ÖZGÜN ARAŞTIRMA ORIGINAL RESEARCH

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FACTORS AFFECTING THE FALL RISK AND ASSISTIVE WALKING DEVICE USE OF PATIENTS WITH KNEE OSTEOARTHRITIS

DİZ OSTEOARTRİTLİ HASTALARDA DÜŞME RİSKİNİ VE YARDIMCI YÜRÜME CİHAZI KULLANIMINI ETKİLEYEN FAKTÖRLER

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Öz

Amaç

Bu çalışmada, ileri evre diz osteoartriti olan hastalarda düşme riskini ve yardımcı yürüme cihazı kullanım oranlarını ve bu hastalarda bu cihazların kullanımını etkileyen faktörleri araştırmayı amaçladık.

Gereç ve Yöntem

Bu prospektif, kesitsel, gözlemsel çalışmaya Mart 2020 ile Eylül 2020 arasında polikliniğimize başvuran ve ileri evre diz osteoartriti olan 79 hastayı (72 kadın, 7 erkek; medyan yaş 60; dağılım, 40-75) dahil ettik. Hastaların denge durumunu Berg Denge Ölçeği ile ağrı düzeylerini Sayısal Derecelendirme Ölçeği ile kişi beyanına dayanan dizabilite skorlarını ise Western Ontario and McMaster Universities Osteoarthritis Index ile değerlendirdik. Birincil sonlanım noktası hastaların denge durumu ve yardımcı yürüme cihazı kullanım oranlarıydı. İkincil sonlanım noktaları ise yaş, obezite, hastalık şiddeti, ağrı düzeyleri, sakatlık skorları ve düşme öyküsüydü.

Bulgular

Berg Denge Skalasına göre 40 (% 50,6) hastada düşme riski saptandı. Yardımcı yürüme cihazı kullanım oranları tüm hastalarda ve düşme riski olan hastalarda sırasıyla % 21.5 ve % 42.5 idi. Düşme riski olanlar ile olmayanlar arasında yardımcı yürüme cihazı kullanımı açısından istatistiksel olarak anlamlı fark vardı (p<0,001). Artan düşme riski ile obezite, yüksek hastalık şiddeti ve yüksek özürlülük skorları arasında anlamlı bir ilişki bulundu. Ancak düşme riski olan kişilerde yaş dışında (p<0,001) yardımcı yürüme cihazı kullanımını etkileyen herhangi bir faktör bulamadık.

Sonuç

Çalışmamızın sonuçları ileri evre diz osteoartriti olan hastalarda düşme riskinin arttığını ve bu hastalarda yardımcı yürüme cihazı kullanımının düşme riski ile ilişkili olduğunu göstermiştir.

Anahtar Kelimeler: Diz osteoartriti, düşme riski, yardımcı yürüme cihazı

Abstract

Objective

In this study, we aimed to investigate the risk of falling in patients with advanced-stage knee osteoarthritis and the rates of assistive walking device use, and the factors affecting the use of these devices in such patients.

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Materials and Methods
In this prospective, cross-sectional, observational study, we included 79 patients (72 females, 7 males; median age 60 years; range, 40 to 75) with advanced-stage knee osteoarthritis. We assessed the balance status of the patients with the Berg Balance Scale, pain levels with the Numeric Rating Scale, self-reported disability scores with the Western Ontario and McMaster Universities Osteoarthritis Index. Our primary outcome measurements were balance status, and assistive walking device usage rates of the patients. Secondary outcome measures were age, obesity, disease severity, pain levels, disability scores, and fall history.

Results
According to Berg Balance Scale, 40 (50.6 %) patients had a risk of fall. Assistive walking device usage rates were 21.5 % and 42.5 % for the total of the patients and for the patients at risk of falling, respectively. There was a statistically significant difference in assistive walking device use between those at risk of falling and those without (P<0.001). A significant correlation was found between increased risk of falling and obesity, high disease severity, and high disability scores. However, we did not find any factors other than age (P<0.001) that affect assistive walking device use in people at risk of falling.

Conclusion
The results of our study showed that the risk of falling is increased in patients with advanced-stage knee osteoarthritis and that the use of an assistive walking device is associated with the risk of falling in these patients.

