# Incidence of primary osteoarthritis knee below 40 years of age and its etiological factors: OPD survey of 200 knee pain patients

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## Abstract

**Introduction:** For decades, knee OA had been viewed as a disease mostly affecting older population, consequently, only few population-based studies have examined the frequency and characteristics of OA knee in persons under the age of 40 years leading to dearth of literature over this subject matter. Recent evidence however, documents increased incidence of two key risk factors for knee OA – traumatic knee injury and obesity, particularly in the young. Studies have shown that mean age of onset of osteoarthritis knee has decreased over couple of decades and projected incidence of the disease in young is on the rise.

**Materials and Methods:** Patients of either sex coming to the OPD of the Department of Orthopaedics with chief complaint of knee pain were assessed as per the preformed and pretested questionnaire and subjected to AP view of both knee in standing position until 200 such cases with age ≤ 40yrs were separated. The cases were assessed as per Kellgren Lawrence grading. The patients were also assessed for height, weight, BMI and other parameters. Cases were selected carefully after excluding the subjects as per the adopted exclusion criterion.

**Results:** After survey of 200 knee pain patients below 40 years of age, over a period of one and a half years, incidence of primary osteoarthritis knee on the radiological basis was found to be 6.54%. Mean age of 200 subjects were 34.7 years with female: male ratio being 6:1(p=0.004). 82.1% cases of OA had BMI >24.9kg/m2 (p=0.004) whereas 80 females cases had BMI>24.9kg/m2 (p=0.007). 53.5% cases had predominantly sitting/ squatting /kneeling as household habits (p=0.02). 67.8% cases were of medium activity group on the basis of their occupation while 57.1% (p=0.05) of cases had history of OA knees in the first degree relatives.

**Conclusion:** The incidence of OA knee in the young is increasing. Knowing the risk factors and disease volume in younger age groups would allow primary prevention of OA to be implemented in young adulthood to curtail the emergence of radiographically-defined OA at the mid-life and also prevent disabilities saving the healthcare system from the tremendous economic burden of the disease.

**Keywords:** Osteoarthritis knee, Below 40 years, Incidence, Etiological factors, Young age.

## Introduction

Osteoarthritis (OA), also often called 'osteoarthrosis or 'degenerative joint disease,' affects more people than any other joint disease.[1] OA is ranked as either the top or second leading cause of disability among elders.[2] It is now listed on the World Health Organization's top 10 list of global disease burden, with the knee being one of the most frequently affected joints.[3]

For decades, knee OA had been viewed as a disease mostly affecting elderly people, consequently, only few population-based studies have examined the frequency and characteristics of OA knee in persons under the age of 40 years.[4] There is very limited literature on this subject matter but recent international studies have shown that over the period of two decades, the age of onset of diagnosed cases of knee OA has decreased by 16 years.[5] In this study, two distinct categories (the 1900s vs 2010s) of age-stratified 10-year incidence of symptomatic physician-diagnosed knee OA were assessed. It was found that the mean age of diagnosed knee OA onset fell from 72 ± 12 years (mean ± standard deviation) to 56 ± 18 years over the period of two decades. Nearly 6.5 million indivisuals between the ages of 35 and 84 will be diagnosed with symptomatic knee OA in the next decade if the same trend of OA incidence continues, the study estimates.[5]

There is increasing evidence that OA is progressing to severe disease in younger people. The Canadian Joint replacement Registry 2009 Annual report cites a 3 folds increase in the number of total knee replacements (from 772 to 3172 procedures) in those ages 45-54 years in between 1996-1997 and 2006-2007. Moreover, the majority of economic costs of OA accounted for by long term disability are incurred by those ages 35-64 years. Despite the considerable impact of OA symptoms in people as early as the third or fourth decade of life, there is paucity of research on OA management in early life. Rather, research has focused on OA management in older adults.[6]

The scarcity of literature regarding characteristics of OA knees in the younger age group both in India and internationally cannot be over emphasised. The last two recent studies reporting incidence of symptomatic knee OA in the US were published 17 years ago in 1995.[7-8] To understand the direction of affect in quality of life and how the health services can be utilized, it is imperative to deternime the age of onset of symptomatic knee OA.[8]

## Materials and Methods

This was a study carried out in the Department of Orthopaedics in the Govt. Medical College, Amritsar. Patients of either sex coming to the OPD of the department with chief complaint of knee pain in one or both knees after screening from the exclusion criterion, were the subjects of the study.

