

Comparison of radiological classification in osteoarthritis knee- A Retrospective Study**Sandesh Agarawal¹, Prabhu Ethiraj^{2*}, Arun Heddur Shantappa³**¹ *Junior Resident ,Department Of Orthopaedics, Sri Devaraj Urs Academy Of Higher Education And Research , Karnataka,India*² *Professor, Department Of Orthopaedics , Sri Devaraj Urs Academy Of Higher Education And Research, Karnataka,India*³ *Professor and HOD,Department Of Orthopaedics , Sri Devaraj Urs Academy Of Higher Education And Research,Karnataka,India***Received: 14-02-2021 / Revised: 07-03-2021 / Accepted: 11-04-2021****Abstract**

Osteoarthritis (OA) is a leading cause of musculoskeletal pain worldwide and the knee is one of the most commonly affected joints. The pathogenesis of OA is poorly understood but is thought to include a complex interplay among mechanical, biochemical, cellular, genetic, and immunologic phenomena. To compare and correlate the radiological classification findings by using the standard anteroposterior view of both knee on standing position in the diagnosis of osteoarthritis of knee joint and its severity. **Methods and Material:** Retrospective study, hospital-based study conducted in 44 patients who were radiologically evaluated for complaints of Knee pain and diagnosed with Osteoarthritis. **Result:** Out of 44 patients, 25% and 41% of the subjects belonged to the class 1 and class 2 of Kellgren-Lawrence classification about respectively, Ahlback's grading about 45% and 43% of the subjects belong to the Class 1 and class 2 , IKDC classification (36%), (36%) subjects belong to the Class 1 and class 2 respectively. There was good agreement between Kellgren-Lawrence and Ahlback's classification with percent agreement of 65.9% and Kappa value of 0.487 (p-value<0.001). **Conclusion:** Agreement between Kellgren-Lawrence method, IKDC, and Ahlback's classification were high among subjects aged more than 40 years with osteoarthritis.

Keywords: Kellgren, Ahlback's, osteoarthritis, IKDC.

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Introduction

Osteoarthritis(OA) is a leading cause of musculoskeletal pain worldwide and the knee is one of the most commonly affected joints [1]. In 1886, English physician, John Kent Spender, coined the term Osteoarthritis. Osteoarthritis ranks globally among the 50 most common sequelae of diseases and injuries, affecting over 250 million people or 4% of the world's population[2].Of the global disease burden for OA, knee OA constitutes 83%. Overall prevalence of knee Osteoarthritis in India was found to be 28.7%[3].A community based cross-sectional study using Kellgren and Lawrence scale, showed the prevalence of 28.7% of OA in the overall sample. City wise estimates vary slightly with Agra having 35.5%, Bangalore 26.6%, Kolkata 33.7%, Dehradun 27.2%, and Pune 21.7% [4].The pathogenesis of OA is poorly understood but is thought to include a complex interplay among mechanical, biochemical, cellular, genetic, and immunologic phenomena[5].Plain radiography remains a mainstay in the diagnosis of OA. The first formalized attempts at establishing a radiographic classification scheme for OA were described by Kellgren and Lawrence(KL) in 1957[6].Later Ahlback's classified the knee osteoarthritis (OA) and published in 1968 [7]. Some studies stated that the KL classification is the most widely used clinical tool for the radiographic diagnosis of OA[8] and others using Ahlback's classification in the literature, clinical practice for the

follow-up of disease progression, as a classification criterion in clinical trials or epidemiological studies[9].The Ahlback's system has been found to have comparable inter observer precision and arthroscopy correlation to the IKDC system which was published in 1987 but most of the span of the Ahlback's system focused at various degrees of bone defect or loss, and it is therefore less useful in early osteoarthritis.

Systems that have been found to have lower interobserver precision and/or arthroscopy correlation are those developed by Kellgren-Lawrence,Fairbank,Brandt, and Jagger-Wirth[10].

Standard objective assessment of pathologic changes in the joint is typically accomplished via radiography to evaluate the presence of osteophytes and joint space narrowing.