Keywords: Knee osteoarthritis, Risk of falling, Assistive walking device

Introduction

Osteoarthritis (OA) is the most common form of arthritis. Among all joints, OA of the knee is one of the most frequent debilitating and life-altering joint diseases causing pain and disability. The lifetime risk of developing symptomatic knee OA is approximately 40 % in men and 47 % women and the likelihood of knee OA increases with age [1, 2].

Falls in the elderly are a major problem and attenuated balance control is an important cause of falls in this group [3]. The prevalence of falls in people over 60 years of age with knee OA is significantly higher than the others without knee OA, with a rate of 50-60 % [4]. Elderly and people with difficulty in walking demand assistive walking devices (AWDs), such as canes (walking sticks), crutches, and walkers, to maintain their balance and move independently. The use of an AWD in people with knee OA takes part in guidelines with strong recommendations [5, 6].

Even though the prevalence of falls is high in patients with knee OA, the mechanism, certain causes, and prevention methods of falling in this group are unclear. Thus more excessive studies are needed to comprehend the magnitude of balance attenuation in this group [4, 7].

Albeit biomechanical and clinical studies have exposed that AWD can help individuals to maintain balance and to improve their mobility, it remains a lack of understanding of the effectiveness of these devices [8]. Furthermore, when these devices are used improperly, on the contrary of expected effect, they can decrease the control on the balance and ability of walking and can cause falls [7, 9].

According to limited studies of understanding the mechanism of the main causes of falls in patients with knee OA and the necessity of AWD use in such group; we aimed to reveal the fall risk of these patients and the rate of assistive walking device use and the relationship between these two factors.

Materials and Methods

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki and was approved by the Suleyman Demirel University, Faculty of Medicine Ethical Committee on March 5, 2020 (number 72867572.050.01.04). All participants included in the study signed a consent form.

Study Design
Our study was a prospective, cross-sectional, observational study, consisted of 79 patients with knee OA, who consulted our outpatient clinic between March 2020 and September 2020. The primary outcome of our study was the association between risk of fall and use of AWD among patients with grade 3 and grade 4 knee OA. Secondary outcome measures were the association between fall risk and AWD usage with age, body mass index (BMI), pain, disease severity, self-reported disability scores, and fall history.

The patients, who were between the ages of 40 and 75, had the ability of walking and had radiographic disease severity of grade 3 and grade 4 knee OA according to the Kellgren-Lawrence (KL) scale, were admitted to the study. The exclusion criteria were the following: (1) another lower extremity disease contributing to a disability, (2) significant cognitive disorder, (3) visual problems, (4) upper extremity disorders that interfere with the usage of AWD, (5) severe respiratory and cardiovascular disease.

All participants were assessed by the same examiner. Demographic characteristics of the patients consisting of age, gender, body mass index (BMI) (data were collected as obese and non-obese), educational status, smoking habit, comorbidities were recorded.

Clinical Data

Clinical data collected were disease-related features including disease duration, pain, previous fall history, serum acute phase reactant (erythrocyte sedimentation rate (ESR), c-reactive protein (CRP)) levels, and therapy-related factors including use of an AWD, drug therapy for OA. Knee radiographs were assessed by the same experienced clinician according to the KL scale. The numeric rating scale (NRS) was used to evaluate the pain severity, the disability was assessed with a self-reported functional questionnaire: Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index. The patients' holistic balance status was assessed with the Berg Balance Scale (BBS).

Assessment Tools

KL grading scale is a radiographic classification system for OA of the knee joint [10]. The scale uses plain radiographs and is graded between 0 and 4. Radiographic images according to the KL grading scale are the following: grade 0: no radiographic features of OA, grade 1: possible joint space narrowing and osteophyte formation, grade 2: definite osteophyte formation with possible joint space narrowing, grade 3: multiple osteophytes, definite joint space narrowing, sclerosis, and possible bony deformity, grade 4: large osteophytes, marked joint space narrowing, severe sclerosis and definite bony deformity.

NRS is a pain severity scale. The numerical scale is 0 to 10. Zero refers to "no pain" while 10 refers to "the most intense pain that the patient can imagine". The patient can express the pain severity either verbally or written [11].

