Risk Factors for Falls in People with Knee Osteoarthritis: Systematic Review

Praewpun Saelee[1]
Plaiwan Suttanon[1*]
[1] Department of Physical Therapy, Faculty of Allied Health Sciences, Thammasat University, Thailand.
* Corresponding author, e-mail address: plaiwan.s@allied.tu.ac.th
Vajira Med J. 2018; 62(4): 281-88
http://dx.doi.org/10.14456/vmj.2018.34

Abstract

Falls among people with knee osteoarthritis (OA) can lead to hospitalization and reduced functional capacities. Understanding of risk factors for falls in the population could lead to an effective falls prevention intervention program, particularly in people with knee OA. This systematic review intended to review the factors associating with falls in people with knee OA. Searches were performed through the following electronic databases: CINAHL, MEDLINE, Web of Science, PubMed and the Cochrane Library. The electronic databases were searched, up until October 2017. The literature search reached 564 articles and four articles were finally selected according to the review's inclusion criteria. The four articles included three prospective cohort studies and one cross-sectional study. Knee extension muscle strength (Crude OR = 0.3, 95% confidence interval [CI] 0.1-0.8), knee flexion muscle strength (Crude OR = 0.2, 95% confidence interval [CI] 0.0–1.0), knee pain (HR = 1.51, 95% confidence interval [CI] 1.32–1.72), use of bisphosphonates (OR = 1.32, 95% confidence interval [CI] 1.07–1.63) and falls in past 12 months (OR = 1.54, 95% confidence interval [CI] 1.35–1.77) were factors that most consistently associated with falls in people with knee OA.

Keywords: Falls, Risk factors, Knee Osteoarthritis

ปัจจัยเสี่ยงการล้มในผู้ที่มีภาวะข้อเข่าเสื่อม: การทบทวนวรรณกรรมอย่างเป็นระบบ

แพรวพรรณ แซ่ลี้ วท.บ. (กายภาพบำบัด)[1]

ไพลวรรณ สัทธานนท์ วท.บ. (กายภาพบำบัด), วท.ม. (กายภาพบำบัด), ปร.ด. (กายภาพบำบัด)[1]*

[1] ภาควิชากายภาพบำบัด คณะสหเวชศาสตร์ มหาวิทยาลัยธรรมศาสตร์

* ผู้ติดต่อ, อีเมล: plaiwan.s@allied.tu.ac.th

Vajira Med J. 2018; 62(4): 281-88

http://dx.doi.org/10.14456/vmj.2018.34

บทคัดย่อ

การล้มในผู้ที่มีภาวะข้อเข่าเสื่อมจะนำไปสู่การเข้ารับการรักษาตัวในโรงพยาบาล การทำกิจกรรมที่ลดลง การทำความเข้าใจเกี่ยวกับปัจจัยเหล่านี้สามารถนำไปสู่การป้องกันการล้มที่เหมาะสม การทบทวนงานวิจัยอย่างเป็นระบบครั้งนี้ มีวัตถุประสงค์เพื่อทบทวนองค์ความรู้เกี่ยวกับปัจจัยที่สัมพันธ์กับการล้มในผู้ที่มีภาวะข้อเข่าเสื่อม การทบทวนวรรณกรรมอย่างเป็นระบบได้ทำการสืบค้นงานวิจัยจากฐานข้อมูลอิเล็คทรอนิคส์ต่อไปนี้ CINAHL, MEDLINE, Web of Science, PubMed และ The Cochrane Library โดยได้ทำการสืบค้นงานวิจัยผ่าน 4 ฐานข้อมูลอิเล็คทรอนิคส์จนถึงเดือนตุลาคม พ.ศ 2560 จากการทบทวนวรรณกรรมอย่างเป็นระบบสามารถสืบค้นงานวิจัยได้ทั้งหมด 564 การศึกษาและมี 4 การศึกษาที่ผ่านเกณฑ์การคัดเลือก โดยมีสามการศึกษาที่เป็นการศึกษาแบบการวิจัยเชิงวิเคราะห์แบบไปข้างหน้า (Prospective cohort studies) และมีหนึ่งการศึกษาที่เป็นการศึกษาแบบการศึกษาแบบตัดขวาง (Cross-sectional study) ผลการศึกษาพบว่า ความแข็งแรงของกล้ามเนื้อเหยียดเข่า (Crude OR = 0.3, 95% confidence interval (CI) 0.1-0.8) ความแข็งแรงของกล้ามเนื้องอเข่า (Crude OR = 0.2, 95% CI 0.0–1.0) อาการปวดเข่า (HR = 1.51, 95% CI 1.32–1.72) การใช้ยา bisphosphonates (OR = 1.32, 95% CI 1.07–1.63) และประวัติการล้มในช่วงหนึ่งปีที่ผ่านมา (OR = 1.54, 95% CI 1.35–1.77) เป็นปัจจัยที่สัมพันธ์กับการล้มในผู้ที่มีภาวะข้อเข่าเสื่อมอย่างมีนัยสำคัญ

