Original article

Co-relation of pain, function, and quality of life with the radiographic findings in knee osteoarthritis patients

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A – Research concept
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Abstract

Introduction: Osteoarthritis (OA) is a prevalent musculoskeletal disorder. In the diagnosis of OA, both the radiographic and clinical findings are used however, various inconsistencies in these systems generate a need to explore to which extent these systems should be followed to establish a diagnosis about OA. Thus, the objective of the study is to find out the co-relation of pain, function, and quality of life with the radiographic findings in patients with knee osteoarthritis.

Material and methods: Study design: Multi-center prospective cross-sectional study. 83 patients were screened and 72 patients were enrolled in the study following the inclusion and exclusion criteria. For radiographic evaluation, Kellgren Lawrence grading system, for pain, visual analog scale (VAS) and the function was measured by six-minute walk test and disability and quality of life was measured by Knee injury and osteoarthritis outcome score (KOOS). Statistical analysis was done using the Kendall tau test.

Results: The result showed significant co-relation of pain (VAS) with the radiographic findings, whereas a significant negative co-relation of knee osteoarthritis outcome score (KOOS) sub-variables of symptom, pain, function, and sports function with the radiographic findings. No significant co-relation in the six-minute walk test and KOOS quality of life sub-variable was found with the radiographic findings in knee OA patients.

Conclusions: Pain is significantly co-related with the radiographic findings. However, the functions were not significantly correlated with the radiographic findings in patients with knee osteoarthritis. Therefore, in addition to radiographic changes, the function of the patients must be assessed to estimate the progression of the disease.

Keywords: joint diseases, visual analog scale, walk test, X-Rays

Introduction

Osteoarthritis (OA) is amongst the highly prevalent musculoskeletal disorders. According to Global burden of diseases 2018, it estimates to affect 330 million people globally [1]. The prevalence of OA is on an exponential rise because of the surge in ageing population and an increase in obesity profiles and increased rates of traumatic knee injuries [2,3]. The prevalence of OA is seen to increase with the increase in the age with female gender having a higher preponderance to develop OA as compared to males [4]. Knee osteoarthritis is prevalent in Asian countries because of certain lifestyle habits that result in greater loads at the weight bearing

joints [5]. The common symptoms of knee osteoarthritis (KOA) include pain, joint stiffness, decrease in range of motion, swelling, crepitus, locking and sensation of giving way of the joint [6].

For establishing a diagnosis regarding the disease, both the subjective as well as objective assessment is followed. Radiographic and clinical findings of KOA patients are compared to establish an accurate diagnosis of the condition. Various radiographic scales such as Kellgren Lawrence (KL) score system, Knee Society Radiographic Scoring System and criteria laid by American College of Rheumatology (ACR) for clinical diagnosis are commonly used for diagnosing the severity of OA. However, because of the various inconsistencies in these systems there is a need to explore to which extent these systems should be followed to establish a diagnosis about OA. A study has shown that the radiographic findings of tibiofemoral joint are co-related to a greater extent as compared to patellofemoral joint in specific clinical findings A study has shown moderate co-relation of clinical results with the radiographic findings for KOA diagnosis [7]. Whereas, one study reports that the symptoms such as pain and stiffness prominently affects the functional status in KOA patients and should be focused over the radiographic findings in patients of knee osteoarthritis to estimate the progression of the condition [8].

Thus, understanding the relationship of radiographic findings with the clinical symptoms must be explored further as, this is of utmost importance in the making clinical decision regarding knee OA patients. The purpose of the study is to find out the relationship of pain, function, disability and quality of life with the radiographic findings in KOA patients.

Materials and methods

The present study is a multi-center prospective cross-sectional study. Patients diagnosed with KOA as per ACR criteria were enrolled in the study following the inclusion and exclusion criteria [9]. Patients diagnosed with KOA, able to read and write English, Hindi and Urdu language and willing to participate were included in this study. The patients were excluded if they had history of knee injury, inflammatory arthropathies, metabolic bone diseases, were unable to walk for 6 minute, unable to walk unaided and intraarticular injection in last 6 months. Eighty three patients with knee OA were screened for participation in the study. Out of these, eleven patients were excluded, three patients had history of intra-articular injection, five had history of injury to the knee joint, one had inflammatory arthritis

and two patients were unable to walk unaided. Seventy two patients were included to participate in the study. Ethical approval was obtained from Institutional ethical committee vide letter no. PTY/2017/484 dated 9th October 2017 and was done in accordance with the declaration of Helsinki, 2013. A written informed consent was obtained from all the participants prior to participation in the study. The sample size estimation was done using G power at 80 % power and 95% significance level and the result suggested of a total of 64 patients.

