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## Evaluation of significance of clinical scoring systems in osteoarthritis knee in a South Indian population

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### Abstract

**Introduction:** Osteoarthritis is one of the most common joint disorders in adult population affecting about 10 % of global population above the age of 60 years. Knee osteoarthritis is an important contributor for global disability among the other osteoarthritis and it contributes for 83% of the global disease burden for osteoarthritis. The symptoms of knee osteoarthritis include pain, stiffness and activity induced swelling. Present study aims to validate the correlation between WOMAC index, a widely used clinical scoring system and radiologically proven osteoarthritis which is graded by Kellgren-Lawrence radiological grading system.

**Material and Methods:** The present study was undertaken in a tertiary care teaching hospital by the Department of Orthopaedics, IGMC & RI, Puducherry. It was a hospital-based cross-sectional study. A sample of 240 respondents was selected based on inclusion criteria. Functional limitation and radiological assessment were done using Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Kellgren and Lawrence (KL) scoring scale respectively.

**Observation and Results:** The mean age of the study participants was 58.17±8.18. Chi square test was applied to test the correlation between WOMAC scoring and Kellgren-Lawrence radiological grading and found that there was significant correlation ( $P=0.0001$  which was  $<0.05$  and hence statistically significant) between two variables.

**Conclusion:** We conclude that from this study a positive correlation has been established between WOMAC scoring and radiological grading by Kellgren-Lawrence in our institute and further studies are needed to assess the use of WOMAC scoring in preoperative and postoperative follow up of severe arthritis.

**Keywords:** clinical scoring systems, osteoarthritis knee

### Introduction

Osteoarthritis is one of the most common joint disorders in adult population<sup>[1]</sup> which causes significant limitation of mobility and increased burden to the patient. As the disease progresses disability<sup>[2]</sup> causes limitations in activities of daily living<sup>[3]</sup>. About 10 % of global population above the age of 60 years are affected by osteoarthritis of knee. The sex distribution of osteoarthritis varies in various age group. Incidence of osteoarthritis below the age of 45 years was more in male patients compared to more female patients being affected after the age of 55<sup>[4]</sup>. The pathology of Osteoarthritis of knee included cartilage degeneration most likely as a result of the chondrocytes attaining a stress induced senescent state due to oxidative stress and cytokine production as a result of aging and mechanical load<sup>[5]</sup>. The prevalence of knee osteoarthritis compared with other joints was found to be higher<sup>[1]</sup>. Knee osteoarthritis was an important contributor for global disability among the other osteoarthritis<sup>[6]</sup> and it contributed for 83% of the global disease burden for osteoarthritis<sup>[7]</sup>. The symptoms of knee osteoarthritis include pain, stiffness and activity induced swelling. Usually knee osteoarthritis is assessed by radiological investigations. Kellgren-Lawrence radiological grading system was used for a long time to assess the severity of knee osteoarthritis. However radiological features of knee osteoarthritis may not always correlate with clinical severity<sup>[8]</sup>. There are many clinical scoring systems used for evaluation of knee osteoarthritis<sup>[9]</sup>. The Western Ontario and McMaster (WOMAC) index is one of the most widely used clinical scoring systems which is validated for its significance in many studies<sup>[10-12]</sup>. The present study aims to validate the clinical significance and correlation between WOMAC index and radiologically proven

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osteoarthritis which is graded by Kellgren-Lawrence.

### Material and Methods

The study was done in tertiary care teaching hospital by the Department of Orthopaedics, IGMC & RI, Puducherry.

