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Research article

Osteoarthritis Falls, Possible Origins and Implications are Many but Lack Clarity: A 2020-2025 Overview and Commentary

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Abstract

Lower limb osteoarthritis, a strong age-related chronic condition, is often accompanied by an increased tendency to fall and sustain various degrees of injury. The disease alone can in turn induce a high falls risk and cycle of recurrent falls and heightened disability. This report updates what is known about falls in the context of disabling osteoarthritis and where more emphasis could be placed in this regard. Using the PUBMED data base and others, clinical studies published largely between January 1, 2020 and December 31, 2025 concerning possible falls and lower limb osteoarthritis linkages were sought. The search results revealed a growing interest in this topic and that osteoarthritis can lead to the chances of incurring one or more falls and further health and disability challenges, while falling can provoke the onset of osteoarthritis in its own right Although confusing or overwhelming, proprioception issues not well studied to date merit exploration in our view as does Tai Chi an exercise approach that appears to improve proprioception in elderly subjects and others.

Keywords: Falls; fall injuries; osteoarthritis; pain; prevention; proprioception; taichi

Background

Osteoarthritis, a progressively disabling disease commonly affects one or more joints such as the hip and knee joints of older adult population, a group prone to falling [1-4]. At the same time, a wealth of data attests to many possible reasons for this, such as the presence of pain, possible muscle mass losses, ligament instability, obesity and muscle fat mass increases, poor proprioception and balance, diabetes, and cardiovascular diseases, but with no unifying consensus in this regard [5-7]. Adding to the confusion are other related data that reveal a possible role for depression, the lack of adequate sleep, and possible medications that can heighten the risk of an older adult with pr without osteoarthritis for falls [7] along with neurological disease correlates, such as impaired joint sense [8]. In the face of the numbers of aging adults worldwide suffering and expected to suffer from lower limb osteoarthritis by 2050 and knowledge that the presence of joint instability and pain may well increase falls risk in this group, even if these conditions are somewhat remediable [9,10], more urgent attention to averting an immense health burden appears indicated. Moreover, although falls and fractures after total hip replacement surgery alone remain under recognized, their clinical importance in the realm of complications should not be ignored [5]. Acknowledging the importance of averting falls and identifying predictive preoperative factors such as knee extensor strength and gait speed, along with discrepancies between postoperative balance confidence and fall

history may provide a high degree of actionable insights for risk stratification and fall-prevention strategies in clinical practice.

However, whether mitigation should focus on a possible suboptimal relationship between desirable spinal proprioceptive input patterns and alterations in neuromuscular control strategies that potentially impair gait control, or whether obesity or ankle dysfunction induce joint instability that heightens falls risk, along with excess foot and ankle pain, and muscle fat mass encroachment that impairs muscle reactively is not clear. The same applies to the presence of cardiovascular disease, unsafe medication usage, and type of medications that may affect falling uniquely and at varying rates and to varying degrees [7,10,11].

Key Research Themes

In this review we sought to examine:

- If there is currently agreement on osteoarthritis falls risk factors that could be harnessed towards more effective falls prevention and osteoarthritis mitigation efforts.
- Whether the association between falls and osteoarthritis is a uni- or bidirectional one in in selected cases. If so, we sought to ascertain if linkages exist and if any are amenable to prevention or intervention.

Since falls associated with osteoarthritis can magnify or induce a life time of suffering, as well as significant health costs even in the face of surgery [8], we sought to establish if there are specific preventive strategies indicated for community dwellers who wish to age 'in place' or whether some might actively avoid the prevention idea because they perceive this as ageist and/or 'stigmatizing or because they have a fear of falling.

Rationale

Osteoarthritis as well as falls injuries currently pose an enormous challenge to many aging individuals, as well health providers. At the same time even if a key cause is deemed to be injury rather than age, there is a pervasive lack of clarity in our view as to whether falling is a relevant pathogenic factor and whether a fall can initiate a cycle of suffering, as well as the onset or increasing osteoarthritis damage despite a host of possible clinical features that include the following, but where some may be remediable.

a) Pain
b) Joint stiffness
c) Joint movement limitations
d) Muscle weakness
e) Instability
f) Limited walking endurance
g) Slow walking speed
h) Poor dynamic balance control
i) Joint locking
j) Faulty posture and deficient proprioception

Since outcomes for knee osteoarthritis sufferers' alone who incur fall, event is found to be significantly worse over time than those outcomes of cases who do not fall, and surgery to replace a diseased end stage knee joint does not always prevent falls post-surgery, it appears a better understanding of what specific variables might underpin this cycle of unwanted events is highly desirable [12]. Moreover, since falling, as well as excess pain and disability are not only paramount falls indicators, but can- if serious- lead to premature mortality and morbidity-it appears it may be beneficial to examine this topic in detail to ascertain if there is a consistent interactive linkage between the onset and progression of disabling osteoarthritis in the older population and certain variables that can arguably lead to and be exacerbated by falls injuries.

