	676.7 (317.1)	807.4 (282.0)	0.020 *	797.2 (340.4)	937.2 (337.2)	943.4 (219.5)	0.144
WOMAC total	1163.8 (595.2)	1202.1 (651.8)	1375.2 (617.5)	0.131	1563.2 (838.9)	1801.3 (782.6)	1685.8 (824.9)	0.537
Pain Catastrophizing Scale	11.1 (9.5)	8.5 (7.0)	14.4 (11.5)	0.021 **	11.8 (9.2)	13.9 (12.5)	12.6 (9.4)	0.739
SF-36 Physical Component Score	36.7 (7.5)	38.8 (7.9)	35.3 (8.4)	0.150	34.1 (8.7)	31.9 (7.5)	30.1 (4.8)	0.195
SF-36 Mental Component Score	54.9 (9.7)	55.9 (8.5)	50.6 13.1)	0.030 *	52.9 (11.0)	53.8 (11.4)	53.5 (8.9)	0.950
Tampa Scale for Kinesiophobia	33.5 (11.3)	32.7 (9.2)	32.7 (12.7)	0.863	29.2 (14.3)	25.3 (16.7)	31.4 (12.6)	0.451
Falls Efficacy Scale: International (7 items)	11.4 (3.8)	10.8 (2.8)	13.5 (5.6)	0.005 *	11.3 (4.3)	13.2 (5.2)	13.6 (4.0)	0.121
Activities-Specific Balance Confidence Scale	71.2 (22.1)	74.8 (20.1)	63.8 (20.6)	0.051	70.8 (23.5)	65.9 (22.8)	59.8 (23.6)	0.272
Cardiac Depression Scale	68.2 (21.2)	68.1 (17.0)	79.5 (23.9)	0.007 *	76.9 (24.1)	82.1 (25.1)	82.3 (18.5)	0.599
IPEQ incidental activity	21.2 (16.2)	22.6 (13.9)	21.1 (17.4)	0.897	17.7 (13.3)	14.0 (11.0)	15.8 (13.1)	0.547
IPEQ planned activity	3.7 (5.2)	5.8 (10.3)	2.8 (4.9)	0.093	2.6 (3.4)	1.7 (3.0)	3.0 (5.6)	0.540
IPEQ total activity	24.9 (18.0)	28.4 (16.0)	23.9 (18.5)	0.500	20.2 (13.8)	15.7 (11.6)	18.8 (14.5)	0.440

The WOMAC measures severity of knee or hip pain during five daily activities (range, 0–500), stiffness (range, 0–200), and severity of impairment of lower-extremity function during 17 activities (0–1700). Items are scored using a 100-mm visual analog scale, where 0 represents no pain or difficulty with physical function and higher scores represent worse functional health. All three subcategories are summed to give a global WOMAC score (range, 0–2400).
* One-way analysis of variance *post hoc* analysis (Student–Newman–Keuls): significant difference between multiple faller and the other groups.
** One-way analysis of variance *post hoc* analysis (Student–Newman–Keuls): significant difference between all three groups.
IPEQ = Incidental and Planned Exercise Questionnaire; SD = standard deviation; SF-36 = 36-Item Short Form Survey; WOMAC = Western Ontario and McMaster Osteoarthritis Index.

Table 4
Comparison of measures between participants with low or high disease severity (total WOMAC for each group dichotomized at the median) for patients on wait-list for knee replacement surgery or hip replacement surgery.

	Knee replacement patients ($n = 197$)			Hip replacement patients ($n = 85$)		
	Low WOMAC (<1105)	High WOMAC (≥1105)	p	Low WOMAC (<1370)	High WOMAC (≥1370)	p
Fallers (%)	38.1	46.8	0.241	38.1	41.9	0.826
Pain Catastrophizing Scale	8.8 (8.1)	15.5 (10.8)	<0.001	9.7 (8.5)	15.1 (10.7)	0.011
SF-36 Physical Component Score	38.5 (7.3)	34.0 (7.9)	<0.001	35.7 (7.1)	30.3 (8.0)	0.001
SF-36 Mental Component Score	56.6 (8.9)	50.1 (11.6)	<0.001	54.2 (9.8)	52.3 (11.5)	0.399
Tampa Scale for Kinesiophobia	34.3 (9.3)	31.5 (13.6)	0.098	32.3 (11.9)	25.1 (16.2)	0.022
Falls Efficacy Scale: International (7 items)	10.6 (3.5)	13.7 (4.6)	<0.001	10.7 (3.1)	13.6 (5.3)	0.002
Activities-Specific Balance Confidence Scale	75.3 (19.8)	62.1 (21.9)	<0.001	74.6 (61.3)	61.3 (24.2)	0.008
Cardiac Depression Scale	67.0 (21.3)	76.7 (21.2)	0.002	73.6 (24.5)	84.2 (21.2)	0.037
IPEQ incidental activity	21.9 (16.3)	20.5 (15.7)	0.529	18.7 (13.5)	14.4 (11.7)	0.119
IPEQ planned activity	4.9 (7.5)	2.3 (3.5)	0.004	3.6 (4.5)	1.3 (2.4)	0.005
IPEQ total activity	26.9 (18.5)	22.8 (16.4)	0.111	22.2 (13.8)	15.7 (12.3)	0.024

Data are presented as mean (standard deviation) unless otherwise indicated.
IPEQ = Incidental and Planned Exercise Questionnaire; SF-36 = 36-Item Short Form Survey; WOMAC = Western Ontario and McMaster Osteoarthritis Index.