Cases were assessed as per the preformed questionnaire and subjected to AP view of both knee in standing position until 200 such cases with age ≤ 40yrs were separated. The cases were assessed as per Kellgren Lawrence grading. Structured questionnaire was in the local language and

consisted of demographic profile age and sex, education, occupation, housing conditions(including type of toilet), type of work and household lifestyle and social habits related information, physical parameters height and weight, history of osteoarthritis knee in any first degree relatives, screening questions (exclusion criterion) and informed consent. Occupation wise cases were divided into high, medium and low activity groups based on daily activity level. (Table 1) Daily activities were noted as predominantly involving sitting/squatting/kneeling, standing or nothing specific.

Exclusion criterion included patients with history of any major medical or surgical illness that limits lower limb function, joint trauma or fracture in the lower limb or spine, infection, rheumatoid arthritis, inflammatory arthritis, polyarthralgia, gouty arthritis (serum uric acid >6.5 mg%). Blood investigations included complete Hemogram, ESR, RA factor, Serum Uric acid, CRP

Kellgren Lawrence Grading- Classification of Osteoarthritis knee was used in our study on standing bilateral knee X-rays AP view. (Table 2)

## Results

Only patients with KL Grading more than or equal to 2 (KL≥2) in both or either knees were considered significant and regarded as cases of OA as it remains the most widely used definition for tibifemoral OA knee.[7] Study results were formulated with observations made over a period of one and a half years. 2141 knee pain patients of all ages, coming to the OPD were evaluated to reach 200 knee pain cases below 40yrs of age. Out of which, 1712 knee pain cases had primary osteoarthritis. Out of 200 below 40yrs age cases, 112(54%) had radiologically proven osteoarthritis.
So,

$$\text{Incidence} = \frac{\text{No. of cases of primary OA below 40 yrs}}{\text{No. of cases of primary OA of all ages}}$$

$$= \frac{112}{1712} \times 100\% = 6.54\%$$

So, Incidence of Primary Osteoarthritis Knee in below 40yrs age group coming to the OPD was found to be 6.54%.

### Kellgren Lawrence (KL) Grade

60 (45.4%) had predominantly right side knee involvement while 16(12.1%) cases had left knee involved. 56(42.4%) had bilateral knee involvement. Bilateral cases had similar KL grading on both sides. Out of the 200 surveyed cases 68(34%) had no radiological evidence of OA knee i,e grade 0 were only symptomatic, 20(10%) had KL grade I, 32(16%) had KL grade II, 72(36%) had KL grade III while 8(4%) cases had KL grade IV in one or both knees. Grade II and III combined constituted 52% cases.
Etiological factor that were found in the study included the following:

### Age Group

76 cases (67.8%) were of 35-40yrs age group, 28cases (25%) were of 30-34yrs group while 8 cases (7.1%) were of 25-29yrs age group.

### Sex

96(85.7%) were females and 16(14.3%) were male, accounting to 85.7% cases. Females to male ratio was 6:1.

### Basal Metabolic Index (BMI)

BMI (kg/mt$^2$) more than 24.9, as a predictor of obesity was found to present in 92(82.1%) cases, while 20(17.8%) had BMI between (18.9- 24.9)kg/mt$^2$ and none of the cases were below 18.9 kg/mt$^2$. (Table 3)

### Family History

Amongst the 112 OA cases, 64(57.1%) had history of OA knees in the first degree relatives. While 58(42.9%) cases did not have any history of OA knee in the family.

### Household Habits

60(53.5%) had predominantly sitting/ squatting /kneeling as household habit. 48(42.8%)cases had predominantly standing as household habit while 4(3.5%) cases had nothing specific as a predominant household habit.

### Female Sex and Household Activities

It was observed that female cases with sitting/squatting/kneeling household activity had strong correlation with OA knee with p value < 0.026 (significant)(Table 4)

### Occupation

In the occupation wise distribution, highest number of cases were housewives and housemaids amounting to 70 cases. Rest of the cases comprised of tailors, skilled workers and farmers, out of the 112 OA cases in the study.