Radiographic evidence, however, has been shown to have variable predictive validity[11].It has been documented that there is discordance between the radiological classifications of osteoarthritis knee[12].This creates interest in us for the comparison of radiological classification of knee osteoarthritis for a better diagnosis and further early management in order to prevent the long-term complications. This study is to compare and correlate the radiological classification findings by using the standard anteroposterior view of both knee on standing position in the diagnosis of osteoarthritis of knee joint and its severity.

Method and Materials

This was a retrospective, observational, and hospital-based study conducted in the department of the R. L. Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Kolar.

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Patient meeting the inclusion criteria and who are willing to participate will be recruited after obtaining written informed consent. Patient data will be collected as per the predesigned proforma. At baseline, demographic details and relevant history will be collected from the patient. This will be followed by clinical examination that includes general physical examination and knee joint examination (inspection, palpation, range of movements, measurements and special tests). X-rays of the knee joint (weight bearing anteroposterior and lateral views on standing position). The sample size was estimated by using population proportion of 8%, sample proportion of 6%, sample power size of 90%, alpha error of 5% and dropout rate of 10%, calculated sample size using hypothesis testing of single proportion [5,12]. The study was approved by the institutional human ethics committee, and informed written consent was obtained from all study participants, with confidentiality maintained. Patients with knee pain irrespective of gender above age of 45 years, disease duration more

than 3 months, symptoms of locking knee, clinically and radiologically diagnosed as osteoarthritis were included in the study. Patients with history of fractures around the knee and treated, tumors, infections, inflammatory disorders, metabolic bone disease, serious systemic disease, previous intra-articular injections were excluded from the study.

Analysis & Statistical Methods

Proportion, measure of central tendencies and dispersion of the variables were tested by appropriate parametric and non-parametric statistical technique (e.g., t-test, z-test, chi square test etc.) depending upon the nature of the variables. The demographic data will be assessed using descriptive statistics.

P-value less than 0.05 will be considered to be statistically significant.