WOMAC pain score and (1) the total physical activity (IPEQ) score ($r = -0.22$, $p < 0.001$), (2) falls efficacy (ABC) score ($r = -0.168$, $p = 0.005$), and significant positive correlations with the falls efficacy (FES-I) score ($r = 0.209$, $p < 0.001$) and depression (CDS) score ($r = 0.166$, $p < 0.005$).

4. Discussion

Osteoarthritis of the knee and hip is a common health problem for older people, with increasing numbers seeking surgical intervention to manage their condition.[32] Although factors associated with falls in people with knee and hip arthritis have been previously identified,[13] only a few studies with small sample sizes have investigated these factors in the immediate preoperative (joint replacement) period,[13,16,17,19] and none has explored these issues in those undergoing hip replacement surgery. In this study, we found that 41% of people with knee and hip arthritis booked for joint replacement surgery reported falling at least once in the preceding year. This is higher than the proportion of fallers (~30%) among older people living in the community, and consistent with a small number of other studies that have reported up to 60% of people with lower limb arthritis reporting a fall in a 12-month period.[15,33–35] Despite the relatively high rate of falls, no difference was found in the proportion of fallers among those awaiting hip or knee replacement surgery in this study. Similar to other studies,[36] few of our study participants sought health professional attention after their fall. This is of concern, as without seeking a review following a fall, which is recommended by international guidelines,[37] it will not be possible to address potentially modifiable factors contributing to the fall, and the risk of future falls is increased.

Falls status (having multiple falls in the preceding 12 months compared with none or 1 fall) was significantly associated with poorer function, greater levels of pain catastrophizing and depression, lower falls efficacy, and poorer scores on the MCS (indicative of poorer mental health) for participants awaiting knee surgery. There were no significant differences on these or other measures for the group awaiting hip surgery. The smaller sample size for the group awaiting hip surgery may have contributed to the

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lack of significant differences between faller status groups, although the results may possibly alternatively indicate a lower impact of falls risk on these measures related to a differential impact of the severe knee joint pathology relative to severe hip joint pathology. A study on a larger sample of patients awaiting hip surgery would clarify this issue. Some of the factors shown to be significantly different between faller statuses for the knee surgery group have been shown to impact on the likely success of the planned joint replacement surgery.[19,38] Approaches to minimize risk of falls for people in milder stages of arthritis through to those approaching the stage of having surgery may help reduce the development and impact of these poor health outcomes, which may in turn result in better postoperative outcomes for these patients. Falls prevention strategies including exercise that involves a moderate challenge to balance, medication review, cataract surgery, podiatric interventions (foot exercise, safe footwear), and home modifications are among approaches to falls prevention that have been shown to be effective for older people living in the community.[9] However, further research is required to determine whether these approaches (e.g., exercise with a moderate challenge to balance) are feasible in people with more advanced lower limb arthritis, and whether they can reduce the risk of falls before surgery, reduce development of complicating factors, and potentially improve long-term outcomes with or without joint replacement surgery for people with lower limb osteoarthritis.

Pain is an important factor for people with arthritis, and has been shown to be associated with increased risk of falls in previous studies.[39,40] Correlation results in our study demonstrated that increased pain was significantly associated with poorer falls efficacy and increased depression. Other studies have also reported that the presence of pain is also associated with higher falls efficacy scores (lower confidence in performing activities without falling).[41] However, the direct mechanism by which these relationships exist are not fully understood.[42] It is possible that the perception of pain and the fear of movement due to pain interfere with older adult's cognition, which might possibly contribute to their concerns of having a fall. However, due to the cross-sectional nature of our study we are unable to determine causality, and further research is needed to establish the nature and magnitude of this relationship.

Almost all measures used in this study (depression, falls efficacy, pain catastrophizing, the physical component of the SF-36 quality of life measure, and physical activity) were significantly worse for both hip and knee patient groups undergoing joint replacement surgery with greater levels of disease severity. These results support previous research where older adults with chronic pain appear to be less active,[43] and our results also showed a significant negative correlation between WOMAC pain and total physical activity. The greater the level of pain and associated physical activity curtailment prior to joint surgery, the greater the level of impairments associated with low physical activity (e.g., reduced function and mobility) that are likely to have developed, which in turn will require greater levels of rehabilitation after surgery. There may be merit in considering joint replacement surgery earlier in the disease process prior to development of secondary problems such as pain catastrophizing and activity curtailment, to possibly improve the longer term surgical outcome.

Although this study provides useful information to better understand falls in people prior to undergoing joint replacement surgery, several limitations need to be acknowledged. First, the study results may not be fully generalizable given that only half of the patients on surgery lists agreed to participate in the study, and this may also have reduced the power of some of the analyses. In addition, our study used retrospective recall of falls, which has been shown to underestimate the actual number of falls relative to prospective documentation of falls.[44] Despite these limitations, our study provides new evidence about the risk of falls, and factors associated with falls for people on waiting lists for hip and knee joint replacement surgery. Based on these results, strategies to reduce the risk of falling and improve patient's symptoms for those with severe lower limb joint arthritis being considered for surgery warrant investigation in a randomized controlled trial, and may be considered to form part of the preoperative care management for people on knee and hip joint replacement surgery lists.

Conclusion

People on waiting lists to undergo hip or knee replacement surgery have high fall rates in the 12 months prior to surgery. Multiple falls in this period are associated with greater disease severity, worse function, reduced falls efficacy, and increased depression. Falls prevention management should be considered as part of preoperative care to reduce fall-related complications and development of factors that may adversely influence outcomes postsurgery.

Conflicts of interest

None of the authors have conflicts of interest to declare related to this manuscript. There is no financial support or other benefits from commercial sources received for the work reported on in the manuscript, or any other financial interests that any of the authors may have, which could create a potential conflict of interest or the appearance of a conflict of interest with regard to the work.

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