**Study design:** It was a hospital-based study conducted during the period of March 2018 to August 2018.

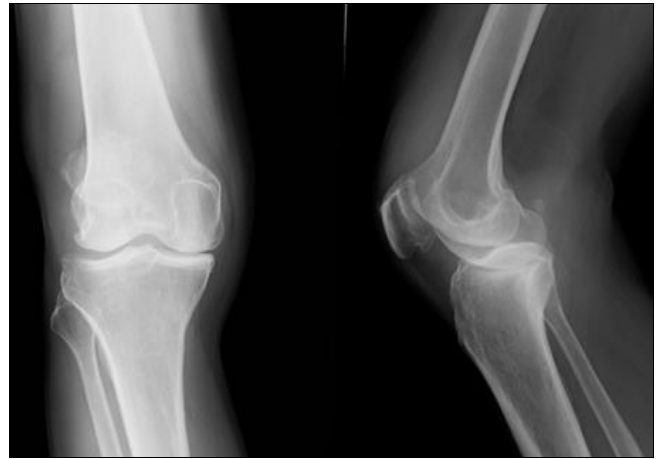
**Sample size and sampling:** According to the data available, prevalence of osteoarthritis is around 28.7%, at the significance level of 0.05, power being taken at 80% and absolute precision of 5%. Thus, the sample size arrived at was 240.

**Selection of participants:** Patients of both genders in the age group of 40-80 years with chronic knee pain (> 3 months), which is non-traumatic and non-radicular with or without deformity (Varus or valgus) and willing to give consent were included in the study. Patients with recent history of trauma to knee, injury to ligaments or any chronic medical condition such as inflammatory rheumatic diseases, pulmonary or cardiac diseases and not willing to participate were excluded from the study.

**Assessment of functional limitations:** We used Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) to evaluate the functional limitation of an Osteoarthritic knee. It is a self-administered questionnaire consisting of 24 items divided into 3 subscale such as Pain (5 items): during walking, using stairs, in bed, sitting or lying, and standing upright, Stiffness (2 items): after first waking and later in the day and Physical Function (17 items): using stairs, rising from sitting, standing, bending, walking, getting in / out of a car, shopping, putting on / taking off socks, rising from bed, lying in bed, getting in / out of bath, sitting, getting on / off toilet, heavy domestic duties, light domestic duties.

**Radiographic assessment:** Each knee joint was graded using the Kellgren and Lawrence system, (KL) grade (0-4), where 0 = normal radiograph; 1 = doubtful pathology; 2 = minimal osteophytes, possible narrowing, cysts, and sclerosis; 3 = moderate, as in definite osteophytes with moderate joint space narrowing; 4 = severe, with large osteophytes and definite joint space narrowing. The Kellgren-Lawrence grading scale is a reliable and valid testing tool used in conjunction with radiograph. It is a self-administered questionnaire consisting of 24 items divided in to 3 subscale such as pain 5 items, stiffness 2 items and physical function 17 items.

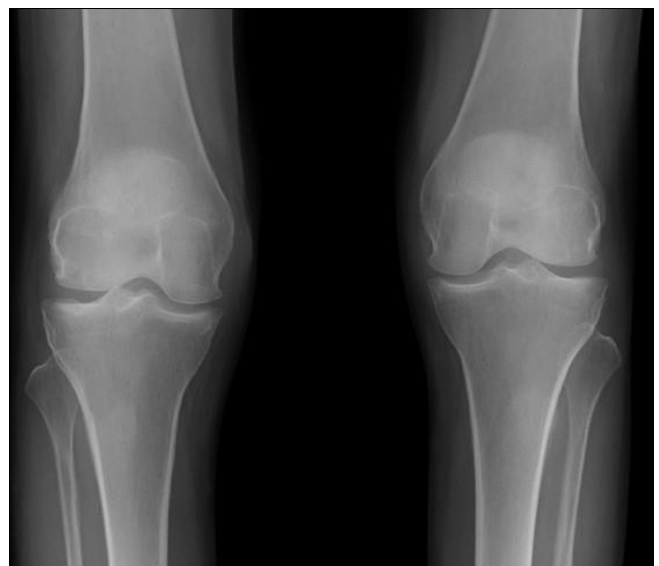
**Statistical analysis:** Data was analysed using SPSS 24.0 software (SPSS Inc., Chicago, Illinois, USA) package. Descriptive statistics were used to describe demographic characteristics. Non-parametric test such as Kruskal Wallis test was used to analyse if there were any significant differences in the level of pain and disability as compared to Kellgren-Lawrence grading scale. Chi square test was used to calculate the P value (value < 0.05 being statistically significant. We followed 'the Strengthening the Reporting of Observational Studies in Epidemiology' (STROBE) guidelines for reporting the present study.



