

# The Characteristics of Radiographic Knee Osteoarthritis According to Age and Gender at a University Hospital

Üniversite Hastanesinde Radyografik Diz Osteoartritinin Yaş ve Cinsiyete Göre Özellikleri

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## Abstract

**Abstract:** The aim of the study was to evaluate the frequency of patients who admitted to physical and rehabilitation medicine clinic of a university hospital with knee pain and to analyse the frequency and characteristics of radiographic osteoarthritis in different age groups according to gender. Patient files of 198 patients with knee pain were detected retrospectively. 146 patient (105 female, 41 male) who met our criteria included in the study and reviewed for gender, age and anterior/posterior and lateral radiographies of knee. Knee radiographies interpreted for the presence of joint space narrowing (medial-lateral), osteophyte and sclerosis. The radiographic measurements were made according to "Kellgren Lawrance Scale". It was found that 2% of all patients admitted to the outpatient clinic had knee pain complaints in 2019. 89 (60%) of 146 patients (65.7% in female, 48.7% in male) had radiographic knee osteoarthritis according to Kellgren Lawrance Scale and 44 (49%) of 89 patients were moderate to severe (Grade 3-4). There was found a narrowing in the joint space in 48 (69%) of 69 females and 10 (50%) of 20 males with knee osteoarthritis. More than half of patients with knee pain had radiographic knee osteoarthritis, and about half of patients with knee osteoarthritis were moderate to severe. The frequency of radiographic osteoarthritis were higher in females, the severity were found higher in females more than males after 50 years old. Radiographic knee osteoarthritis increased with age among both males and females,

**Keywords:** Kellgren Lawrance Scale; knee osteoarthritis; radiographic knee osteoarthritis

## Özet

Bu çalışmada, bir üniversite hastanesi Fizik Tedavi ve Rehabilitasyon kliniğine diz ağrısı ile başvuran hastaların oranını belirlemek ayrıca yaşa ve cinsiyete göre radyografik osteoartritin sıklığını ve karakteristik özelliklerini belirlemek amaçlanmıştır. Diz ağrısı ile başvuran 198 hasta dosyası geriye dönük incelenerek, kriterleri karşılayan 146 (105 kadın, 41 erkek) hastanın yaş, cinsiyet, radyografi bilgileri kaydedilmiştir. Radyografik olarak eklem aralığında daralmanın varlığı ve varsa hangi kompartmanda daha fazla olduğu, osteofit, skleroz araştırılmıştır. Radyografik ölçümler Kellgren Lawrance Skalasına göre yapılmıştır. 2019 yılında ayakta hasta kliniğine başvuran hastaların %2'sinin diz ağrısı ile başvurduğu saptanmıştır. 146 hastanın 89'unda (%65.7 kadınlarda, %48.7 erkeklerde) radyografik osteoartrit saptanmıştır, 89 hastanın ise 44'ünün (%49) düzeyinin orta ve ağır (evre 3-4) olduğu gözlenmiştir. Ayrıca 69 kadın hastanın 48'inde (%69), 20 erkek hastanın ise 10'unda (%50) eklem aralığında daralma saptanmıştır. Diz ağrısıyla başvuran hastaların yarısından fazlasında radyografik olarak osteoartrit saptanmıştır. Diz osteoartriti saptanan hastaların yarısının evresi orta-ağırdır. Kadınlarda sıklığı daha fazla saptanmış olup, 50 yaş üzerindeki kadınlarda ise şiddetinin de erkeklere göre daha fazla olduğu gözlenmiştir. Her iki cinsiyette de yaş arttıkça radyografik osteoartrit sıklığı artmıştır.

**Anahtar Kelimeler:** Diz osteoartriti; kellgren Lawrance Skalası; radyografik diz osteoartriti

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## 1. Introduction

A major cause of knee pain is knee osteoarthritis (OA) in worldwide (1) Direct radiography is a common, easy, and inexpensive method that has been used for many years in diagnosis of knee osteoarthritis. Kellgren Lawrance (K-L) scale is the most commonly radiologic grading system for knee osteoarthritis. It determines the severity of radiographic osteoarthritis by evaluating the degree of osteophytes, narrowing in the joint space, sclerosis. Grade 2 or higher grades are defined as radiographic knee osteoarthritis (2).

The results of prevalence studies about radiographic osteoarthritis differ to methodology and ethnic differences. In the ROAD study in Japan, the prevalence of radiographic osteoarthritis which was determined by Kellgren Lawrance Scale, was reported 47.0% of 817 men and 70.2% of 1465 women (3). The Framingham Osteoarthritis Study reported the prevalence lower, radiographic OA as 34.4% in women and 30.9% in men aged 60 and above (4).