Introduction

Falls are one of the leading causes of serious injury and hospital admissions in older people[1]. Falls have been reported as one of the major public health issues. Falls can occur from a variety of circumstances and multiple contributing factors. Chances of falls appears to rise with the number of risk factors a person has[2]. Arthritis has been reported for over 25 years as one of the factors that raise the probability of a fall[3], and the most prevalent form of arthritis is osteoarthritis (OA)[4].

Osteoarthritis is one of the most common degenerative joint diseases, affecting 37.4 million Americans[5]. Knee osteoarthritis is a chronic condition of the knee joint that can be influenced by mechanical or biomechanical factors[6]. Progression of osteoarthritis is usually slow but can impact quality of life and physical function. The main symptoms of osteoarthritis are stiffness, pain, limited range of motion and reduced balance[7]. Most people with knee OA have a 30% greater chance of falling compared with people who do not have knee OA[8]. Unfortunately, the underlying mechanisms of the increased risk of falls reported in this population are still not known.

Therefore, it would be important to identify factors that most influence risk of falls in people with knee OA. Improved understanding of risk factors for falls could be an essential part of developing strategies to prevent falls particularly, for individuals with knee OA. This systematic review aimed to review risk factors associated with falls in people with knee osteoarthritis.

Methods

The inclusion criteria for this systematic review were: 1) participants were diagnosed with knee OA, and 2) included falls or fall risk as variable(s). Five electronic databases (CINAHL, MEDLINE, PubMed, Web of Science and Cochrane library) were searched up until October 2017.

The combination of three search terms were combined using AND. The first term using the following Medical Subject Heading (MeSH): accidental falls or fall* or trip* or slip*. The second term using the following Medical Subject Heading (MeSH): osteoarthr* or degenera* or arthr*. The third term using the following Medical Subject Heading (MeSH): risk* or screen* or probabilit* or history* or predict*. All search terms were combined in title/abstract. Databases searched for full text available in English and with case-controlled, prospective cohort and cross-sectional studies have been included. Opinion papers, literature reviews, editorials and case reports were not included in the review. Two review authors independently screened the titles and abstracts to determine if the articles matched the criteria. Articles that met the eligibility criteria were retrieved and screened. Disagreements among reviewers about the results were resolved by discussion and consensus. Data were extracted from the included articles. The extracted data were composed of author name, year of publication, the number of patients, participant characteristics (mean age and gender), study design and falls risk factors. For each factor, the odds ratio (OR) or risk ratio (RR) and 95% confidence interval (CI) were extracted.

Results

This review aimed to identify the risk factors for falls in people with knee osteoarthritis. The literature search initially reached 564 articles. After screening title and abstract, 121 articles were retrieved. Of these, 117 articles were excluded as they did not meet all the inclusion criteria. The flowchart of the review process is given in Figure 1.

Of the four articles included in this review, the sample size varied widely (range 68–1350), and they were published between 2006 and 2016. For all studies the mean age of participants was between 61.5 and 73 years. The prevalence of females with knee osteoarthritis in all studies was >63%. As for the study design, four articles included three prospective cohort studies[9-11] and one cross-sectional study[12].