**Fig 1:** Shows grade IV Kellgren-Lawrence showing large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bone contour



**Fig 2:** Plain radiograph showing grade III Kellgren-Lawrence. Moderate osteophytes, definite joint space narrowing in medial compartment, deformity of bony contour



**Fig 3:** Shows grade II Kellgren-Lawrence with definite osteophyte lipping, definite narrowing of joint space.

## Results

**Table 1:** Distribution of age, gender and BMI among study participants

Variables	Total n=240
<b>Age group</b>	
40-49	50 (21)
50-59	88 (36.6)
60-69	80 (33.3)
70-80	22 (9.1)
Age (years) (mean $\pm$ SD)	58.17 $\pm$ 8.18
<b>Gender</b>	
Female	139 (58)
Male	101 (42)
BMI (kg/m <sup>2</sup> ) (mean $\pm$ SD)	30.20 $\pm$ 3.13

Figures in the parenthesis are percentages

**Table 2:** Clinical characteristics among study participants

Variables	Total n=240
<b>Womac score</b>	
31 – 40	28 (11.6)
41 – 50	52 (21.7)
51 – 60	120 (50)
> 60	40 (16.7)

Figures in the parenthesis are percentages

**Table 3:** Radiological characteristics among study participants

Variables	Total N=240
<b>Kellgren – Lawrence scale</b>	
Grade I doubtful pathology	31 (13)
Grade II minimal osteophytes, possible narrowing, cysts, and sclerosis	72 (30)
Grade III moderate, as in definite osteophytes with moderate joint space narrowing	109 (45.4)
Grade IV severe, with large osteophytes and definite joint space narrowing	28 (11.6)

Figures in the parenthesis are percentages

**Table 4:** Correlation between Functional WOMAC score and KL score

Womac score	KL score				Total
	1	2	3	4	
31 - 40	12	12	4	0	28
41 – 50	17	24	10	1	52
51 - 60	2	18	90	10	120
> 60	0	18	5	17	40
Total	31	72	109	28	240

(P value = 0.0001)

### Observations and Results

Of the total 240 patients included in this study 139 were females and 101 were male patients with a slight female predominance of 58%. The mean age of the study group was 58.17 $\pm$ 8.18. The highest distribution of osteoarthritis in our study population was found in the age group of 50-59 (36.6%) followed by age group of 60-69(33.3%). The average Body Mass Index (kg/m<sup>2</sup>) was 30.20 $\pm$ 3.13. Most patients had WOMAC scoring between 51-60 which was around 50% followed by 41-50 (21.7%), >60(16.7%) and least had scores between 31-40 (11.6%). Radiological characteristics among study participants based on Kellgren-Lawrence scale showed that 31 patients (13%) had grade I changes, 72 patients (30%) had grade II changes, 109 patients (45.4%) had grade III changes and finally 28 patients (11.6%) had grade IV changes.

In our study on comparing the clinical and radiological scoring system we found that out of total 28 patients with WOMAC score between 31-40 twelve patients had Kellgren-Lawrence grade I and grade II each and 4 patients had grade III and no patient had grade IV changes. Similarly, 52 patients had WOMAC scoring between 41-50 and out of which 17 patients had grade I, 24 patients had grade II, 10 patients had grade III and 1 patient had grade IV Kellgren-Lawrence radiological changes. 120 patients with WOMAC score between 51-60 which denoted significant clinical pain and discomfort had 90 patients with grade III, followed by 18 patients with grade II, 10 patients with grade IV and only 2 patients with grade I Kellgren-Lawrence scale. Remaining patients with more than 60 WOMAC score who amounted to 40 in number, had no patients with grade I, 18 patients with grade II, 5 patients with grade III and 17 patients with grade IV Kellgren-Lawrence scale radiological changes.