There are conflicting results about the relation between symptomatic, immunologic (5) and radiological OA, however pain prevalence is higher and quality of life (6) was lower in severe radiological OA. Direct radiography indicates structural changes in the osteoarthritic joint, it is believed that there is a relation between structural changes and osteoarthritis (7).

Age and female gender is generally believed as a risk factor for knee osteoarthritis. Age is a risk factor due to reduced muscle strength, disruption in proprioception, cartilage thinning, increased oxidative stress with aging (8). But there are conflicting results about the association of age and radiographic OA. Some studies showed positive association (9) and some studies showed no association (10). The results of many studies demonstrated females have high risk for knee OA more than males (11,12) however a few study showed that males had more (9).

In the normally aligned, ambulating knee, load is disproportionately transmitted to the medial compartment (33).

Varus malalignment further increases the total load passing medially during gait (30). Although valgus mal-alignment is associated with an increase in lateral compartment peak pressures (32), the medial compartment often continues to bear more load than the lateral compartment until severe valgus malalignment is present (34,35). Varus malalignment increases medial compartment load; valgus malalignment increases lateral compartment load (28,31,32). In the normally aligned, ambulating knee, load is disproportionately transmitted to the medial compartment (33). Varus malalignment further increases the total load passing medially during gait (30). Although valgus mal-alignment is associated with an increase in lateral compartment peak pressures (32), the medial compartment often continues to bear more load than the lateral compartment until severe valgus malalignment is present (34,35).

In normally ambulating knee, medial compartment carries most load of the body. Furthermore, varus malalignment increases this load while ambulating. As a result, the medial compartment carries more load than lateral compartment and medial tibiofemoral OA is more often than lateral tibiofemoral OA (13). Wise et al. reported that the prevalence of medial joint space narrowing was 29.5% and lateral joint space narrowing 8.2% in 2652 subjects between 50-79 years (14).

This study was conducted: 1- to evaluate the frequency of patients who admitted to physical and rehabilitation medicine clinic of a third level hospital with knee pain, 2- to analyse the frequency and characteristics of radiographic osteoarthritis in patients with knee pain in different age groups according to gender.

## 2. Material and Methods

This retrospective study was an analysis of patients with knee pain, seen at Department of Physical Medicine and Rehabilitation in Eskisehir Osmangazi University (Eskisehir, Turkey) in 2019 by searching the patient files and computerized database. The medical records of 198 patients with knee pain (ICD-10 : M17, M22, M23, S83 and subgroups, M70.5, M71.2) were reviewed for gender, age

and knee radiographs. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards (16-06-2020/23/E-25403353-050.99-68776)

Patients over the age of 18 years with records of sex, age and knee radiographs (both anterior and lateral), were included to the study. Under the age of 18 and patients with knee radiography which is not suitable for accurate assessment, also patients with total knee arthroplasty and knee surgery (with nail or other implants), positivity of rheumatoid factor were excluded from the study. 146 (105 female, 41 male) patients who met the criteria were included to the study.

Anterior and lateral knee radiographs were interpreted by two physical therapy and rehabilitation specialists for the presence of osteophyte, narrowing in the joint space, sclerosis and grading was done according to Kellgren-Lawrance (K-L) Scale (2) : Grade 0-Normal, Grade 1- Doubtful narrowing in the joint space, possible osteophyte, Grade 2-Definite osteophyte, possible narrowing in the joint space, Grade 3- Moderate osteophytes, definite narrowing in the joint space, some sclerosis, Grade 4- Marked narrowing in the joint space, severe sclerosis and definite bone ends deformity. Also it will be determined whether the narrowing in the joint space is more medial or lateral by measuring the distance between the tibial plateau and the femoral condyle (15).

IBM SPSS Statistics 22.0 (SPSS Inc., Chicago, Illinois) program was used for statistical analysis. Categorical variables are

shown as frequency and percentage (%) and continuous numerical variables are shown as mean  $\pm$  standart deviation.

### 3. Results

A total of 9854 patients admitted to the Outpatient Clinic in 2019, 198 (2%) of them admitted with knee pain (139 female, 59 male). 12 patients with total knee arthroplasty, 40 patients with no radiography, 2 patients with knee radiography which is not suitable for accurate analysis were excluded from the study.