Procedure

The patients were evaluated at baseline day and demographic data was collected. Visual Analogue Scale (VAS) was used to measure pain during walking a short distance. The pain was assessed on a 10 cm scale where 0 indicates no pain and 10 indicate severe pain. For radiographic evaluation, the radiographs were taken at weight bearing position from the Antero-posterior side. The radiographic evaluation was done using Kellgren Lawrence Grading Scale (KL) [10]. KL system involves measuring the changes in the joint seen on the radiographs with grades from 0–4, where 0 denotes minimal changes or near normal radiographs, 1 denotes doubtful pathology, 2 denotes presence of minimal osteophytes, possible narrowing of the joints, presence of cysts and sclerosis, 3 denotes moderate changes and presence of definite osteophytes with moderate joint space narrowing and 4 denotes severe changes with presence of large osteophytes and definite joint space narrowing. The radiographs were evaluated by an experienced orthopedician who referred patients for the study. For assessment of function six minute walk test was used. The patient was asked to walk between the 30 m corridor which was marked by cones with no verbal feedback on the pace of walking. Six-minute walk test is a reliable tool for objective measurement of function in knee osteoarthritis [11]. The disability was measured using Knee Osteoarthritis Outcome Score (KOOS) questionnaire which is an extension of WOMAC and contains symptoms, pain, function, sports and recreation and quality of life components. The score ranges from 0 to 100 where 100 indicate a minimum problem. KOOS is a reliable assessment tool in Indian knee OA patients [12,13].

Statistical analysis

The data was reported as mean and standard deviation and was analyzed using SPSS version 25.0. The significance level was compared at $p<.05$. The Kendall tau was used to determine co-relation between the radiographic findings and pain, function and disability. Kendall tau is a non parametric test to estimate correlation between variables for small sample size.

Results

Table 1 shows the demographic characteristics of the participants included in the study. A total of 72 patients (21 males and 51 females) diagnosed with knee OA were included in the study. Left knee was affected in 28 patients and right knee was affected in 22 patients, while 20 patients had bilateral KOA. KL grading was done for all the patients and 43.8% patients had grade 3, 31.5% patients had grade 2, 3.4% had grade 1 and 2.2% had grade 4 as per Kellgren Lawrence grading system for radiographic evaluation of the condition.

Tab.1. The demographic feature, clinical and radiological characteristics of the participants included in the study

Variables	N = 72
Age (years) [Mean ± SD]	53.58 ± 5.99
Height (cm) [Mean ± SD]	159.02 ± 7.36
Weight (kg)[Mean ± SD]	72.16 ± 9.50
BMI (Kg/m^2)[Mean ± SD]	28.62 ± 3.97
Affected Knee (Left)	28 (38.8%)
Affected Knee (Right)	22 (30.5%)
Bilateral Knee OA	20 (27.7%)
Males	20 (28.2%)
Females	48 (67.6%)
KL grade 1	3 (3.4%)
KL grade 2	28 (31.5%)
KL grade 3	39 (43.8%)
KL grade 4	2 (2.2%)

KL = Kellgren Lawrence grading

Tab. 2. The values of the Co-relation between the variables and radiographic findings

Variables	Co-relation coefficient (r)	p value
Age	0.316**	0.001
Weight	0.357**	0.000
BMI	0.231*	0.016
VAS	0.240*	0.021
6MWT	−0.140	0.147
KOOS Symptom	−0.264*	0.008
KOOS Pain	−0.229*	0.021
KOOS Function	−0.321**	0.001
KOOS Sports Function	−0.249*	0.012
KOOS Quality of life	−0.065	0.526

** Significant at $p < 0.001$, * significant at $p < 0.05$. VAS = Visual analog scale, 6MWT = Six minute walk test, KOOS = Knee injury and osteoarthritis outcome score.

Table 2 shows the value of correlation between the variables and the radiographic findings. The results of the study showed a significant co-relation of age with the KL scoring, weight and BMI with the radiographic findings. There was a significant co-relation of pain and KL scoring. However, no significant co-relation between function measured by six minute walk test and the radiographic findings was observed. The disability and quality of life measured using KOOS showed significant negative co-relation in symptom, pain, function and sports function sub-variable and no significant co-relation was found in quality of life sub variable with the radiographic findings.

Discussion

Pain is a salient feature of KOA. The presence of knee pain is significantly affects the function and contributes enormously to disability and the risk of disability increases further with the presence of knee pain in the community [14,19]. A study has shown that OA is amongst the most highly prevalent musculoskeletal condition and is amongst the chief contributor to global YLD and contributes 2.4% of all years lived with disability (YLD) and has been ranked 10th in contributing to global YLD's and imposes a huge socioeconomic burden to the society [15,16]. For making a diagnosis about the condition conventional radiographs are commonly used. Various other methods are also available that classifies the specific features of OA but are less popular and have low validity and sensitivity. Thus, radiographs being easily available, economical and well accepted by the patients are considered as cornerstone in diagnosing KOA [17,18].