In our study chi square test was applied to test the correlation between WOMAC scoring and Kellgren-Lawrence radiological grading and found that there was significant correlation (P=0.0001 which was <0.05 and hence statistically significant).

### Discussion

Osteoarthritis knee is particularly important in view of its high prevalence and association with severe pain and disability. In this cross-sectional study, we compared clinical and radiological scoring system. Our study demonstrated significant correlation between functional WOMAC score and radiological (KL) scoring system. Chi square test was applied and P value was found to be 0.0001 which is < 0.05 so it is said to be statistically significant. A similar study was done by Vidyarthi *et al.* [13] in India and found a significant correlation between WOMAC scoring, joint space narrowing and Kellgren-Lawrence grading. Similarly Rajpoot *et al.* [14] in his study established a direct correlation between clinical scoring system of WOMAC and radiological grading of KL. Kwok *et al.* [15] in his study found moderate correlation between WOMAC pain progression and loss of tibiofemoral cartilage in the year before knee replacement but failed to establish any correlation between WOMAC pain and radiological medial joint space narrowing. On the other hand a study done in Turkey by Cubukcu *et al.* [16] could not establish any correlation between KL scoring and WOMAC index. A study was done in 2004 by Baker *et al.* [13] found poor correlation between functional WOMAC score and KL score. Rupprecht *et al.* [17] in his study to compare different diagnostic features of osteoarthritis knee did not find any correlation between WOMAC scoring and radiological grading by KL. This may be due the variation in radiological features of knee osteoarthritis not always correlating to clinical features like pain and stiffness as observed in the studies done by Davis *et al.* [18] and a similar study of McAlindon *et al.* [19] where he concluded that functional impairment of elderly osteoarthritis patients depended more on age, knee pain and quadriceps strength and not on radiological severity. These studies suggest that though radiological severity based on KL scoring can be used to grade severity of the disease but clinical scoring systems which are based on pain, stiffness and physical function are more important and can be independent of radiological severity.

The mean age of the patients included in this study was 58.17 $\pm$ 8.18 which was similar to the Sancheti *et al* study [20], India-Based Knee Osteoarthritis Evaluation (iKare) conducted

in 3 different hospitals in India which was 55.6 and comparable the study done by Cubukcu *et al.* [16] in Turkey which was 56.98 ( $\pm 8.28$ ) [16]. The average age of knee osteoarthritis patients in the study done in a medical college from North India by Singh *et al.* [21] was 51.28 + 7.93 years. In our study female patients (58%) were more than male patients (42%) with a ratio of 1.38:1 and similar to 64% female distribution in India-Based Knee Osteoarthritis Evaluation (iKare) study and similar to increased prevalence in female (31.6%) than in male (28%) as in study of epidemiology of knee osteoarthritis in India by Pal CP *et al.* [22] The Singh *et al.* [21] study had similar sex distribution of 64% female and 36% male patients.

Since a positive correlation was established between WOMAC scoring and radiological grading by KL in our hospital the significance of WOMAC scoring in assessing the clinical severity of knee osteoarthritis can be established. The limitations of this study where it was done in a small sample size and in hospital set up, the study findings cannot be generalized. The study could not establish long term reliability of WOMAC scoring in follow-up patients which could be done in the future and in patients undergoing surgical management.

### Conclusion

We conclude that WOMAC scoring which is a simple, cost-effective but efficient instrument for assessing the clinical severity of knee osteoarthritis has a positive correlation with radiological grading of Osteoarthritis by Kellgren-Lawrence grading and hence can be used alone or in combination with radiological examination to grade and monitor the clinical course of patients with knee osteoarthritis.

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