Four articles identified factors associated with falls in people with knee osteoarthritis. From the four included articles, 27 fall risk factors were identified. Multivariate logistic regression was used to identify potential factors associated with falls in the prospective cohort studies[9-11] and cross-sectional study[12]. The OR in one study was not extracted, therefore, a crude OR was computed[12]. The risk factors for falls are summarized in Table 2.

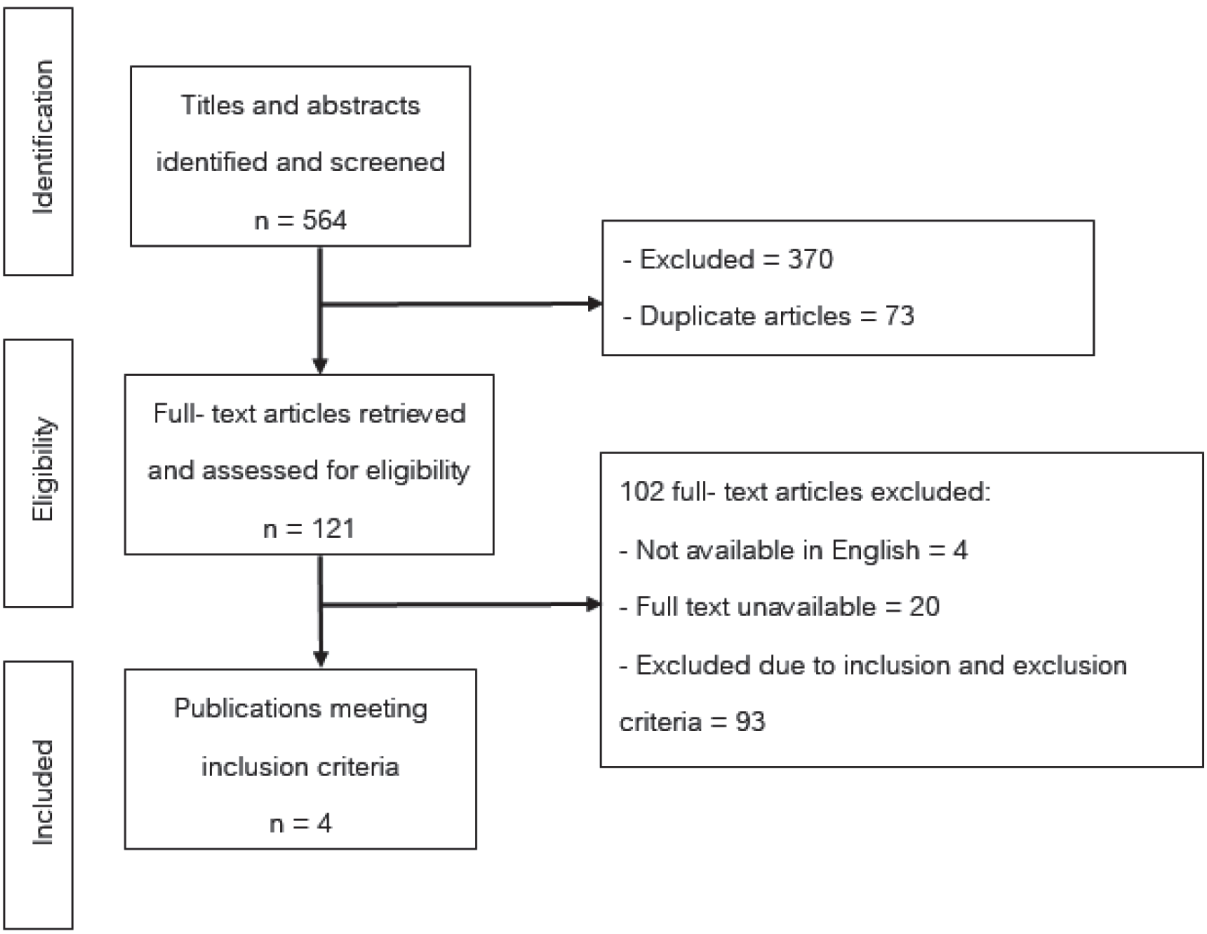

Figure 1: Flowchart of the review process

Table 1:

Characteristics of articles included in the review of falls risk factors in people with knee osteoarthritis