The radiographs of 146 patients (ages between 24-84, mean  $59.1 \pm 13.59$ ) with suitable radiography were found for the analysis. 105 (70.4%) of them were female with the mean age of  $60.67 \pm 11.72$ , 41 (29.6%) of them were male with the mean age of  $55.09 \pm 17.02$ . Only 5 females and 5 males had the radiography of one knee, other 136 patients had the radiographies of both knees.

Most of the female patients who admitted with knee pain were over 50 years old (84%). On the other hand, most of the male patients were over 60 years old, however the age distribution of males were similar.

89 (60%) of 146 patients (65.7% in female, 48.7% in male) had radiographic knee osteoarthritis according to Kellgren Lawrance Scale and 44 (49%) of 89 patients were moderate to severe (Grade 3-4). 30.8% of the patients were K-L grade 2, 20.5% of the patients were K-L grade 3 and 9.5% of the patients were K-L grade 4. Radiographic knee osteoarthritis increased with age among both males and females. Also the severity of osteoarthritis and narrowing in the joint space increased with age in females (Table 1).

**Table 1.** Distribution of radiographic knee osteoarthritis by age groups and gender

Female	Definite knee OA (K-L Grade 2-4)	Moderate to severe knee OA (K-L Grade 3-4)	Narrowing in the joint space
20-29 (n=1)	0		
30-39 (n=5)	1 (20%)		
40-49 (n=10)	2 (20%)		
50-59 (n=28)	14 (50%)	5 (17.8%)	8 (28.5%)
60-69 (n=37)	29 (78.3%)	16 (43.2%)	23 (62.1%)

≥ 70 (n=24)	23 (95.8%)	14 (58.3%)	17 (70.8%)
Total (n=105)	69 (65.7%)	35 (33.3%)	48 (45.7%)
<b>Male</b>			
20-29 (n=2)	0		
30-39 (n=8)	1 (12.5%)		
40-49 (n=6)	1 (16.6%)	1 (16%)	1 (16%)
50-59 (n=5)	2 (40%)		
60-69 (n=10)	7 (70%)	6 (60%)	6 (60%)
≥ 70 (n=10)	9 (90%)	2 (20%)	3 (30%)
Total (n=41)	20 (48.7%)	9 (21.9%)	10 (24.3%)

(OA: Osteoarthritis, K-L : Kellgren-Lawrance Scale)

There was found a narrowing in the joint space in 48 (69%) of 69 females, 10 (50%) of 20 males with knee OA. 47 narrowings in females and all narrowings in males were

in the medial joint space. The rates of the narrowing in the medial joint space increased with the K-L Grades (Table 2).

**Table 2.** Distribution of the narrowing in the medial joint space by Kellgren Lawrance Grades in both gender with knee osteoarthritis

<b>Female</b>	<b>K-L Grade 2 (n=34) N(%)</b>	<b>K-L Grade 3 (n=23) N(%)</b>	<b>K-L Grade 4 (n=12) N(%)</b>	<b>Total (n=69) N(%)</b>
The narrowing in the medial joint space	17 (50%)	19 (82.6%)	11 (91.6%)	47 (68%)
<b>Male</b>	<b>K-L Grade 2 (n=11) N(%)</b>	<b>K-L Grade 3 (n=7) N(%)</b>	<b>K-L Grade 4 (n=2) N(%)</b>	<b>Total (n=20) N(%)</b>
The narrowing in the medial joint space	2 (18.1%)	6 (85.7%)	2 (100%)	10 (50%)

(K-L: Kellgren Lawrance Scale)

#### 4. Discussion

Our study which examined the features of radiographic knee osteoarthritis in detail, showed that; the frequency of patients with knee pain were 2% of all the patients who admitted to physical and rehabilitation medicine clinic of a thirdlevel hospital. 60% of patients with knee pain had radiographic knee osteoarthritis, and about half of patients with knee OA had moderate to severe OA (K-L Grade 3-4). The frequency of radiographic OA were higher in females, the severity were found higher in females more than males after 50 years old. Radiographic knee osteoarthritis increased with age among both males and females also the rate of narrowing in the joint space increased with K-L grades. The contribution to the literature is; analysing the frequency and characteristics of radiographic osteoarthritis in different age groups according to gender at a university hospital with knee pain

The frequency of patients with knee pain were 2% of all the patients who admitted to outpatient clinic. We think that the frequency

of knee pain was low due to the fact that patients with pain mostly apply to the public hospitals. Patients with treatment resistant pain may be applying more to university hospitals. Most of the patients were female, similar to other published papers (16,17).

