Original Research

Assessment of the correlation of Kellgren-Lawrence score (On Radiography) and cartilage abnormality (On MRI) in Osteoarthritis of knee patients: An observational study

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ABSTRACT:
Background: Osteoarthritis (OA) is a disease of the synovial joint tissues in which there is destruction of synovial joint tissues and active, but ineffective attempts at repair. This structural change can lead to pain and disability. Hence; the present study was conducted for assessing correlating the correlation of distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI). **Materials & methods:** A total of 20 patients suspected of presence of osteoarthritis of knee were enrolled. Informed consent was obtained from all the subjects/guardians before the study. The detailed clinical history regarding the onset of symptoms was also obtained. All radiographs were assigned scores by using the Kellgren-Lawrence scoring system as follows: grade 0, normal; grade 1, doubtful osteoarthritis; grade 2, minimal osteoarthritis; grade 3, moderate osteoarthritis; or grade 4, severe osteoarthritis. MR imaging of the knee was performed. Radiographic and MR imaging findings were compiled as per performa and subjected to analysis using appropriate statistical tests. **Results:** A total of 20 patients with OA were analyzed. On MRI examination of the cartilage abnormality, 15 percent of the patients were of Grade 0, 10 percent of the patients were of Grade 1, 35 percent of the patients were of Grade II and the remaining 40 percent of the patients were of Grade III. Significant results were obtained while correlating distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI). **Conclusion:** There exists a significant correlation between Radiography findings and cartilage abnormality (On MRI) in patients of osteoarthritis of knee.
Key words: Kellgren-Lawrence score, Osteoarthritis, Cartilage abnormality

INTRODUCTION

Osteoarthritis (OA) is a disease of the synovial joint tissues in which there is destruction of synovial joint tissues and active, but ineffective attempts at repair. This structural change can lead to pain and disability. Technologic advances and implementation of sophisticated post-processing instruments and analytic strategies have resulted in imaging playing a more and more important role in understanding the disease process of OA. Radiography is still the most commonly used imaging modality for establishing an imaging-based diagnosis of OA. [1-3]
Knee osteoarthritis is a major public health problem that primarily affects the elderly. The increasing importance of imaging in osteoarthritis for diagnosis, prognosis and follow-up is well recognized by both clinicians and osteoarthritis researchers. Radiography is the simplest, least expensive and most commonly deployed imaging modality for OA. The severity of radiographic OA can be assessed with semi-quantitative scoring systems. The Kellgren and Lawrence (KL) grading system is a widely accepted scheme for defining radiographic OA based on the presence of a definite osteophyte. MRI has become a key-imaging tool for OA research thanks to its ability to assess pathology in structures not visualized by radiography i.e. articular cartilage, menisci, ligaments, synovium, capsular structures, fluid collections and

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bone marrow.[4-6] Hence; the present study was conducted for assessing correlating the correlation of distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI).

MATERIALS & METHODS

The present study was conducted for assessing MRI findings in patients with osteoarthritis of knee. A total of 20 patients suspected of presence of osteoarthritis of knee were enrolled. Informed consent was obtained from all the subjects/guardians before the study. The detailed clinical history regarding the onset of symptoms was also obtained. The spectrum of findings was recorded as per the performa. Anteroposterior radiographs of the knee were obtained in a weight-bearing extended position by using a standard radiographic technique. All radiographs were assigned scores by using the Kellgren-Lawrence scoring system as follows: grade 0, normal; grade 1, doubtful osteoarthritis; grade 2, minimal osteoarthritis; grade 3, moderate osteoarthritis; or grade 4, severe osteoarthritis. MR imaging of the knee was performed. Radiographic and MR imaging findings were compiled as per performa and subjected to analysis using appropriate statistical tests.

RESULTS

A total of 20 patients with OA were analyzed. Mean age of the patients was 52.46 years. 60 percent of the patients were females while 40 percent of the patients were males. According to Kellgren-Lawrence score (on Radiography), Grade 0, Grade 1, Grade 2 and Grade 3 were seen in 55 percent, 15 percent, 20 percent and 10 percent of the patients respectively. On MRI examination of the cartilage abnormality, 15 percent of the patients were of Grade 0, 10 percent of the patients were of Grade 1, 35 percent of the patients were of Grade II and the remaining 40 percent of the patients were of Grade III. Significant results were obtained while correlating distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI).

Table 1: Distribution of patients according to Kellgren-Lawrence score (on Radiography)

Kellgren-Lawrence score (on Radiography)	Parameter	Number of patients	Percentage of patients
Grade 0	Normal	11	55
Grade 1	Doubtful Osteoarthritis	3	15
Grade 2	Minimal Osteoarthritis	4	20
Grade 3	Moderate Osteoarthritis	2	10
Grade 4	Severe Osteoarthritis	0	0

Table 2: Correlation of distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI)

Cartilage abnormality (On MRI)	Kellgren-Lawrence score (On Radiographic)				Total	Fisher's Exact Test p- value
	Grade 0	Grade 1	Grade 2	Grade 3		
Grade 0	3	0	0	0	3	0.00 (Significant)
Grade I	2	0	0	0	2	
Grade II A	3	1	0	0	4	
Grade II B	1	1	1	0	3	
Grade III A	1	1	1	0	3	
Grade III B	1	0	2	2	5	
Total	11	3	4	2	20	

