

Epidemiological Study Of Knee Arthritis: Age- And Gender-Wise Prevalence With Radiographic Grading In A Clinical Population

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Abstract

Background: Knee arthritis, particularly osteoarthritis (OA), is among the most common and debilitating joint disorders globally, especially affecting women in mid to late adulthood. It significantly hampers mobility, independence, and overall quality of life. Identifying age- and gender-related trends is crucial for timely diagnosis, prevention, and targeted intervention.

Objectives: This study aims to determine the prevalence and severity of knee arthritis across different age groups and genders using radiographic findings, analyze gender differences in arthritis occurrence, identify trends in early-onset arthritis, and suggest potential preventive measures.

Methodology: A cross-sectional descriptive study was conducted at IPSC Pain and Spine Hospital, including 174 patients aged 25–84 years clinically and radiographically diagnosed with knee arthritis. Patients were assessed using the Kellgren-Lawrence (KL) grading system. Demographic data, side of knee involvement, arthritis type, and clinical history were collected through structured interviews and medical record reviews. Descriptive statistics, Chi-square tests, and ANOVA were used for data analysis.

Results: Out of 174 patients, 141 (81%) were female and 33 (19%) were male. The highest prevalence was observed in the 45–54 age group (31%), followed by the 55–64 age group (29.3%). Bilateral knee arthritis was predominant (74.1%). Grade III (moderate) OA was the most common radiographic finding (32.7%), particularly in females. Early arthritis (Grade 0–I) was found in 36 patients (20.6%), suggesting rising trends in early-onset arthritis.

Conclusion: Knee arthritis predominantly affects middle-aged and older women, with moderate-stage OA and bilateral knee involvement being most frequent. The findings reinforce the need for age- and gender-specific screening programs and emphasize preventive strategies, including lifestyle modification and early medical intervention. The data also support integrating clinical and radiographic evaluation for accurate grading and management.

Introduction

One common musculoskeletal condition that has a major impact on people's mobility and quality of life is knee arthritis. The two main types of the illness, which involves inflammation or degradation of the knee joint, are osteoarthritis (OA) and rheumatoid arthritis (RA), with OA being the most prevalent type that affects the knee [1]. One of the main causes of disability in older persons is knee OA [2]. As the world's population ages and obesity and physical inactivity rates rise, knee arthritis is becoming more common and a greater public health concern. Developing successful prevention and therapy measures for knee arthritis requires an understanding of the epidemiological factors that affect its prevalence, especially age and gender.

One of the biggest risk factors for knee arthritis is age, as the condition's incidence rises sharply with age [3]. The pathogenesis of knee OA includes gradual cartilage degradation, which is frequently made worse by genetic predispositions, obesity, and previous joint traumas [4]. Research has repeatedly demonstrated that while knee arthritis is uncommon in younger people, it sharply rises with age, especially after the age of 50 [5]. The degenerative nature of OA, which causes a progressive loss of joint structural integrity and results in pain, stiffness, and functional restrictions, is the main cause of this age-related prevalence increase [6]. Knee OA is a major cause of disability and a reduced quality of life in older people, especially those over 65 [7]. This study is done in BPL x-ray machine in IPSC Pain and Spine hospital.

Another important factor influencing the occurrence of knee arthritis is gender. Several studies show that women are more prone than males to develop knee OA, especially postmenopausal women [8]. Hormonal changes are

assumed to be the cause of this discrepancy, with decreased estrogen levels following menopause perhaps causing greater inflammation and cartilage deterioration. In addition, women often have lower muscle mass and higher body fat percentages than males, which puts more strain on knee joints and raises the risk of OA. Despite the fact that men are more likely than women to suffer knee arthritis in younger age groups, this gender disparity becomes more noticeable as people age, especially after menopause.







Fig 1.1 BPL x-ray machine (IPSC Pain and Spine hospital)

The prevalence of knee arthritis also varies by geography and ethnicity, with some groups having greater rates because of socioeconomic, environmental, and genetic variables. For instance, African Americans and Indigenous people have a higher risk of developing knee arthritis, which may be brought on by environmental factors, socioeconomic inequalities, and genetic predispositions. Furthermore, a significant risk factor, especially in Western societies, is the rising incidence of obesity in both men and women.