WOMAC OA index is a widely used self-reported functional questionnaire [12]. The WOMAC measures totally 24 items; 5 for pain (score range 0-20), 2 for stiffness (score range 0-8) and 17 for functional limitation (score range 0-68). Symptom severity is directly proportional to high scores in the knee.

BBS is a measurement tool used for determining holistic balance and fall risk of elderly individuals [13]. The scale consists of 14 items. Each item is scored from 0 to 4, while the maximum score is 56. Scores between; 0-20 indicate severe balance impairment and a high risk of fall, 21-40 indicates moderate balance impairment and a moderate risk of fall, 41-56 indicates normal balance status and a low risk of fall. The assessment takes about 15-20 minutes.

Statistical Analysis

The statistical analysis was performed using SPSS for IBM version 21. Data are presented as a percentage, median (range), or mean±Standard deviation as appropriate. All the continuous variables were evaluated for normality by Kolmogorov-Smirnov and Shapiro-Wilk test. The comparisons between the risk of fall groups and also walking aid usage groups were made using the Chi-square or Fisher's exact tests for nominal and categorical variables and the Mann-Witney U test for continuous variables. Logistic regression analysis was performed to evaluate the risk factors that may affect the fall situation in the previous year. We considered the p value less 0.05 statistically significant.

Results

Patients

A total of 79 patients, 7 (8.9 %) male, and 72 (91.1 %) female met the inclusion criteria and enrolled in the study. The median age of all patients was 64 (40-75). The baseline characteristics of the patients including age, gender, body mass index, education level, smoking habit, and clinical features were detailed in Table 1.

Clinical Evaluations

The median scores of all patients for NRS, WOMAC OA index, and BBS were 6 (0-9), 42.7 (4-80.2), 40 (5-56), respectively. According to BBS, 40 (50.6 %) patients had a risk of fall, 7 (17.5 %) of which had a high risk. AWD usage rates were 21.5 % and 42.5 % for the total of the patients and for the patients at risk of falling, respectively. An AWD was recommended and prescribed for 31 (77.5 %) patients all of which were among those who have a risk of fall. Of these 31 patients, 17 (54.8%) used the recommended device, while 14 (45.2%) did not. Among these 14 patients, 7 patients have tried to use the prescribed AWD but

Table 1 The baseline characteristics of all patients(n=79)

	Number	Percentage
Gender		
Male	7	8.9 %
Female	72	91.1 %
Age		
<65	41	51.9 %
≥65	38	48.1 %
Body mass index (kg/cm$^{2)}$		
<30	38	48.1 %
≥30	41	51.9 %
Education		
Primary	54	68.4 %
High school	15	19 %
Graduate	10	12.6 %
Smoking		
Yes	14	17.7 %
No	65	82.3 %
Regular drug use		
Yes	34	43 %
No	45	57 %
Other chronic disease		
Yes	61	77.2 %
No	18	22.8 %
Pain		
Yes	76	96.2 %
No	3	3.8 %
	Median	Range
Time from diagnosis(year)	4	1-20
C-reactive protein (mg/l)	3.23	0.04-68
Erythrocyte sedimentation rate (mm/h)	12.5	2-38
	Mean	**Standart Deviation**
Uric acid (mg/l)	5.09	±1.31

had to stop using due to increasing pain severity and further impairment of their walking skills. Despite professional recommendation four of the other seven people never used an AWD for cosmetic reasons and three did not believe they had an imbalance. The walking aids used were standard canes (12), Canadian crutches (3), and simple wooden sticks (2). All AWD users had been using AWD for more than a year, except for one patient who had been using Canadian crutch for two months. Walker and custom-made walking sticks were neither advised nor prescribed for any of the patients. None of the patients without fall risk were using an AWD. 37 (46.8 %) patients had a fall in the one last year, and 20 of them fell two or more times.

The clinical findings of the patients with and without risk of fall are compared in Table 2. There were no statistically significant differences between the two groups for age and pain (P=0.454, P=0.541 respectively). Only 3 of our patients did not suffer from pain and 65.8 % of those suffering, were describing severe pain. The rate of obesity (62.5 % vs 41 %) and grade 4 knee OA (40 % vs 7.7 %) were statistically

Table 2 The comparison of clinical findings of patients who have a risk of fall and have not.

