ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 07 | July - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ASSOCIATION BETWEEN CLINICAL AND RADIOLOGICAL FEATURES OF OSTEOARTHRITIS OF THE KNEE

Orthopaedics

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ABSTRACT

Background: Osteoarthritis (OA) of knee is a progressive degenerative joint disorder characterized by cartilage breakdown and structural changes in the bone. Clinically, it presents with pain, stiffness, and functional impairment, while radiological grading often relies on the Kellgren-Lawrence (KL) classification. However, discordance between clinical symptoms and radiological severity is frequently observed. **Objective:** To assess the association between clinical features and radiographic findings in patients with primary knee osteoarthritis. **Methods:** This cross-sectional study was conducted on 97 patients aged >50 years with primary OA knee. Clinical symptoms were evaluated using Western Ontario and McMaster Universities Osteoarthritis Index, and radiographic severity was assessed using KL grading. Statistical associations were analyzed using ANOVA and Chi-square tests. **Results:** The majority of patients were in KL Grade III (48.5%) or IV (41.2%). A significant correlation was observed between KL grades and WOMAC scores ($p < 0.001$), indicating increasing clinical severity with higher radiological grades. No significant association was found with age or gender. **Conclusion:** Radiological severity in OA knee significantly correlates with clinical impairment. A combined clinical-radiological approach is essential for accurate diagnosis and management.

KEYWORDS

Osteoarthritis, Knee Joint; WOMAC Index; Kellgren-Lawrence Grading; Radiographic Assessment.

INTRODUCTION

Osteoarthritis (OA) of knee is leading cause of chronic pain and disability.[1] It is characterized by progressive degeneration of articular cartilage, subchondral bone changes, and osteophyte formation. Clinically, patients present with joint pain, stiffness, and functional limitation, while radiological assessment—most commonly via Kellgren-Lawrence (KL) grading—evaluates structural changes.[2]

Patients with mild imaging changes may report significant pain, while others with advanced radiological OA may remain relatively asymptomatic. This discordance raises concerns about relying solely on radiological grading for diagnosis and treatment decisions.[3,4]

Given the increasing burden of knee OA and the rising rate of total knee replacements driven largely by symptomatic presentation, it is essential to assess the extent to which clinical and radiological features align.[5] This study aims to evaluate the association between clinical symptoms and radiological findings in knee OA, to better guide individualized treatment planning and improve patient outcome.

MATERIAL AND METHODS

The present study was a cross-sectional observational analysis conducted in the Department of Orthopaedics at SRMS Institute of Medical Sciences, Bareilly, from 1st May 2023 to 31st October 2024. Ethical clearance was obtained from the Institutional Ethics Committee (Ref. No. SRMS IMS/ECC/2023/122), and informed consent was taken from all participants prior to inclusion. The study population comprised patients diagnosed with primary osteoarthritis of the knee who met the defined eligibility criteria.

Participants included were aged above 50 years, diagnosed with primary knee osteoarthritis, and demonstrated at least grade 1 changes on the Kellgren-Lawrence (KL) radiographic scale. Patients were excluded if they had secondary OA resulting from trauma, metabolic or endocrine disorders, congenital or developmental abnormalities, neuropathic conditions, or previous arthroplasty. Patients with serious systemic illnesses such as congestive heart failure or cerebrovascular accidents were also excluded to avoid confounding variables.

The minimum required sample size was calculated using the formula:

$$\mathbf{n = z^2pq/e^2}$$

where

- $p = 28.7\%$
- $q = 71.3\%$
- $e = 10\%$
- $z = 1.96$ at a 5% level of significance

Yielded a sample size of approximately 90.

Ultimately, 97 eligible patients were included. Prior to main study, a pilot study involving 10 patients (10% of the total sample size) was conducted to assess the feasibility and refine the study protocol, including tools such as the proforma and consent forms. These patients were not included in the final analysis.

All included patients underwent detailed clinical and radiological evaluation. In cases of bilateral knee involvement, the more symptomatic knee was assessed. Clinical assessment included evaluation of swelling, range of motion, crepitus, and functional status using WOMAC, which quantifies pain, stiffness, and physical function through a 24-item questionnaire. Radiological assessment was carried out using standing anteroposterior and lateral radiographs of knee, and severity was classified according to the KL grading system.