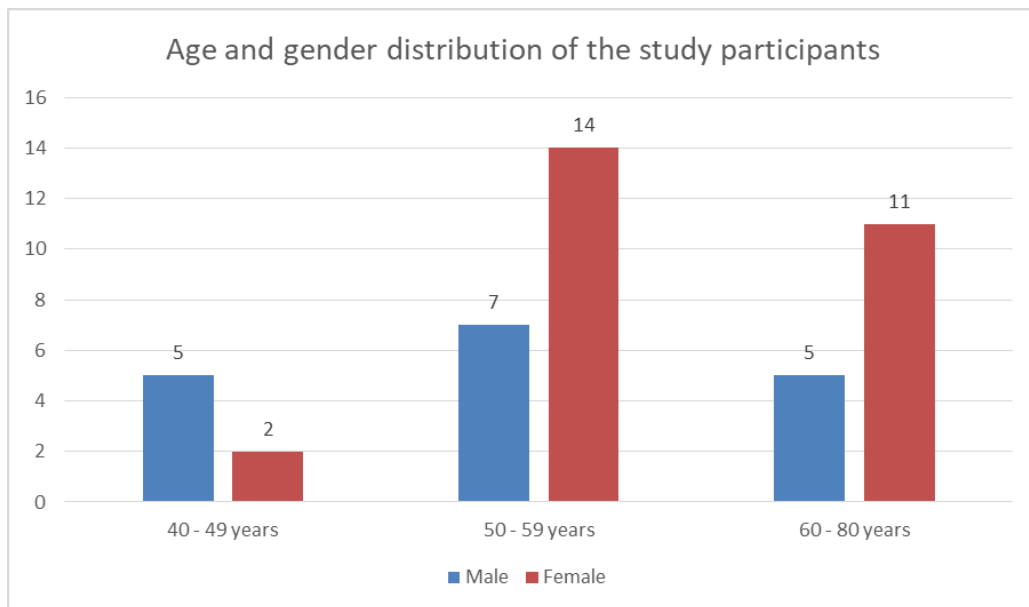


Fig 1: Patient Characteristics

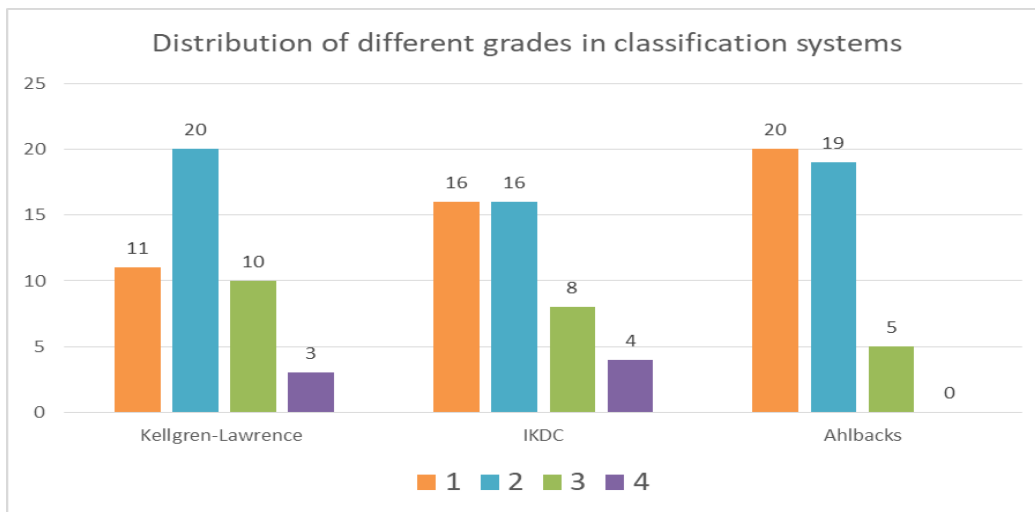


Fig 2: Distribution of different radiological classification

Result

In our study, we included a total of 44 patients who were radiologically evaluated for complaints of Knee pain and diagnosed with Osteoarthritis. Of the total 44 subjects, about 61% (n=27) were males and the remaining 39% were female (n=17). The Mean (SD) age of the study subjects was 55.1 (5.8). About 16%, 48% and 36% belonged to the age groups 40 – 49 years, 50 – 59 years and more than 60 years respectively. About 70% of the subjects had disease involvement on the right side. According to the Kellgren-Lawrence classification about 25% and 41% of the subjects belonged to the class 1 and class 2 respectively. Whereas by Ahlback’s grading about 45% and 43% of the subjects belong to the Class 1 and class 2 respectively (table-2).

The distribution of the subjects according to IKDC classification was class A (36%), class B (36%), class C (19%) and class D (9%) as shown in table-3. Agreement between different classification systems for Osteo-arthritis was moderate to good in our analysis. The highest percent agreement and kappa was found to be present between Kellgren-Lawrence and IKDC classification methods (kappa=0.51) and the agreement was statistically significant (p-value<0.001). There was good agreement between Kellgren-Lawrence and Ahlback’s classification with percent agreement of 65.9% and Kappa value of 0.487 (p-value<0.001). Table 4- depicts the agreement between Ahlback’s classification and IKDC classification with Kappa of 0.412 (p-value<0.001).

Table 1: Socio-demographic characteristics of the study subjects (n=44)

Characteristics	Frequency (%)
Age category	
40 – 49 years	7 (15.9%)
50 – 59 years	21 (47.7%)
60 and above	16 (36.4%)
Mean (SD) age	55.1 (5.8)
Gender	
Males	17 (38.6%)
Females	27 (61.4%)
Side of injury	
Right side	31 (70.4%)
Left side	13 (29.6%)

Table 2: Comparison between different OA Classification systems (Kellgren-Lawrence vs. Ahlback’s classification)

		Ahlback’s classification		
		1	2	3
KL	1	11 (25.0%)	0	0
	2	5 (11.4%)	15 (34.1%)	0
	3	4 (9.1%)	3 (6.8%)	3 (6.8%)
	4	0	1 (2.3%)	2 (4.5%)

Agreement = 65.9%; Kappa=0.487 (p-value<0.001)

Table 3: Comparison between different OA Classification systems (Kellgren-Lawrence vs. IKDC classification)

		IKDC classification			
		A	B	C	D
KL	1	10 (22.7%)	1 (2.3%)	0	0
	2	3 (6.8%)	12 (27.2%)	3 (6.8%)	2 (4.5%)
	3	3 (6.8%)	2 (4.5%)	5 (11.4%)	0
	4	0	1 (2.3%)	0	2 (4.5%)