### Activity Level

On the basis of occupation, cases were divided into 3 categories of activity group. Highest number of cases belonged to the medium activity group with 76 (67.86%). Low activity group and high activity group had 20(17.8%) and 16(14.29%) cases respectively. (Table 1)

The etiological factors found in the study were assessed by both univariate (Table 5) and multivariate logistic regression (Table 6).

Univariate logistic regression was performed to assess significant risk factors for the presence of OA. The risk of OA was significantly higher in females as compared to males with odds ratio of 2.8. Patients with BMI>24.9 kg/mt$^2$ had significantly higher risk of OA with odds ratio of 2.629.

After adjusting for confounding factors, gender and BMI was independent risk factors of OA Female and patients with BMI>24.9 were the significant risk factors of OA with odds ratio of 2.587 and 2.438 respectively.

**Table 1**

| High activity group | Farmer working actively in the field and labourers both men and women. |
|---|---|
| Medium activity group | Shopkeepers, skilled workers, women doing household work, land owners who do not till the land themselves. |
| Low activity group | Retired men and women leading a sedentary life, professionals, traders, office staff. |

**Table 2**

| Grade 0 | No findings |
|---|---|
| Grade 1 | Doubtful: minute osteophyte, doubtful significance. |
| Grade 2 | Minimal: definite osteophyte, unimpaired joint space. |
| Grade 3 | Moderate: moderate diminution of joint space. |
| Grade 4 | Severe: joint space greatly impaired, with subchondral bone sclerosis and possible deformity of bone ends. |

**Table 3**

| BMI | OA absent | OA present | |
|---|---|---|---|
| Sample size | 88 | 112 | |
| Mean ± Stdev | 26.72 ± 4.16 | 28.56 ± 3.78 | P value 0.007 |
| Median | 27.45 | 28.96 | |
| Min-Max | 19.7-33.33 | 21.7-36.73 | |
| Inter quartile Range | 23.190 - 30.400 | 25.850 - 31.345 | |

**Table 4**

| Household habits/activities (females) | OA absent | OA present | Total | |
|---|---|---|---|---|
| Siting/squatting/kneeling | 24(40%) | 56(58.3%) | 80 (51.28%) | |
| Standing | 36(60%) | 40(41.6%) | 76 (48.72%) | P value 0.026 |
| Total | 60 (100.00%) | 96 (100.00%) | 156 (100.00%) | |

**Table 5: Univariate logistic regression for presence of OA**

| | B (Unstandardized beta) | S.E. (Sample error) | P value | Odds ratio | 95% C.I. for Odds ratio | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **Age (years)** | .063 | .041 | .129 | 1.065 | .982 | 1.154 |
| **Sex** | | | | | | |
| Male | | | | 1.000 | | |
| Female | 1.030 | .354 | .004 | 2.800 | 1.399 | 5.604 |
| **BMI(kg/mt$^2$)** | | | | | | |
| 18.9-24.9 | | | | 1.000 | | |
| >24.9 | .966 | .332 | .004 | 2.629 | 1.372 | 5.035 |
| **Activity level** | | | | | | |
| Low | | | | 1 | | |
| Medium | .488 | .350 | .164 | 1.629 | .820 | 3.236 |
| High | .875 | .528 | .098 | 2.400 | .852 | 6.760 |
| **Family history** | | .291 | .055 | 1.750 | .989 | 3.097 |
| **Household activity** | | | | | | |
| Sitting/squatting/kneeling | | | | 1 | | |
| Standing | -.511 | .293 | .082 | .600 | .338 | 1.066 |
| Nothing specefic | -.511 | .738 | .489 | .600 | .141 | 2.548 |

**Table 6: Multivariate**

| | B (Unstandardized beta) | S.E. Sample error | P value | Odds ratio | 95% C.I. for Odds ratio | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **Sex** | | | | | | |
| Male | | | | 1.000 | | |
| Female | 0.950 | .361 | .008 | 2.587 | 1.275 | 5.250 |
| **BMI** | | | | | | |
| 18.9-24.9 | | | | 1 | | |
| >24.9 | .891 | .338 | .008 | 2.438 | 1.256 | 4.734 |

df=1

**Statistical Analysis**

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Quantitative variables were compared using Mann-Whitney Test (as the data sets were not normally distributed) between the two groups.