The results of published studies about the frequency of radiographic knee OA, can vary due to ethnic and methodologic differences. Bedson et al. discussed these epidemiologic difficulties and reported that the proportion of the radiological changes varied between 15% and 76% in patients with knee pain (18). In our study, more than half of the patients with knee pain had radiographic knee osteoarthritis. Similar to our study, in England, another study determined by K-L scale, reported radiographic OA in 69,5% of 650 patients with knee pain (19). However Hannan et al. found radiographic OA 15% of patients with knee pain (20). Grade 3 and 4 was defined as moderate to severe radiographic osteoarthritis (2). 49% of our patients with knee OA were moderate to

severe. Peat et al. reported that 56.8% of 452 patients aged 50 and above with knee pain, had moderate or severe radiographic OA (19). The fact that the study population of this study is older than our study, may explain that the frequency of moderate and severe radiographic OA is slightly more than our study.

In most of the studies, the frequency (4,11,12) and the severity (11) of knee osteoarthritis were found in females more than males, however there are a few studies showing that males had more (9) In many studies it is explained by hormonal changes in women with age, changes in the balances of bone formation and resorption, more pain perception, less ability to cope with stress in women (21,22). Similar to literature, our study showed that the frequency of radiographic OA were high in females (65.7%) more than males (48.7%) The Framingham (4) and the SEKOAI (15) studies reported the prevalence of radiographic OA higher in females. The meta-analysis reported that females had a higher risk for knee OA (11). And another study, published in Lancet reported that osteoarthritis is more common in female due to the role of hormones (12) However in the Baltimore Study, 31.6% of 547 Caucasian men and 28.5% of 351 Caucasian women aged 20 and above, were defined as radiographic osteoarthritis (9). The subjects we studied were a random sample of patients with knee pain not a population based sample. Therefore the frequencies of radiographic knee osteoarthritis is expected to be higher than the Baltimore study. Our study results showed that the severity of radiographic OA were found higher in females (50% in 69 females) more than males (40% in 20 males) aged over 50 years. We think this result may be due to decreased modulating effect of oestrogen on cartilage in females (23). Also a study reported that difference in knee cartilage volume between males and females became greater above 50 years of age due to possible hormonal mechanism (24). Also the metaanalysis reported that females  $\geq 55$  years of age had more severe knee osteoarthritis, they believe that it is the result of menopause (11).

Our study results showed that radiographic knee osteoarthritis increased with age among both males and females. We believe that age related changes in articular cartilage, ligaments, muscles may contribute to the development of knee osteoarthritis. Similar to our study, Cubukcu et al found a positive correlation between age and radiological findings in knee OA, they associated this finding with changes in cartilage, reduced muscle strength, loss of flexibility in subcondral bone, inadequate neuromuscular response (25). Also Baltimore Study demonstrated the prevalence of radiological OA increased with age in both gender (9). And Botha et al. reported that narrowing in the joint space and osteophyte scores increased with age (26). Age-gender interaction is poorly understood in knee osteoarthritis, many studies shows different results. According to our study, the severity of osteoarthritis increased with age in females, not in males, however it is expected increased severity in both gender due to the changes in the cartilage with aging. Similar to our study results, the Framingham Study reported that the severity of radiographic OA increased with advancing age in female but not in men (4). We think this results of our study and the Framingham study were probably because of the small sample of males.

Kellgren-Lawrence Scale has been proven to be applicable in knee OA in both gender (27), however some studies reported that patients without radiographic degeneration demonstrated a narrowing in the joint space with age (27,28). Our study results showed that narrowing in the joint space were in medial in almost all patients and all patients with narrowing in the joint space had radiographic OA. Also the rate of the narrowing in the medial joint space increased with the K-L grades. Similar to our study, there are published studies which shows the relation between K-L grades and narrowing in the joint space. The Copenhagen Osteoarthritis Study reported that the narrowing in the joint space in the subjects with radiographic OA were more than the subjects without radiographic OA (27). Also the relation between K-L grades and

narrowing in the joint space was reported in another study (29).

This study has some limitations : we could not be able to evaluate functionality and pain levels as a result of retrospective design, and also we could not be able to evaluate the progression of knee OA due to the absence of control radiographies. The strength of our study was, not only evaluating age, gender distribution and frequency of knee OA, but also evaluating the relation between

narrowing in the joint space and K-L grades in patients with knee pain.

In conclusion, the rate of the radiographic knee osteoarthritis was 60% in patients with knee pain who admitted to a thirdlevel clinic. About half of them had moderate to severe OA (K-L Grade 3-4). The frequency of radiographic OA was higher in females and increased with age among both gender. Also the rate of narrowing in the joint space increased with K-L grades.

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