In formulating the present report, we limited this to recent plus new data believed to address the key questions posed in this mini review. To this end, we largely extracted PUBMED electronic data base information using the key terms: "osteoarthritis and falls", "osteoarthritis and falls risk/injury" as listed and catalogued from January 1 2020- December 15 2025. As well, the PubMed Central, and Google Scholar data bases were reviewed. Accepted were articles published in the English language as full reports and pertinent to the current theme, with the exception of falls relative to older adults in general, those with specific health challenges other than osteoarthritis, laboratory studies, and/or studies on total joint replacement surgery, intervention studies and articles that did not discuss osteoarthritis per se, for example those that discussed the perception of possible falls, the fear of falling, or falls self-efficacy, but not osteoarthritis. Data were carefully reviewed by the author- an osteoarthritis expert- for relevance and those articles deemed potentially informative in the author's view were downloaded and analyzed. PUBMED was selected as the key electronic data source of information given its widespread data repository and effective method of organizing recent as well as relevant data.

Results

As of December 18, 2025, a scan of the current data shows osteoarthritis remains a topic of immense interest to researchers and its association with falls studied intermittently since 1987 continues more intently than not. Although limited numerically when compared to other clinical themes, most current studies focusing on osteoarthritis and falls uniformly acknowledge this association is one of high importance to clarify more specifically, as well as one likely amenable to a variety of remediable efforts [13-18]. However, concepts such as 'the fallers concern level', along with their possible deficient walking stability, dynamic balance, and slow walking speed may not be obviated readily without due analyses and planning [13]. Unfortunately, despite years of study, a closer examination reveals most recent as well as past studies remain largely atheoretical and assume certain variables are salient falls mediators without any due validation. Generalizability of the data is also limited because almost all studies that prevail focus on the osteoarthritis knee joint, even though ankle, hip, spine, and

even shoulder osteoarthritis may disturb gait control that leads to a high falls risk. Within the knee osteoarthritis data reports alone, most exhibit diverse conclusions, test differing research questions, and fail to conduct uniform assessment approaches. Moreover, most studies appear to focus on one or more assumed 'physical' falls risk factors, while far fewer place any emphasis on deficits in cognition, psychological status, and factors such as anxiety and a lack of vitality [14]. Rosado et al. [8] point out however, that cases with higher degrees of dysfunction or other related osteoarthritis symptoms, such as a persistent fear of falls, low back pain, diabetes mellitus, and an increased body mass index may be risk. As well, Rosadi et al. [8] did feel their study showed that knee proprioception and joint range of motion are potential noteworthy falls risk factors in the context of knee osteoarthritis as these tentatively serve as protective factors against falls when intact. Other mediating or moderating factors include pain and progressive knee joint damage and increasing instability [19-21].

According to Iijima, et al. [22] who examined cases with sarcopenic knee osteoarthritis, those with both these attributes tended to have 4.17 times higher odds of incurring two or more falls than controls after adjustment for age, sex, and body mass index. Although the increased recurrent falls experience was not clearly confirmed in participants with isolated sarcopenia and knee osteoarthritis, a loss of muscle mass is likely to have an impact on balance and timely reflex response ability, especially if replaced by fat mass. However, results of falls over time may vary depending on what is assessed or not assessed in our view. For example, in their study, van Schoor et al. [23] who observed Individuals with clinical knee osteoarthritis to be at an increased risk for recurrent falls argued this was likely mediated by pain medication, particularly the use of opioids. Other studies show that having a falls risk appears to be more likely in cases experiencing challenges in carrying out dual tasks when walking or trying to balance [24-26], or specific features of any altered gait and gaze behaviors deemed falls determinants [27]. Additional findings [4] imply a further falls role for high levels of back pain, and a reduced walk distance capacity. Others imply falls risk is increased in osteoarthritis older women found to have cognitive symptoms of anxiety and excess stress [28], although others imply muscle weakness and early pathological changes in the neuromuscular system are the most salient risk factors [13].