Author	Year	Participants description	Age/range [mean (SD)]	Falls incidence results	Potential risk factors	Study Design	Falls Ascertainment
Arden et al.[9]	2006	277 participants with knee OA (70 males : 157 females)	78.7 years	At least 1 fall	Knee pain and walking aid usage	Prospective cohort study	6-month period
De Zwart[12]	2015	301 participants with knee OA (98 males : 203 females)	35 - 82 years (61.5 ± 8.3 years)	31 patients with knee OA with knee instability (10%) reported at least 1 fall incident	Age, gender, body mass index, radiographic OA, knee muscle strength, knee pain, knee proprioception and knee laxity	Cross-sectional study	3-month period
Tsonga et al.[10]	2015	68 participants with severe knee OA (grade 3 and 4) (11 males : 57 females)	Aged 65 years and older (73.0 ± 5.2 years)	63.2% of the sample had at least 1 fall in the past year, and 43 patients had 65 falls	Age, gender, body mass index, social environment, muscle strength, SF-36, WOMAC score, pain elsewhere in the body and turn up and go test	Prospective cohort study	12-month period
Smith et al.[11]	2016	1350 participants with early-diagnosed unilateral knee OA (534 males : 816 females)	(66.5 ± 8.8 years)	People with knee osteoarthritis had a 54% greater chances of falls.	Age, gender, marital status, employment, race, medical history and physical activity	Prospective cohort study	12-month period

Table 2:

Summary of risk factors for falls

Risk factor	References	Associated factor	Statistics	*P* value
Age	De Zwart [12]	No	N/R	0.84
	Tsonga et al. [10]	No	N/R	0.97
	Smith et al. [11]	No	OR: 1.00; 95% CI: 0.99, 1.00	0.97
Gender	De Zwart [12]	No	N/R	0.21
	Tsonga et al. [10]	No	N/R	0.10
	Smith et al. [11]	No	OR: 1.00; 95% CI: 0.86, 1.18	0.91
Body mass index	De Zwart [12]	No	N/R	0.09
	Tsonga et al. [10]	No	N/R	0.78
Marital status	Smith et al. [11]	No	OR: 0.98; 95% CI: 0.92, 1.05	0.62
Employment	Smith et al. [11]	No	OR: 0.95; 95% CI: 0.80, 1.14	0.58
Race	Smith et al. [11]	No	OR: 1.06; 95% CI: 0.89, 1.27	0.51
Social environment	Tsonga et al. [10]	No	N/R	0.47
Previous THA	Smith et al. [11]	Yes	OR: 2.16; 95% CI: 1.03–4.51	0.04
Contralateral TKA	Smith et al. [11]	Yes	OR: 0.39; 95% CI: 0.15–1.01	0.05
Other arthroplasty	Tsonga et al. [10]	No	N/R	0.75
Hip osteoarthritis	Smith et al. [11]	Yes	OR: 1.38; 95% CI: 1.07–1.77	0.01
Falls in past 12 months	Smith et al. [11]	Yes	OR: 1.54; 95% CI: 1.35–1.77	< 0.001
$SF\text{-}36_{PCS}$	Tsonga et al. [10]	No	N/R	0.73
$SF\text{-}36_{MCS}$	Tsonga et al. [10]	No	N/R	0.79
WOMAC pain	Tsonga et al. [10]	No	N/R	0.34
WOMAC stiffness	Tsonga et al. [10]	No	N/R	0.61
WOMAC physical function	Tsonga et al. [10]	No	N/R	0.88
Radiographic OA, KL score ≥ 2				
-Left	De Zwart [12]	No	N/R	0.06
-Right	De Zwart [12]	No	N/R	0.06
Knee extension strength	De Zwart [12]	Yes	Crude OR: 0.3; 95% CI: 0.1-0.8	0.02
Knee flexion strength	De Zwart [12]	Yes	Crude OR: 0.2; 95% CI: 0.0–1.0	0.05
Pain elsewhere in the body	Tsonga et al. [10]	No	N/R	0.79
Knee pain	Arden et al.	Yes	HR: 1.51; 95% CI: 1.32–1.72	N/R
	De Zwart [12]	Yes	N/R	<0.001
Knee proprioception	De Zwart [12]	No	N/R	0.83
Knee laxity	De Zwart [12]	No	N/R	0.21
Walking aid usage	Arden et al. [9]	Yes	HR: 1.34; 95% CI: 1.25–1.44	N/R
Turn up and go test	Tsonga et al. [10]	No	N/R	0.60
Use of bisphosphonates	Smith et al. [11]	Yes	OR: 1.32; 95% CI: 1.07–1.63	0.01