However, there is discordance in the available literature on the importance of radiographs in diagnosing the condition. But radiographs are often used by the surgeons in making judgment regarding surgical procedures such as arthroplasty. Thus, it is very important to understand the relationship of pain, function, disability and quality of life with the radiographic findings in KOA patients. So, the present study aimed at estimating the co-relation of pain, function and quality of life with the radiographic findings in knee OA patients.

The result of the study showed a significant co-relation of pain with the radiographic findings. However, there was no significant co-relation of function measured by six minute walk test and quality of life with the radiographic findings. The significant correlation of pain found in the present study was consistent with the findings of various studies that showed a strong association of radiographic osteoarthritis with the knee pain [19,20]. Another study has also demonstrated that the

knee pain was significantly associated the presence of definite KOA with KL grading more than or equal to grade 2 and with the presence of all individual features [21]. In consistence the present study also had greater number of patients in grade 2 (31.5%) and grade 3 (43.8%) of the KL scoring reflecting significant correlation of pain with the radiographic findings. Similarly, some other studies have also shown that individuals that have presence of both the osteophytes and joint space narrowing i.e KL grade 3 or higher had highest odds of having knee pain [22,23].

The significant co-relation of pain with the radiographic findings can also be because of the greater number of female participants in the study. Various studies have also reported greater incidences of symptomatic KOA in females as compared to males [4,24]. Boyan et al. has suggested three possible causes for the gender differences as biomechanical differences in limb alignment, obliterated protective effect of estrogen after menopause and neurologic contribution for increased disease severity is seen in females being responsible for higher preponderance of OA in females [25].

Cubukcu et al. has also shown that the severity of knee pain is more important feature in determining the disability than the radiographic findings [8]. The result of the present study showed no significant correlation of function measured by six minute walk test and quality of life with the radiographic findings. Various studies have shown that the function has a strong relationship with the structural changes in early disease [26,27] Creamer et al. has also shown that pain and obesity are more important determinant in estimating the function in KOA as compared to the changes in the structure seen on radiographs, as the radiographs only shows the bony changes while muscles and ligament are important determinants of the functions in patients with KOA [26]. Similarly, Larson et al. reported that the functional ability was not related to radiographic diagnosis of osteoarthritis [28]. Cubukcu et al. have also reported to have no correlation between function and radiographic features [8]. It was also reported that obesity is another major determinant of functional loss and is associated with voluntary weakness of quadriceps muscle in patients with knee OA [29].

In addition to this, the present study has also found significant correlation of age, height, weight and BMI with the radiographic findings. Thus, it can be interpreted that the pain and symptoms can be reflected by the structural changes seen on radiographs but in order to accurately estimate about the condition, assessment of function should be done separately. As various factors such as strength of muscle, psychological status of patient, lifestyle habits and education about the condition might have influence on the functional ability of the patient [30]. The negative correlation of KOOS sub variables and no correlation of function measured by six minute walk test and quality of life with the radiographic findings reflect that the structural changes seen on radiographs does not predict about the function and quality of life of OA patients, thus interventions such as exercises and physiotherapy management can prove to be beneficial in improving the functions and activities of daily living as well as quality of life and can help in decreasing the requirement of operative and corrective procedures required in patients with KOA. The strength of the present study is that the subjective, objective as well as radiographic evaluation was done to estimate the co-relation between the variables. Loss of longitudinal follow up, small number of patients and confounding variables such as presence of co-morbidities like diabetes, hypertension were some potential limitations of the study.

Therefore, it is important to refer the radiographs along with the clinical findings to make an accurate diagnosis of the condition and most importantly functional assessment mimicking the activities of daily living should also be done to accurately estimate the progression of the disease. It is also suggested that newer methods that includes both the radiographic findings as well as objective assessment such as "New Knee Society Scoring system" should be adopted in diagnosing OA in place of the conventional system. Therefore, understanding the relationship of these variables can be of utmost importance in formulating an accurate diagnosis and estimating the progression of disease.

Conclusion

It can be concluded that the radiographic changes must be given importance in formulating a diagnosis of KOA. However, symptoms such as pain and stiffness along with the estimation of functional status of the patients must be done in addition to accurately interpret about the disease status, as this can play a vital role in clinical decision making process for patients affected with KOA.

Conflicts of interest
The authors declare no conflict of interest.

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