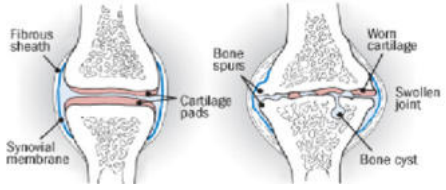

Figure 1: Knee Osteoarthritis

To ensure validity, standardized tools were used and assessment was done by experienced clinicians. Reliability was ensured through consistent data collection using a predesigned proforma, and test-retest reliability was confirmed by correlation coefficients indicating high reproducibility. Statistical analysis was performed using both descriptive and inferential methods. Frequencies, means, and standard deviations were used to summarize data, while t-tests and ANOVA assessed associations between demographic variables and WOMAC scores. The relationship between radiological severity and clinical features was evaluated using Chi-square test, with a p-value less than 0.05 considered statistically significant.

RESULTS

In our study comprising 97 patients diagnosed with knee osteoarthritis,

mean age was 64.84 ± 7.9 years. The majority of patients (42.3%) belonged to the 61–70 years age group, followed by 34.0% in the 51–60 years group, and 23.7% were aged 71 years and above. A gender-wise analysis revealed that females constituted a higher proportion of study population, accounting for 61.9%, while males comprised 38.1%, indicating a female predominance in knee osteoarthritis cases.

Table 1: Descriptive Statistics of WOMAC Score

WOMAC Component	Maximum Score	Mean	Standard Deviation	Median (Range)
Pain Score	20	7.70	2.147	8 (3–13)
Stiffness Score	8	2.19	1.102	2 (0–6)
Physical Function Score	68	41.96	7.647	43 (25–60)
WOMAC Total Score	96	51.86	9.901	53 (29–72)
WOMAC (in %)	100%	54.02	10.31	55.21 (30.21–75)

Rating difficulty score – 0: None, 1: Slight, 2: Moderate, 3: Very, 4: Extreme

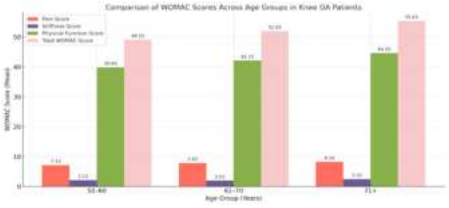

Figure 2: Comparison of WOMAC Scores Across Age Groups in Knee OA

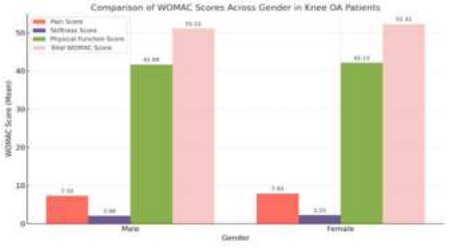

Figure 3: Comparison of WOMAC Scores Across Gender in Knee OA

Table 2: Distribution of KL Grade in Knee Osteoarthritis Patients

Kellgren–Lawrence Grade	Frequency	Percentage %
I	0	0.0%
II	10	10.3%
III	47	48.5%
IV	40	41.2%
Total	**97**	**100%**