CI: confidence interval, NR: not reported, OA: osteoarthritis, KL: Kellgren and Lawrence, TKA: total knee arthroplasty, THA: total hip arthroplasty, WOMAC: Western Ontario and McMaster Universities Arthritis Index, SF-36: 36-item Short Form Health Survey, MCS: Mental Component Score, PCS: Physical Component Score.

There were no significant differences in age, gender and body mass index between fallers and non-fallers in two articles[10,12]. Similarly, another article[11] also found no significant association between number of falls and age.

There were no associations found between an individual's demographic characteristics (marital status, employment and race) and falls history in the past 12 months[11]. People with knee OA had a greater chance of falls in the first 12 months of their diagnosis compared to those without knee OA. Smith et al.[11] found previous total hip arthroplasty, contralateral total knee arthroplasty, hip OA and the use of bisphosphonates to be significant predictors of falls in the first 12 months post-diagnosis of knee OA. The clinical test (TUG test) and self-report instruments (SF-36 and WOMAC) had no significant effect on falls in a study of people with severe knee OA (grade 3 or 4)[10]. De Zwart et al.[12] reported that fallers had significantly lower extension strength, lower flexion strength and higher pain levels when compared with non-fallers. They also found that knee extension muscle strength and knee flexion muscle strength were significantly associated with falls in people with knee OA. Arden et al.[9] found that 42% of people with knee OA used a walking aid, which was associated with increased falls risk. They also reported that the risk of falling was greater in participants with severe knee pain compared to participants without knee pain.

Discussion

This systematic review intended to review the factors associated with falls in people with knee OA. The review suggested that there is still conflicting evidence as a result of only a small number of factors which have been found to be consistently associated with increased falls risk in people with OA.

Early-diagnosed unilateral knee OA was reported as a fall risk factor in which people with early-diagnosed unilateral knee OA had a greater chance of falls compared with healthy people with similar age and characteristics. Lower knee flexion and knee extension muscle strength were also found to be fall risk factors in people with knee OA[12]. This result corresponds with the fact that declined knee muscle strength is an important risk factor for falls among older people[13], and that muscle weakness is a characteristic in people with knee OA[14]. Additionally, muscle weakness can result in gait pattern changes (reduced toe clearance, increased double support time and reduced gait velocity), since knee extension muscle strength is important for maintenance of balance after external perturbations on walking[15,16].

Bisphosphonate was also identified as a significant predictor of future falls in the first years after diagnosis of knee OA[11]. Bisphosphonate is commonly used for treatment in osteoporosis. Possible adverse effects of Bisphosphonate could be esophageal cancer, severe muscle pain, sub-trochanteric femoral fractures and ocular inflammation[17]. However, this result of Bisphosphonate as a fall risk factor should be interpreted with caution due to the fact that the usage, timing, and type of bisphosphonate in relation to fall events remains unclear.

The limitation of this review is related to the small number of included studies. In addition, the varied sample sizes among the included studies (between n=68[10] and n=1350[11]) may affect the impact of reported fall risk factors. Fall risk factors in people with knee OA is an area that still requires more information and knowledge which is essential in developing prevention and intervention plans specifically for this population.

Conclusion

Fall rates in people with knee OA are higher than those without knee OA. In this review, falls appear to be independent of age, gender and individual demographic characteristics (marital status, employment and race). The identified risk factors for falls were symptoms of OA (knee muscle weakness), a history of previous falls, knee pain and use of bisphosphonates in people with knee OA. As on a small number of factors have consistently been associated with an increased risk for falls in people with OA, it is difficult to draw conclusions.