Others imply older adults with radiographic evidence of osteoarthritis who may tend to have an increased likelihood of experiencing recurrent falls may do so because they have decreased mobility, and use opioids or paracetamol to control pain [23,29-33]. They may also exhibit repeated falls especially if they are experiencing pain [32], plus abnormal gait cycle mechanics and proprioception [13,15,34], depression and/or exhibit a fear of falling [31,35,36] and the presence of concurrent back and hip pain [37]. Moreover, the combined role of physical as well as psychological correlates may be implicated [7,19]. In addition, impaired balance, muscle weakness, the presence of one or more comorbidities, and increasing number of symptomatic joints are potential falls risk factors [18] associated with osteoarthritis [37,38]. As well, disease severity or grade of disease is another possibly highly salient falls predictor in addition to stability and balance dysfunction and level of pain [39]. It is also increasingly apparent personal factors are likely to impact falls risk as may environmentally factors, but these are often not studied in this regard in tandem [39]. Another view is that compared with older disease-free adults, those with osteoarthritis may exhibit a significantly reduced step length, as well as gait speed, and subnormal vertical ground reaction forces in both normal walking as well as in the first recovery step following a backward slip perturbation. As well, their inadequate joint flexion and extension angles and generation of joint moments could predispose the older adult with osteoarthritis to injurious falls [40]. This possible aforementioned scenario may well reflect the convergence of multiple disease-related osteoarthritis influences on bipedal postural control during activities of daily living that require attention, but in what order and to what degree each is a salient determinant is unknown [41]. In this regard, it does appear disease associated muscle force declines as well as nerve associated pathway attrition can adversely affect gait and balance control, safe adaptive walking, plus associated reflex responsiveness [42-44].

Additional findings show falls in end stage knee osteoarthritis may be due however to low back pain coupled with a limited walking endurance [4,37]. Moreover, knee osteoarthritis may be an independent risk factor for falls in its own right [2] but this may depend on the circumstances in which the older adult falls, as well as their cognitive state [45]. In short, over time, the literature and data cited and others above have revealed many variables may explain falls risk or predict the nature of the osteoarthritis-falls linkage, but all are hard to unify and unravel readily in our view. In addition, in the absence of careful sub studies, the general exclusion of high age adults with severe osteoarthritis from many studies, as well as a failure to examine the role of multiple affected joints, osteoarthritis severity and pain, muscle force capacity, and timing, as well as balance, their relevance as salient widespread risk factors is uncertain [46]. As well, walking ability, pain, the centre of mass velocity and knee extension moment, nutrition, and medication intake impacts appear of key import, but are challenging to validate or weight [47-53]. Moreover, both within individuals diagnosed with osteoarthritis or at risk for this, many diverse falls factors rather than uniform attributes are likely to prevail, but are not studied in depth at joints other than those at the knee. Largely based on retrospective data or observational study, osteoarthritis-falls trajectories are also rarely studied prospectively to any degree over time, despite a possible informative need in the realm of prevention and intervention. A potential association between the presence of fatty muscle infiltration and falls in female cases who underwent total hip joint replacement also indicated a role for obesity as a falls risk factor, but this attribute is rarely studied in association with falls risk and outcomes [54, 55]. Other identified falls risk factors-such as the implied role of advancing age, having a lower than desirable body mass index, heart disease, vision alterations, and a history of narcotics use, gait disturbances, and depression are also hard to unravel in the absence of sound data from sizeable representative samples [56-60].

As a result, future efforts to enable predictions and the ability to identify high-risk individuals for falls appears crucial. However, at present, study inclusion criteria that often omit cases with mental health issues, or those adults of higher ages with severe joint disease will continue or render it unclear as to whether possible cognitive factors underpin falls risk or not in at least some older adults suffering from painful disabling osteoarthritis. Whether these attributes should be treated at all, and if so, separately in their own right or not needs to be examined especially in the face of a possible role for poor muscle coordination attributes, muscle contractures, muscle fibrosis and pathology, ligament or meniscus damage, poor balance, comorbid disability, obesity, low activity levels, and common health challenges that raise falls risk, such as deficits in gait control, plus multi pain joint sites [13,24,37,52,57].

In the interim, it appears safe to say osteoarthritis, an important contributor to falling in its own right, even among healthy older adults is especially relevant to mitigate and avert given its impact on recurrent falls and disability extent.