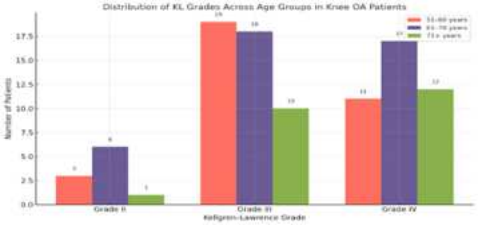

Figure 4: Distribution of KL Grades Across Age Groups in Knee OA

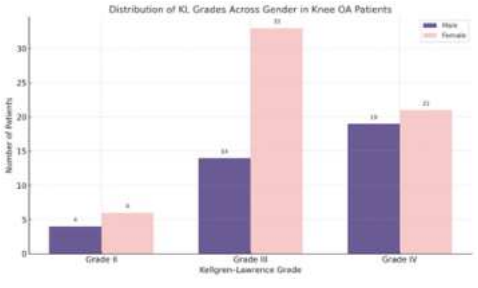

Figure 5: Distribution of KL Grades Across Gender in Knee OA

Table 3: Comparison of WOMAC Score Between Kellgren–Lawrence (KL) Grades

Score	KL Grade II (Mean ± SD)	KL Grade III (Mean ± SD)	KL Grade IV (Mean ± SD)	p value
WOMAC Pain Score	4.30 ± 0.675	7.15 ± 1.642	9.20 ± 1.556	<0.001
WOMAC Stiffness Score	1.10 ± 0.994	2.06 ± 1.009	2.60 ± 1.033	<0.001
WOMAC Physical Function Score	30.40 ± 3.688	39.87 ± 5.269	47.30 ± 6.268	<0.001
WOMAC Total Score	35.90 ± 4.677	49.09 ± 6.477	59.10 ± 7.642	<0.001

ANOVA Test

DISCUSSION

Osteoarthritis (OA) of knee is a major public health concern, especially among elderly, with a global prevalence of 3.3–3.6% and Indian estimates ranging from 17–61%. The current study reflected this trend, with majority of participants in their 60s (mean age: 64.84 years) and a female predominance (62%), likely due to postmenopausal hormonal changes.

Clinically, patients showed moderate pain and physical limitations, with mean WOMAC scores indicating moderate disability. No statistically significant variation in WOMAC scores was observed across age or gender, although slightly higher scores were noted in older individuals and females. While our study showed no significant age-related trends, **Gorial et al.** and **Singh et al.** found age to be positively correlated with WOMAC scores, likely due to declining proprioception.[6,7] Similarly, **Fang et al.** and **Elbaz et al.** observed worse WOMAC scores in females, suggesting a need for gender-specific management strategies.[8,9]

Radiographically, majority of patients were graded as KL III (49%) or KL IV (41%), indicating advanced disease stages. No significant association was found between KL grade and age or gender. However, **Choi et al.** reported higher KL grades in older individuals, potentially due to decreased bone density.[10] Other studies, such as those by **Elbaz et al.**, suggest estrogen deficiency post-menopause accelerates OA progression in women.[9]

Importantly, our study showed a strong association between KL grade and WOMAC scores. Higher KL grades corresponded to more severe pain, stiffness, and functional limitation, consistent with **Bedson and Croft**, who emphasized that KL grade ≥3 better predicted pain severity.[11] Additionally, **Davis et al.** and **Wang et al.** noted that higher KL grades were significantly associated with frequent pain and poor health outcome.[12,13]

Despite these findings, some studies highlighted discordance between clinical and radiological findings. **Hannan et al.** and **Steenkamp et al.** reported weak correlations between structural damage and pain, citing inflammation, soft tissue involvement, and central sensitization as possible contributors.[14,15] Subjective assessments may overlook early OA, underscoring the need for integrated diagnostic protocols.

Strengths

This study employed a strong methodology by integrating validated clinical assessment (WOMAC) with standardized radiological grading (Kellgren-Lawrence). The use of a well-defined, diverse sample and consistent scoring tools enhanced reliability and clinical relevance. Analysis across age and gender further strengthened the study's comprehensive evaluation of knee osteoarthritis.

Limitations

As a cross-sectional, single-center study, it cannot establish broad generalizability. Dependence on X-rays may overlook early soft tissue changes, and subjective WOMAC scores may be influenced by psychological or cultural factors.

CONCLUSION

In conclusion, our study demonstrates a significant association between clinical severity and radiological grading in knee osteoarthritis. Patients with higher Kellgren–Lawrence grades exhibited more pronounced pain, stiffness, and functional limitations as per WOMAC scores. While age and gender showed no statistically significant influence, the findings reinforce the importance of a combined clinical-radiological approach in diagnosing, staging, and managing OA knee. This integrative evaluation supports more

personalized and effective treatment strategies.

Conflict Of Interest: None.
Funding: None.
Ethical Approval: Obtained.
Consent: Written consent secured.

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