The degenerative joint condition known as osteoarthritis (OA) is typified by the slow breakdown of joint tissue. It is the most prevalent type of arthritis and frequently affects older people. Radiographic evidence of OA is seen in about 80% of people over 65. Pain, stiffness, edema, and limited joint movement are examples of physical symptoms. Age, gender, race, heredity, obesity, prior injuries, vitamin D insufficiency, and lifestyle variables are all considered risk factors. As it progresses through different severity phases, OA is progressive.

Joint space narrowing (JSN), osteophytes, cyst development, and subchondral sclerosis are important radiographic characteristics. Loss of protecting cartilage between knee joints is indicated by JSN. Bony growths on bones or joints are called osteophytes, whereas abnormal thickening of the underlying bone is known as subchondral sclerosis.

	GRADE	X-RAY IMAGE
1.	GRADE-0 (early OA changes) Represents normal bone structure with no radiographic signs or symptoms.	

2.	<p>GRADE-I (doubtful) Suggests questionable joint space narrowing (JSN) with a possible presence of osteophytes.</p>	
3.	<p>GRADE-II (mild) Indicates clearly defined osteophytes with possible joint space narrowing (JSN).</p>	
4.	<p>GRADE-III (moderate) Exhibits multiple osteophytes along with potential bone deformity.</p>	
5.	<p>GRADE-IV (severe) Displays prominent osteophyte formation, clear joint space narrowing (JSN), and marked subchondral sclerosis.</p>	

Using a semi-quantitative approach, the Kellgren and Lawrence (KL) grading system assigns ordinal grades based on particular criteria to evaluate the severity of knee OA on radiographic images. Due to the lack of significant morphological distinctions between subsequent grades, many automated and physician-based grading systems are less accurate and frequently mistake a KL grade for a nearby grade, making precise differentiation difficult. Most previous research ignores the KL scale's intrinsic ordinal structure and treats KL grading as a multi-class classification task. Ordinal regression, on the other hand, recognizes the ordered relationship between classes in which class labels follow a natural order and input values are continuous. Handcrafted characteristics are usually retrieved and supplied into a classifier or regressor in image-based ordinal classification in order to predict results. In the same way, determining the degree of knee OA from X-ray pictures is an image classification task, with each KL grade denoting a different class. To appropriately depict OA growth, it is imperative to maintain the ordinal link among KL grades. The KL grading system is subjective by nature and mostly depends on the knowledge and discretion of the radiologist. Consensus on radiograph grading is therefore particularly challenging, especially in the early phases of KOA, as inter-observer and intra-observer agreement, which is commonly quantified by the quadratic Kappa coefficient, can range from 0.56 to 0.67. The accuracy of early-stage KOA detection is still low in several investigations. Some methods simplify categorization jobs by combining more difficult steps. Other approaches combine extra clinical data with X-ray features in an effort to improve diagnostic performance. Since prompt intervention can help slow or prevent disease progression and lower the probability of needing a total

knee replacement, early and precise diagnosis is essential. Therefore, there is a growing need for supportive tools to assist clinicians in early KOA detection and effective progression management.

METHODOLOGY

A cross-sectional descriptive approach will be used in this study to examine the age and gender-based distribution of knee arthritis. By collecting data at a specific point in time, the cross-sectional technique offers insights into the prevalence of knee arthritis within the designated patient population. 174 patients with knee arthritis will be included in the trial; they were chosen from IPSC Pain and Spine hospital, Delhi to provide a varied sample that accounts for variations in age and gender. Osteoarthritis (OA), rheumatoid arthritis (RA), or other types of arthritis affecting the knee joint may be among the confirmed diagnoses of knee arthritis for the participants.

Patients 25 years of age or older, of either gender, who have been diagnosed with knee arthritis by clinical examination and/or radiographic evidence, are eligible to participate in the study, and have given their informed consent. Patients with knee arthritis brought on by traumatic traumas, those who had knee replacement surgery or other major knee procedures, and those who are unable of giving informed consent because of cognitive impairments were all excluded.

Structured interviews, checks of medical records, and physical examinations was used to gather data. Age (grouped into 25-34, 35-44, 45-54, 55-64,65-74,75-84), gender, and the length of time that arthritic symptoms have persisted are among the demographic data that will be collected. The medical history will cover the type of arthritis (OA, RA, etc.), family history of arthritis, co-morbidities such as diabetes or hypertension, and current medications (e.g., anti-inflammatory drugs, pain relievers).