Discussion

Osteoarthritis, a progressively disabling joint disease and one increasing in prevalence despite years of study is a costly health concern that reduces independence among many older adults in all parts of the world. At the same time, the prevalence of falls among older populations and that can be attributed in part to osteoarthritis disease features is an understudied topic even though it may have a bearing on the disease progression as well as its costs [42]. Moreover, when studied the key importance of identifying remediable disease outcomes and pathogenic factors remains confusing to apply uniformly even though most current authors support the view that falls are inextricably linked to osteoarthritis of the knee joint among other determinants and that more should be done to revert this link. This may be because few groups have sought to examine if falls, a major health determinant of the elderly in its own right, can lead to the onset of knee or other forms of osteoarthritis, a hypothesis that cannot be ruled out. Moreover, even if it appears those with more severe disease may fall to the same degree as those with less joint damage, this appears mostly true for radiological not the clinical disease features.

At the same time, even when the data sources examined in cumulative reviews are known to be reputable, and give the impression that they house a reasonable number of relevant papers on the present topic of interest, most do not appear to be based on any sound theoretical framework and thus a high number either examine many possible falls osteoarthritis correlates simultaneously, while others only examine a small number. Some data drawn from specific data repositories and not others, and analyses that employ secondary data sets captured in the previous decade using surveys and medical charts, may not represent the entirety of the situation as this occurs globally in 2025 and only knee osteoarthritis seems to have been studied to any degree across time.

Moreover, how the issues of osteoarthritis and falls interact is however rarely studied prospectively in non-surgical contexts as opposed to those detailing post-surgical knee or hip osteoarthritis follow up studies and falls occurrences. At the same time, what is being measured specifically is unclear as the terms applied for both knee osteoarthritis as well as falls, falling, and recurrent falls are not uniformly defined or employed in a standardized way across available studies. As well, a high number of studies continue to rely on subjective reports and measures that could be flawed, for example estimating the frequency of falls incidents as recounted by the faller who must rely on memory [61-71].

The possible confounding factors of differing osteoarthritis phenotypes, types of falls, falls location, disease duration, and extent, plus the role of prior surgery, overall health status, corticosteroid injections and others is also a profound limitation to progress in this realm in our view. As well, no current trend has emerged that would advance this field that currently omits wide age range of study subjects, with limited stratification attempts to group key cohorts selected for study at baseline. Hence even if can predict with reasonable certainty that some older adults with knee osteoarthritis may be more prone to falling or falls than healthy age-matched adults, this idea is not universally supported or possible to contest or validate. On the contrary, it has been possible to argue that that osteoarthritis may actually be protective against falls and related fractures, especially if it is severe and induces less rather than more weight bearing activities. However, if this is so, it is unclear how poor grip strength on the affected side appears to raise the risk for falling in knee osteoarthritis cases [46], or why joint replacement surgery does not obviate falls risk entirely [14]. There is also evidence that a persistent preoccupation related to an incident fall, term also called fear of falling by some authors, is of interest in the fields of geriatrics and gerontology because it is related to the risk of falling and subsequent morbidity of falling [36].

However, even if it is accepted that this report is a limited one, and the quality of the reported assessments cannot be readily discerned, this topic yielded the same vague outcomes as long ago as 1998 [72]. As at that time, what the weightings of the possible role of balance, muscle strength and proprioception and other factors play in explaining the prevailing falls risk and outcomes among osteoarthritis cases as well as the vulnerable older adult remains to be studied more carefully and comprehensively to allow for salient clinically relevant patterns to emerge in our estimation. Moreover, the role of comorbid health conditions, gender, and age, plus gait challenges, and obesity are clearly relevant, but the relative magnitude of these factors is currently hard to discern [9].

It is also apparent that some data may be erroneous, inaccurate, unrecognized, underreported or exaggerated by the immense reliance on self-reports, along with the frequent exclusion of osteoarthritis cases other than the knee and who might be cognitively challenged or at high risk for falls due to vision problems or heart disease. Additionally, efforts to examine the precise role of potentially modifiable risk factors not highlighted in the literature, such as diabetic neuropathy, joint inflammation, assistive device

use, footwear, sedatives, sleep issues, frailty, fatigue, social factors, unsafe environments, and erroneous health beliefs about falling may prove insightful as may a focus on nutritional factors [63]. At the same time, efforts to differentiate static from dynamic balance, which has not been studied to any degree in any osteoarthritis population, and its possible falls risk and injury linkage warrant study among samples of cases with well-defined and clearly established clinical and radiological osteoarthritis of varied joints, as well as in the case of differential disease sub groups.