	Risk of fall(n=40)	No risk of fall(n=39)	p value
Age			
< 65	20(50%)	21 (53.8%)	0.454
≥ 65	20(50%)	18(46.2%)	
Obesity			
Yes	25(62.5%)	16(41%)	0.046
No	15(37.5%)	23(59%)	
Pain			
Yes	39(97.5%)	37(94.9%)	0.541
No	1 (2.5%)	2(5.1%)	
KLGS			
Grade 3	24(60%)	36(92.3%)	0.001
Grade 4	16(40%)	3(7.7%)	
Use of an AWD			
Yes	17(42.5%)	0	<0.001
No	23(57.5%)	39(100%)	
Fall in the previous year			
Yes	30(75%)	7(17.9%)	<0.001
No	10(25%)	32(82.1%)	
NRS score	6.5 (0-9)	6 (1-9)	0.151
WOMAC score	55.2(21.8-73.95)	31.25(4-80.2)	<0.001

AWD: Assistive walking device, KLGS: Kellgren Lawrence grading system, NRS: Numerical rating scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

Table 3 The comparison of clinical findings and falling status of patients at risk of fall (n=40), with and without AWD

	Using a walking aid (n:17)	No walking aid (n:23)	p value
Age			
< 65	2 (11.8 %)	18 (78.3 %)	<0.001
≥ 65	15 (88.2 %)	5 (21.7 %)	
Obesity			
Yes	8 (47.1 %)	17 (73.9 %)	0.107
No	9 (52.9 %)	6 (26.1 %)	
Pain			
Yes	16 (94.1 %)	23 (100.0 %)	0.425
No	1 (5.9 %)	0 (0.0 %)	
KLGS			
Grade 3	9 (52.9 %)	15 (65.2 %)	0.522
Grade 4	8 (47.1 %)	8 (34.8 %)	
NRS score	7 (0-9)	6 (3-9)	0.381
WOMAC score	66.6 (27-73.95)	53.12 (21.8-71.8)	0.122
Fall in the previous year			
Yes	13 (76.5%)	17 (73.9%)	0.853
No	4 (23.5%)	6 (26.1%)	
Falling number			
0	4(23.5%)	6(26.1%)	0.720
1	5(29.4%)	9(39.1%)	
≥2	8(47.1%)	8(34.8%)	

AWD: Assistive walking device, KLGS: Kellgren Lawrence grading system, NRS: Numerical rating scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis İndex

significantly high in the group of fall risk, WOMAC scores were statistically significantly different between the two groups (all P values <0.001). The rate of falling in the one last year was noticeably higher in the patients at risk of fall (75 % vs 17.9 %, P<0.001)

The clinical findings of the patients at risk of falls with or without using an AWD are compared in Table 3. There was a statistically significant difference between the two groups for age (P<0.001). There were no statistically significant differences for obesity, pain, pain scores, and WOMAC scores (all P values >0.005). To investigate the effect of using a walking aid on falls, the fall status in the last year and the number of falls were compared between the patients at risk of fall who used and did not use an AWD. The number of falls and falling status in the last year were similar in the patients who used and did not use a walking aid (Table 3) (P=0.853 and P=0.720 respectively).

Logistic regression analysis was performed to evaluate the risk factors that may affect the fall situation in the previous year. We examined age, gender, obesity, presence of pain, pain scores, disease severity, and self-reported functional scores of WOMAC for disability as risk factors. Only high scores of WOMAC were associated with fall history in the last year (OR: 1.068, 95 % CI: 1.029-1.109, p=0.001).

Discussion

The main findings of our study are the fall risk of the patients with moderate to severe knee OA and their AWD usage rates. Our secondary findings were the relationship between fall risk and use of an AWD with age, obesity, pain, the severity of the disease, disability, and fall history.

We used the BBS tool to determine the fall risk of the participants. Such performance-oriented functional tests are widely used in clinical practice to assess the mobility and balance problems of the elderly. BBS has been claimed to have a ceiling effect in patients with mild knee OA who are functioning well [3]. To our knowledge, a similar relationship has not been demonstrated in moderate to severe (grade 3-4) knee OA. Furthermore, in a systematic review, published in 2017, it is reported that the BBS score (≤50 points) is one of the most evidence-based functional measures in determining the risk of future falls [14].