Qualitative variables were correlated using Chi-Square test. Univariate and multivariate logistic regression was used to assess significant factors for the presence of OA. A p value of <0.05 was considered statistically significant. The data analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

**X-rays B/L knee AP standing view of OA cases below 40yrs of age KL grade I**
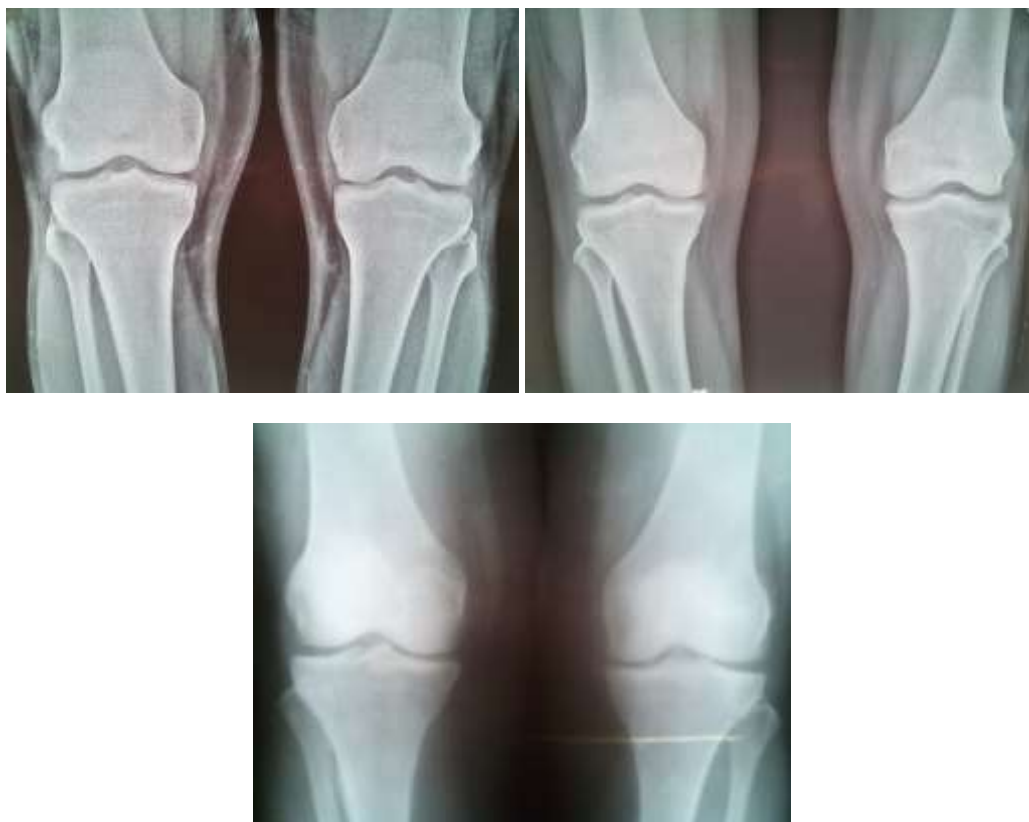
**X-rays B/L knee AP standing view of OA cases below 40yrs of age KL grade II**



**X-rays B/L knee AP standing view of OA cases below 40yrs of age KL grade III**

**X-rays B/L knee AP standing view of OA cases below 40yrs of age KL grade IV**

## Discussion

There is paucity of meaningful data on the cumulative incidence of developing OA. Most population-based data on knee OA prevalence and incidence refer to studies conducted in the mid-1990s.[7-9] National data on incidence of OA are lacking, and studies are scarce even in the international context.[10] There is also dearth of literature over the characteristic and frequency of osteoarthritis knee in the young age. However the evolving data points to a high prevalence of post traumatic knee OA in younger persons.[11] This trend and the increasing prevalence of obesity among children are likely to lead to increased rates of osteoarthritis in young adults.[12]Significant portion of middle aged population is now projected to be suffering from osteoarthritis knee. The incidence of Osteoarthritis knee below 40yrs calculated in our study was 6.54%.It provides some insight and baseline figure characterizing osteoarthritis knee in young age group. No previous study distinctly specifies knee OA incidence below 40 years age group.