Research implications

To advance this line of inquiry it is evident more comprehensive theory-based insights are required including broadening our understandings of the falls risk linkages between:

- Nutritional [e.g. magnesium intake], cognitive, and health status factors [44,47,63].
- Medication intake, environmental, and sleep factors [11].
- Specific osteoarthritis correlates, such as pain, joint instability, poor dynamic balance during gait, poor proprioceptive sensitivity, muscle fatigue, contractures, muscle weakness [48] and atrophy, plus falls fears, falls self-efficacy [38,41,46-50,61], and obesity [9].

To advance this line of inquiry, we specifically advocate for efforts that can more clearly differentiate high from low falls risk individuals using samples that match the median age of most osteoarthritis cases and who have either distinctive unilateral versus bilateral joint disease. The development and validation of practical cost-effective reliable personalized screening tools, including those that can capture falls history accurately are paramount as well [51]. To this end, the role of a simplified, two-question screening approach distinguishing who has osteoarthritis and who does not that can be effectively implemented in the clinic to identify high-risk individuals for targeted preventive interventions such as proprioception training [48] may prove beneficial [64,67], as may those targeting fear of falling, that is either excess fear or no fear in our view [69].

However, even though studied and identified as a sizeable serious costly public health problem more than 10 years ago [71], it appears much more clarity and specificity in the design and implementation topical focus of related studies is indicated. In particular, it appears that a more distinct topical focus and agreed upon validated 'gold' standard assessments are needed to determine what should be implemented-if anything-in older adult groups to foster falls prevention. As many falls appear to occur in conjunction with environmental factors, more ecologically oriented studies are clearly desirable even if lab-based simulations are informative. Case studies that reveal the possible weight of personal factors, cognitive and medication factors, alongside environmental factors may help to enlighten as well as personalize what is needed and why to prevent falling injuries among osteoarthritis cases, rather than aggregate views of controlled studies accessible to only those who fulfil the study criteria, These may not accurately account for the high [40%] percentage of those with a falls history undergoing surgery [56], and question the role of home based exercises or treatment plans that are individualized, closely monitored, or contra indicated in the face of intractable pain, depression, frailty, and neuromuscular deficits, plus deficient cognitive ability, poor physical and emotional status, erroneous health beliefs, and multiple medical conditions [65,68,69].

Clinical implications

As per Ling [72] until more compelling deterministic data are forthcoming about the cause effect osteoarthritis falls linkage, applying what we do know carefully may have both profound health cost benefits as well as favourable longevity implications [64]. The degree of prevailing falls fears regarding falling [immense fear or no fear-that could also prove problematic] should be studied in its own right [69]. Additionally, the relative role of type and usage of prescribed medications, osteoarthritis severity, pain extent, walking and balance facility, hip impairments, and environmental safety issues requires clarification [37]. In the meantime, five assessment methods-Single-Leg Stance, Six-Minute Walk Test, Timed Up and Go Test, Chair Stand Test, and Fall Efficacy Scale-and identifying those exhibiting 'cautious' walking and hip impairments may prove beneficial, alongside the 'at risk' subject's cognitive, physical, and medical profile [13,37]. The individual's personal beliefs and concerns if generating anxiety warrant attention as well in our view, as do estimates of whether at risk elders will be or are able to follow and benefit from exercises such as a TaiChi oriented program of motor training [65], or dual-task gait training protocol, as well as behavioural efforts directed towards increasing falls self-efficacy [55,56-58,73]. The use of a falls predictive model here plus an inertial measures and sensory weighting analytic approach may also prove extremely helpful [74].

Concluding remarks

Despite a lack of unity and a strong reliance on data already collected plus data largely focused solely on the diseased knee joint, it is clear falls are serious injuries that now prevail in sizeable numbers of osteoarthritis cases can account for their oftentimes substantive independently losses and magnification of its disability in multiple ways, even after surgery. In this regard, we conclude posture and balance as well as muscle modulation factors appear of high import among those tentatively explaining falling in many osteoarthritis cases. However, to advance this line of inquiry - objective gait and neuromuscular analogues appear paramount to examine and evaluate alongside cognitive responses and status [7, 53, 55, 63, 74]. In addition, in planning to avert excess falls associated osteoarthritis disability, efforts to address healthy lifestyle practices, health beliefs, muscle weakness, muscle wasting, obesity, medication safety, and deficient reflex responsiveness, and pain require dedicated attention in our view. Those who are in the higher age ranges, those who exhibit sarcopenia, and those requiring multiple medications to quell pain should be preferentially targeted.

Acknowledgment

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Conflict of Interest

None.

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