We found that 50.6 % of the patients had a risk of fall and 21.5 % of total patients were using an AWD. The AWD usage rates among patients at risk of falling were 42.5 %. The amount of fall risk in our study is in accordance with the literature while the AWD usage rates among individuals with knee OA are much lower than the estimated rates of 40-70 % [9, 15, 16]. In an analytical systematic review, it is put forward that people with knee OA have a higher risk of falling and more than half of them express a fall history in the previous year [7, 17]. Similar to such knowledge, 46.8 % of our patients had a fall experience in the last year, and according to our results, the fall history of the participants in the previous year was an important predictor of fall risk in our participants.

In our study, we could not find any relationship between age, pain score, and fall risk. But there was a statistically significant association between obesity, disease severity, and self-reported disability scores. Although 48.1 % of our patients were over 65 years old, contrary to the literature [18] we found no relationship between age and fall risk. This might be caused by our patients who had advanced stage knee OA regardless of age. We could not find a relationship between pain and fall risk unlike Kim et al. and results reported in a systematic review [7, 19]. This may be because almost all of our patients suffer from pain and a large percentage of them have a high pain score. On the other hand, our findings suggest a close relationship between fall risk with disease severity and self-reported disability scores (WOMAC) like that of Kim et al. [19] and Adegoke et al., respectively [20]. Since the gait pattern of obese adults is similar to the elderly, obesity is linked to both static and dynamic stability and thus to higher rates of fall risk [21, 22]. Our results were consistent with these reported results in obesity-related fall risk in patients with knee OA.

According to our results, age was the only factor that was contributing to the use of an AWD among patients with knee OA who were at risk of falls. We could not correlate pain, pain score, obesity, disease severity, and disability with AWD use. Walking sticks are used not only to increase balance but also to reduce pain with a weight-bearing effect. The factors contributing to the possession of an AWD were determined as age, disability, and pain [15, 23]. The reason why we could not associate device use with pain may be that our patients who were at risk of falling had similar pain intensity. A similar inference can be made for disease severity and disability. Because both of the factors were associated with falling risk, and patients at risk of falling had similar disease severity and disability scores. On the other hand, Van Hook et al. reported that standard canes would not be sufficient to reduce pain and they offered that offset walking sticks should be used in such expectation especially in patients with knee OA. Furthermore to

increase the base of support they put forward that custom-made devices, fitted to the patients, should be prescribed [24]. Although all of our patients took the professional opinion of a clinician, the majority of them were using simple and non-custom fitted canes. Additionally, in accordance with nonuse reasons of our patients, Akinbo et al. found that nonuse is related to a negative outcome, negative effects on walking, and no need [23]. Contrary to the relationship with the risk of falling, fall history did not affect AWD use. Use of walking aids were specified as the only extrinsic risk factor for fall risk in a recent comprehensive review [7]. However, considering that these devices are generally prescribed for patients at high risk of falling, we believe that more comprehensive studies are needed to fully reveal this relationship. A fact that should not be overlooked is the adaptation process to AWD use, which is included in the OARSI 2014 recommendations [25]. It was stated in this report that at the end of the second month of use, compliance would not be a further concern.

We would like to point out that our study has some limitations. First, the sample size was small due to being a single-center study and our sample group was not homogenous for gender which has been previously shown to influence pain perception and expression [26]. Only 7 of the 79 participants were male. Therefore, we could not perform any statistical comparisons between male and female participants. Second, BBS is an objective measurement tool, but to a certain extent, it depends on the opinion of the patient and the clinician.

In conclusion, we found that about half of the participants with moderate to severe knee OA have fall risk and the rate of acquiring and using walking devices of such patients is well below than expected. We think that it is important to prescribe the right device for the right purpose and to inform the patient about the intended use of the device and the adaptation period. We believe that more comprehensive disease-specific studies will shed light on scientific literature.

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Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Ethical Approval
The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki and was approved by the Suleyman Demirel University, Faculty of Medicine Ethical Committee on March 5, 2020 (number 72867572.050.01.04).

Consent to Participate and Publish
Written informed consent to participate and publish was obtained from all individual participants included in the study.

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