Several risk factors were identified in the study, female sex being the most significantly associated and present in 85.7% of cases. It is known that gender influences development of knee osteoarthritis by multiple routes including hormonal influence on cartilage metabolism, gender related difference in joint laxity[13] and strength related to bodyweight.[14] Several studies have shown that women develop knee osteoarthritis more frequently than men.[15,16] In India the scenario is worsened for females because of routine social habits of kneeling/squatting putting additional stresses during worshipping, cleaning and mopping of household etc.

BMI >24.9 kg/mt$^2$ (obesity) was found in 82.1% of OA cases. Body mass index is an independent predictor of knee osteoarthritis as seen by Gelber et al[17] in there study. Increased loading on the joint is probably the main, but not only, mechanism by which obesity causes knee or hip OA. Overloading the knee and hip joints could lead to synovial joint breakdown and failure of ligamentous and other structural support. We also observed significant correlation between female sex with high BMI and OA knee.

Data from the first National Health and Nutritional Examination Survey (HANES I) indicated that obese women had nearly 4 times the risk of knee OA as compared with non–obese women, for obese men risk was 5 times greater.[18] Similarly Fellon et al[19] reported obesity as a strong risk factor for both progression in the affected knee and osteoarthritis in the contralateral knee. Compared with normal weight women, obese women with knee osteoarthritis were found to have significantly poorer quality of life and function scores too. The results from the Framingham Study demonstrated that women who had lost about 5 kg had a 50% reduction in the risk of development of symptomatic knee OA.[20]

53.5% of OA cases in our study had predominantly sitting/ squatting /kneeling as routine household habits. In a study to see the impact of squatting on tibiofemoral knee osteoarthritis by Zhang et al,[21] it was found squatting at age 25 was a risk factor for knee OA among elderly Chinese subjects in Beijing. Its effect was much stronger on tibiofemoral knee OA than on patellofemoral knee OA. For Indian scenario, there has been no similar study which shows association between OA knee with kneeling/ squatting. Although Indian style toilet, household activities of washing utensils, cleaning the floor, farming in the fields in squatting and kneeling is very common. These activities have led to higher incidence of OA knees. Fellon et al similarly reported that the risk of development of knee OA was more than two times greater for men whose jobs required both carrying and kneeling or squatting in mid-life had more than for those whose jobs did not require these physical activities.[22]

In our study, 57.1% cases of OA had history of OA knees in the first degree relatives showing heritable component of OA. The association is supported by Kerkhof et al[23] who reported that the C allele of rs3815148 on chromosome 7q22 was associated with a 1.14-fold increased prevalence of knee and/or hand OA and also with a 30% increased risk of knee OA progression.

## Conclusion

Since OA knee is a significant contributor to pain and disability and poses severe burden on economy, primary prevention of knee OA should become a major aim of health care. Unlike earlier views, OA knee is no longer restricted to older age group. Evidence shows that its frequency is

increasing in younger age also. With scarcity of literature characterizing it in the younger age group, need for further research is required in this field so as to shift the focus from management of OA knee in the older age to its prevention in early age and decrease the risk of disease progression to advanced stages. The design of preventive strategies requires a clear understanding of the risk factors for the disorder which as shown in the study mainly include female sex, obesity, occupation, kneeling/squatting in daily activity, family history of OA knee.

The study, albeit being an OPD based observational study highlights the disease volume of OA knee and gives a baseline estimate of the incidence of OA knees in younger age groups, coming to the OPD of a typical government hospital of our country (calculated as 6.54%). It also identifies the etiological factors, especially the modifiable ones, associated with knee OA occurrence in early life. In such cases, lifestyle modifications in the form of weight reduction, knee physiotherapy, quadriceps and hamstring strengthening and stretching exercises should be encouraged from the beginning. Avoiding stresses to knee joint by excessive kneeling and excessive squatting in routine activities. Knowing the risk factors would allow primary prevention of OA to be implemented in young adulthood to curtail the emergence of radiographically-defined OA at the mid-life. Furthermore, efforts to curtail the progression of OA at early age would prevent disabilities and save the healthcare system from the tremendous economic burden of the disease.

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