Descriptive statistics was used in the data analysis to determine the prevalence of knee arthritis in various age groups and between genders, as well as the frequency distribution of age and gender. For continuous variables like age, the mean and standard deviation was determined. Each gender and age group's prevalence of knee arthritis were determined independently, and the overall prevalence was reported as a percentage of the sample of 174 patients. Chi-square tests were used for comparison analysis in order to determine whether gender and the existence of knee arthritis are significantly correlated. Additionally, to check for variations in the prevalence of knee arthritis among various age groups, ANOVA (Analysis of Variance) will be employed.

RESULT

Among approximately 180 individuals who underwent knee radiographic evaluation at IPSC Pain and Spine Hospital, 174 patients met the inclusion criteria and were subsequently enrolled in the study. These are differentiated and analyzed based on the patient's grade following the examination, gender, age group, and different knee (right knee, left knee and B/L knee). There are 174 patients total, with 141 (81%) being female and 33 (19%) being male. All patients underwent X-ray examination and presented with varying medical histories and knee-related complaints. Based on data analysis, the majority of patients reported knee pain as their primary symptom."

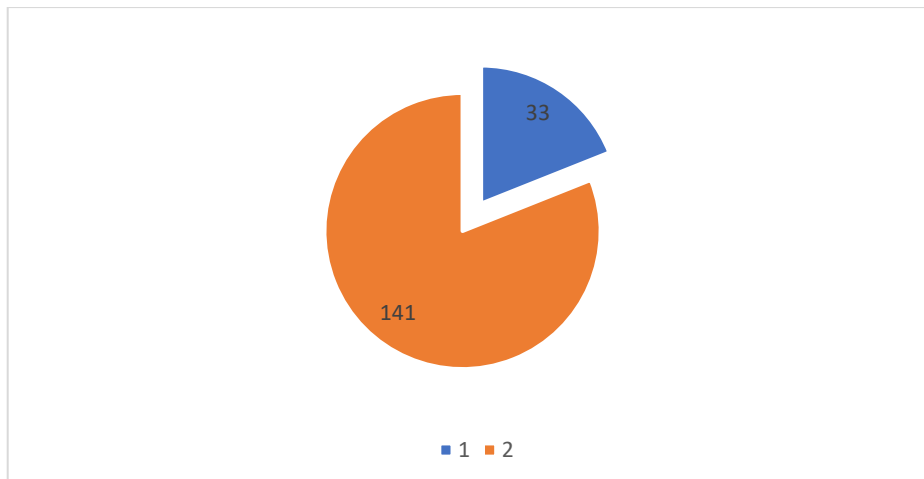


CHART 1.1 NO. Of patients based on gender prevalence.

A total of 174 patients who met the age criteria for knee X-ray examination ranged in age from 25 to 84 years. These patients were categorized into six age groups: 25–34, 35–44, 45–54, 55–64, 65–74, and 75–84 years. In the 25–34 age group, there were 6 patients (3.4%), including 4 males and 2 females. The 35–44 age group comprised 18 patients (10.3%), with 6 males and 12 females. The largest number of patients, 54 (31%), belonged to the 45–54 age group, consisting of 9 males and 45 females. In the 55–64 age group, there were 51 patients (29.3%), including 9 males and 42 females. The 65–74 age group included 42 patients (24.1%), of whom 3 were male and 39 were female. Finally, the 75–84 age group had 3 patients (1.7%), all of whom were male. The average age of the patients undergoing knee X-ray examination was 48 years. The highest frequency of knee complaints was observed in the 45–54 age group.