However, other potential risk factors in people with knee OA have not been fully investigated. Studies on the relationship between OA impairments and falls are needed, as is further research on potentially important neglected risk factors for falls in people with knee OA. Detection of fall risk factors is essential in developing fall prevention intervention specifically for people with knee OA.

Conflicts of interest:

The authors declare no conflict of interest.

References

1. Carey D, Laffoy M. Hospitalisations due to falls in older persons. Ir Med J. 2005;98(6):179-81.
2. Kempton A, van Beurden E, Sladden T, Garner E, Beard J. Older people can stay on their feet: final results of a community-based falls prevention programme. Health Promot Int. 2000;15(1):27-33.
3. Lawlor DA, Patel R, Ebrahim S. Association between falls in elderly women and chronic diseases and drug use: cross sectional study. BMJ. 2003;327(7417):712-7.
4. Nguyen U-SDT, Zhang Y, Zhu Y, Niu J, Zhang B, Aliabadi P, et al. Increasing Prevalence of Knee Pain and Symptomatic Knee Osteoarthritis. Ann Intern Med. 2011;155(11):725-32.
5. Lawrence RC, Felson DT, Helmick CG, Arnold LM, Choi H, Deyo RA, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States: Part II. Arthritis Rheum. 2008;58(1):26-35.
6. Astephen JL, Deluzio KJ, Caldwell GE, Dunbar MJ. Biomechanical changes at the hip, knee, and ankle joints during gait are associated with knee osteoarthritis severity. J Orthop Res. 2008;26(3):332-41.
7. Farrokhi S, Chen YF, Piva SR, Fitzgerald GK, Jeong JH, Kwoh CK. The Influence of Knee Pain Location on Symptoms, Functional Status, and Knee-related Quality of Life in Older Adults With Chronic Knee Pain: Data From the Osteoarthritis Initiative. Clin J Pain. 2016;32(6):463-70.
8. Kelsey JL, Berry SD, Procter-Gray E, Quach L, Nguyen USD, Li W, et al. Indoor and outdoor falls in older adults are different: the maintenance of balance, independent living, intellect, and Zest in the Elderly of Boston Study. J Am Geriatr Soc. 2010;58(11):2135-41.
9. Arden NK, Crozier S, Smith H, Anderson F, Edwards C, Raphael H, et al. Knee pain, knee osteoarthritis, and the risk of fracture. Arthritis Rheum. 2006;55(4):610-5.
10. Tsonga T, Michalopoulou M, Malliou P, Godolias G, Kapetanakis S, Gkasdaris G, et al. Analyzing the History of Falls in Patients with Severe Knee Osteoarthritis. Clin Orthop Surg. 2015;7(4):449-56.
11. Smith TO, Higson E, Pearson M, Mansfield M. Is there an increased risk of falls and fractures in people with early diagnosed hip and knee osteoarthritis? Data from the Osteoarthritis Initiative. Int J Rheum Dis. 2016.
12. de Zwart AH, van der Esch M, Pijnappels MA, Hoozemans MJ, van der Leeden M, Roorda LD, et al. Falls Associated with Muscle Strength in Patients with Knee Osteoarthritis and Self-reported Knee Instability. J Rheumatol. 2015;42(7):1218-23.
13. Rubenstein LZ, Josephson KR. The epidemiology of falls and syncope. Clin Geriatr Med. 2002;18(2):141-58.
14. Hassan B, Mockett S, Doherty M. Static postural sway, proprioception, and maximal voluntary quadriceps contraction in patients with knee osteoarthritis and normal control subjects. Ann Rheum Dis. 2001;60(6):612-8.
15. Pijnappels M, Bobbert MF, van Dieen JH. Push-off reactions in recovery after tripping discriminate young subjects, older non-fallers and older fallers. Gait Posture. 2005;21(4):388-94.
16. Pijnappels M, van der Burg PJ, Reeves ND, van Dieen JH. Identification of elderly fallers by muscle strength measures. Eur J Appl Physiol. 2008;102(5):585-92.
17. Kennel KA, Drake MT. Adverse Effects of Bisphosphonates: Implications for Osteoporosis Management. Mayo Clin Proc. 2009;84(7):632-8.