Agreement = 65.9%; Kappa=0.510 (p-value<0.001)

Table 4: Comparison between different OA Classification systems (IKDC vs. Ahlback’s classification)

		Ahlback’s classification		
		1	2	3
IKDC	A	13 (29.5%)	3 (6.8%)	0
	B	5 (11.4%)	11 (25.0%)	0
	C	2 (4.5%)	3 (6.8%)	3 (6.8%)
	D	0	2 (4.5%)	2 (4.5%)

Agreement = 61.4%; Kappa=0.412 (p-value<0.001)

Discussion

Radiographs of the knee joint are an integral part of clinical assessment and diagnosis of Osteoarthritis. Classifying the severity of disease based on the radiological criteria serves not only to document the disease severity and progression, but also to aid in clinical decision making and treatment algorithms. In some context, the decision making for surgical management relies entirely on the radiological classification of disease severity as an adjunct to clinical criteria. Several epidemiological studies use different classification tools to assess response to treatment in these patients. The different

classification systems focus on different aspect of the disease. According to Kellgren & Lawrence classification[13,14] the grade of radiograph ranged from 0 to 4, which correlated with the increasing severity of OA. Grade 0 signified the absence of OA and Grade 4 signified severe OA. Grade 1 in K-L classification depicts doubtful Joint Space Narrowing with possible osteophytic lipping. Grade 2 – 3 signifies definite osteophytes, possible JSN with possible bone-end deformity. Large osteophytes, marked JSN, severe sclerosis, and definite bone ends deformity are hallmark features of K-L grade 4 disease. IKDC classification predominantly focuses on the joint

space narrowing. Ahlback's classification systems considers the reduction of the joint space as an indirect sign of cartilage loss in addition to Bone defect/loss. However, the agreement between the different classification systems have not been studied elaborately in Indian population. In our study the majority of patients with radiological evidence of OA were aged more than 50 years. Our study reported moderate to good agreement between different classification systems. The agreement between K-L and Ahlback's classification in our study was 0.487. This is supported by the findings from Ingemar F Peterson et al [15] who had reported that agreement between the two classification methods was 0.76. Nicholas Wing et al [16] in their study reported that Intra class correlation between different classification methods varied between 0.52 – 0.91. This is in accordance with the results from our study. Adam G. Culvenor et al [17] has also reported a moderate inter observer reliability of 0.67 between K-L method and OARSI atlas method. In the study done by Keenan et al [18] the grading of radiological severity also correlated with the intra-operative findings of full thickness cartilage loss (FTCL). There was a medium level of correlation between different classification systems and disease severity. Since different classification systems had a high degree of agreement in our study, it is also expected that they correlate with disease severity (operative findings). In our study, only less than 30% belonged to grade 3 – grade 4 K-L class whereas in the study by Keenan et al. more than 95% belonged to grade 3 or higher in K-L classification. Similarly, the proportion the grade C and D according to IKD comprised of less than 40% in our study compared to 90% in other study. This signifies that patients in our study had less severe OA disease compared to the other study. This depicts the distribution of severity in our setting where diverse patients present with OA symptoms.

The study has the following strengths. This study comprehensively evaluated the same set of patients by different classification systems in the Indian population. The investigator was experienced and trained in reading the radiographs. The limitations of the study include: the rating was performed only by a single investigator and hence variability in grading between different observers could not be accounted for in our study. We included only patients with clinical symptoms of Osteoarthritis and it is likely that lower grades of radiological classes were limited in our study. The disease severity was not correlated with the intra-operative findings as data on the arthroscopic findings were not included in this study.

Conclusion

Agreement between Kellgren-Lawrence method, IKDC, and Ahlback's classification were high among subjects aged more than 40 years with osteoarthritis. Future studies should aim to investigate the agreement among clinical, radiographic, and arthroscopic findings in these patients. We acknowledge that our current manuscript has some limitations i.e. low grade osteoarthritis patient were included in the study. We also recognize that by comparing classifications we make it more cumbersome and, therefore, more prone to lack of reproducibility. Future studies, taking into consideration disease severity correlation with clinical, radiographic intra-operative finding, may provide clear guides to preoperative planning which should hopefully help to avoid surgical mistakes and improve the outcomes of treatment.

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