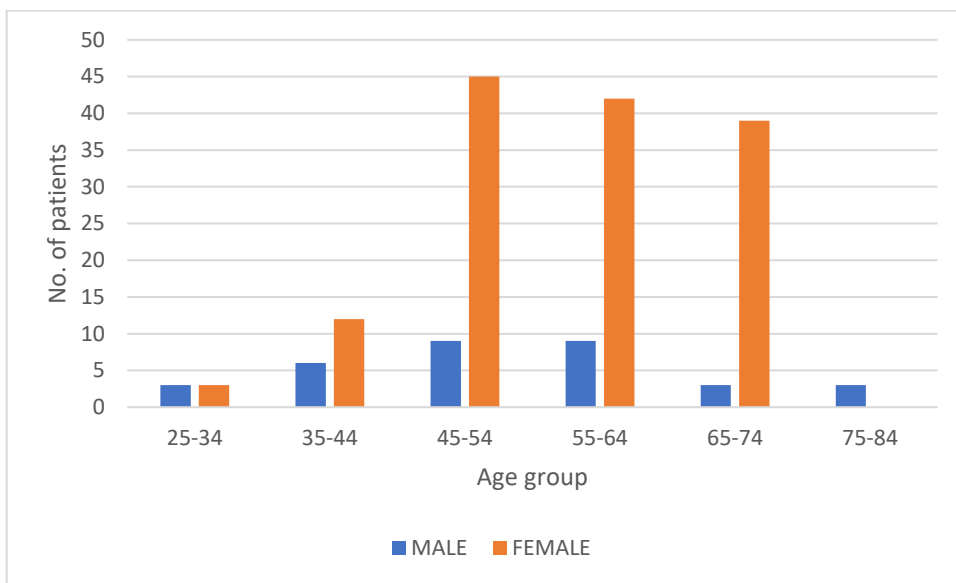


Chart No. 1.2 Patients divided by age group

Clinically diagnosed knee

One of the most prevalent and incapacitating joint conditions in the world is osteoarthritis, namely knee arthritis. One of the main weight-bearing joints, the knee is essential for balance, movement, and daily tasks including standing, walking, and climbing stairs. The knee is especially susceptible to degenerative changes over time due to its pivotal function in movement and its susceptibility to mechanical stress. The study analyzes that among 174 patients, 18 patients has left knee arthritis, 27 patients has right knee arthritis and 129 patients has bilateral knee arthritis which are further divided into 5 grades. These grades are separated with the different stages of knee arthritis grades in male and female.

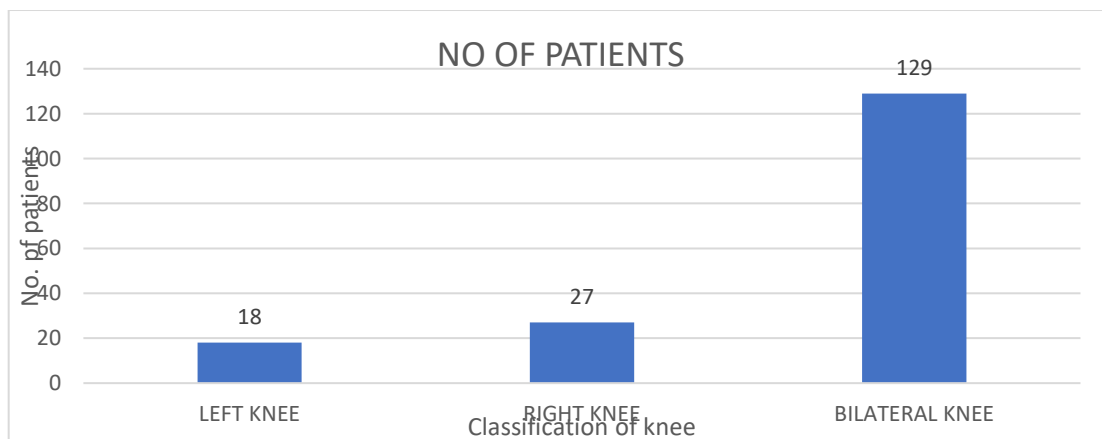


Chart 1.3 classification of knee

In our study, 15 patients were identified with early knee osteoarthritis changes classified as Grade 0 (G-0), including 6 males and 9 females. A total of 21 patients had Grade I (G-I) osteoarthritis, with 3 males and 18 females. Mild knee osteoarthritis, classified as Grade II (G-II), was observed in 45 patients, comprising 6 males and 39 females. Moderate knee osteoarthritis changes (Grade III, G-III) were seen in 57 patients, of whom 9 were males and 48 were females. Severe osteoarthritis (Grade IV, G-IV) was present in 36 patients, including 9 males and 27 females.

Notably, the majority of female patients in our data exhibited moderate knee osteoarthritis changes, corresponding to Grade III (G-III).

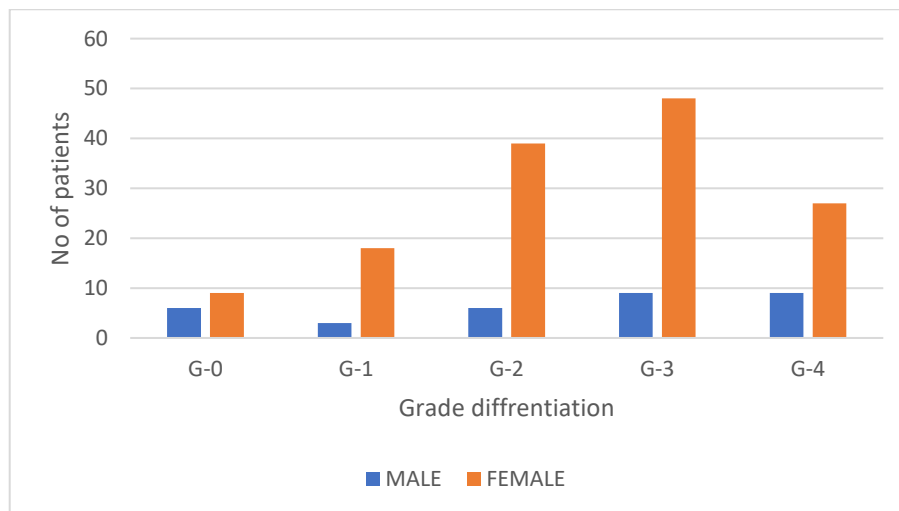


Chart 1.4 Grade differentiation

DISCUSSION

This epidemiological investigation focused on assessing the prevalence of knee osteoarthritis (OA) across age and gender among 174 patients, with particular emphasis on those exhibiting Kellgren-Lawrence (KL) grade 3 radiographic findings. Interestingly, a greater percentage of women had grade 3 OA, which is consistent with earlier studies showing that women are more susceptible to OA, especially after menopause, because of hormonal and biomechanical reasons [9,10].

Our results are consistent with those of Shamir et al. (2009), who used an automated KL classification system to examine 350 knee X-rays and discovered that grade 3 OA (moderate) could be distinguished from normal knees with a classification accuracy of 91.5%. Their research, which was part of the Baltimore Longitudinal Study of Aging, confirms that OA is very common in older people, especially those over 65, where up to 80% of people had radiographic OA [11]. The gender-based skew in OA severity is consistent with wider epidemiological trends, despite the lower size of our sample. The Shamir et al. study recognized demographic influences by guaranteeing a balanced representation of the aged population, regardless of symptoms, even though it concentrated on the technical classification of OA grades. This approach subtly emphasizes the significance of sex-specific analyses while bolstering the generalizability of their data. The greater incidence of grade 3 OA in our cohort's female participants may potentially be related to variances in joint alignment and biomechanical loading. Our investigation used clinical grading, which may include more subjective judgment, particularly in borderline situations, as opposed to the automated detection approach used by Shamir et al. Both studies, however, highlight the value of KL grading as a reliable instrument for epidemiological understanding, with KL grade 3 acting as an unmistakable indicator of moderate illness burden.

Future research should combine demographic information with automated image analysis to improve early detection and focused therapies, particularly for high-risk populations like older women [12].

CONCLUSION

Knee osteoarthritis is one of the common forms of arthritis. A lot of people in the world suffer from it, causing pain, stiffness and disability. It's a growing concern in aging population globally. To diagnosis knee osteoarthritis

the primary modality is x-ray. The x-ray examination diagnoses knee osteoarthritis at the early stage, so we can take the major preventive at the starting stage to reduce it to become a severe grade arthritis. In this study 174 patients were selected out of which 141 patients were females and 33 patients were males. Patients were separated in different group according to their age.

This data analyzed that the age between two age groups 45-54 have maximum no. of patients that came for knee diagnosis. To further analyzing this data, we firstly categorized all patients into different categories based on whether they had left knee, right knee, or bilateral knee involvement. Out of all case studies, the maximum cases were found related to bilateral knee osteoarthritis, indicating that most patients experienced symptoms in both knees rather than in a single knee. This result shows the major probability of bilateral involvement among the studied population.

Based on our study, Knee arthritis has been divided into five grades from 0 to 4, based on their severity levels. Out of all patients, most of them had Grade 3, that shows the reference of having a moderate level of arthritis. This shows that moderate knee damage was the most common in our population. In this study we found out there were 15 patients who showed signs of early osteoarthritis on X-ray. And if early osteoarthritis changes occur and got detected on x-ray or by clinical symptoms there are many preventive strategies which can help Control the condition, ease discomfort, and support a better daily life. The preventive measures that we can take are: - weight management, muscle strengthening, low impact aerobic activity, anti-inflammatory diet, regular monitoring, use of knee braces and support. In the conclusion of this study, we found out that there is more probability of getting knee arthritis in females in comparison then the males.

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