DISCUSSION

Osteoarthritis (OA) is the most common form of arthritis and one of the leading causes of disability. This degenerative and progressive joint disease affects around 250 million people worldwide and more than 27 million people in the United States. Elderly (approximately 35% of patients over 65 years old) females, patients with obesity and African Americans are the population with the highest risk of developing OA. Given the trend of the population to live longer and the progressive increment of obesity in our country, the number of affected patients most likely will substantially increase within the upcoming years. This is concerning given the functional impairment and disability associated with this condition and its negative toll on the social and economic aspects of our society. The knee is the largest synovial joint in humans, it is composed by osseous structures (distal femur, proximal tibia, and patella), cartilage (meniscus and hyaline cartilage), ligaments and a synovial membrane. The latter is in charge of the production of the synovial fluid, which provides lubrication and nutrients to the avascular cartilage. Unfortunately, given the high use and stress of this joint, it is a frequent site for painful conditions including OA.[6-9] Hence; the present study was

conducted for assessing correlating the correlation of distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI).

In the present study, a total of 20 patients with OA were analyzed. Mean age of the patients was 52.46 years. 60 percent of the patients were females while 40 percent of the patients were males. According to Kellgren-Lawrence score (on Radiography), Grade 0, Grade 1, Grade 2 and Grade 3 were seen in 55 percent, 15 percent, 20 percent and 10 percent of the patients respectively. On MRI examination of the cartilage abnormality, 15 percent of the patients were of Grade 0, 10 percent of the patients were of Grade 1, 35 percent of the patients were of Grade II and the remaining 40 percent of the patients were of Grade III.[10] Kijowski R et al retrospectively correlated radiographic findings of osteoarthritis of the tibiofemoral joint with arthroscopic findings of articular cartilage degeneration within the tibiofemoral joint in patients with chronic knee pain. The study group consisted of 125 patients with osteoarthritis of the tibiofemoral joint (66 men, 59 women; age range, 35-77 years; average age, 52 years) and 25 patients of similar age (14 men, 11 women; age range, 36-69 years; average age, 50 years) with no osteoarthritis of the tibiofemoral joint. All patients underwent standing anteroposterior radiography of the knee prior to arthroscopic knee surgery. Each articular surface of the tibiofemoral joint was graded at arthroscopy. Two radiologists retrospectively reviewed the knee radiographs to determine the presence of marginal osteophytes, joint space narrowing, subchondral sclerosis, and subchondral cysts. The sensitivity and specificity of the radiographic features of osteoarthritis for the detection of articular cartilage degeneration within the medial and lateral compartments of the tibiofemoral joint were determined. The sensitivity of marginal osteophytes, joint space narrowing, subchondral sclerosis, and subchondral cysts for the detection of articular cartilage degeneration was 67%, 46%, 16%, and 10%, respectively, for the medial compartment and 49%, 7%, 6%, and 3%, respectively, for the lateral compartment. The specificity of marginal osteophytes, joint space narrowing, subchondral sclerosis, and subchondral cysts for the detection of articular cartilage degeneration was 73%, 95%, 100%, and 100%, respectively, for the medial compartment and 81%, 100%, 100%, and 100%, respectively, for the lateral compartment. It was concluded that marginal osteophytes were the most sensitive radiographic feature for the detection of osteoarthritis of the tibiofemoral joint. Joint space narrowing, subchondral sclerosis, and subchondral cysts were less sensitive radiographic features of osteoarthritis and rarely occurred in the absence of associated osteophyte formation.[10] Eckstein F reviewed semiquantitative scoring of changes of articular tissues (e.g. WORMS = whole-organ MRI scoring or KOSS = knee osteoarthritis scoring system), quantification of cartilage morphology (e.g. volume and thickness), quantitative measurements of cartilage composition (e.g. T2, T1rho, T1Gd = dGEMRIC index) and quantitative measurement of bone structure (e.g. app. BV/TV, app. TbTh, app. Tb.N, app. Tb.Sp) in osteoarthritis. For each of these fields we describe the hardware and MRI sequences available, the image analysis systems and techniques used to derive semiquantitative and quantitative parameters, the technical accuracy and precision of the measurements reported to date and current results from cross-sectional and longitudinal studies in osteoarthritis. Moreover, the paper summarizes studies that have compared MRI-based measurements with radiography and discusses future perspectives of quantitative MRI in osteoarthritis.[11]

In the present study, significant results were obtained while correlating distribution of patients according to Kellgren-Lawrence score (On Radiography) and according to cartilage abnormality (On MRI). Rauscher I et al evaluated differences in T1(rho) (T1 relaxation time in the rotating frame) and T2 values in the meniscus at magnetic resonance (MR) imaging in both patients with varying degrees of osteoarthritis (OA) and healthy control subjects. The study was institutional review board approved and HIPAA compliant. Written informed consent was obtained from all subjects. T1(rho) and T2 measurements were performed at 3.0-T MR imaging in 60 subjects deemed to be healthy, having mild OA, or having severe OA. Semiautomatic segmentation was performed to generate T1(rho) and T2 maps of the menisci. Clinical findings were assessed by using Western Ontario and McMaster Osteoarthritis (WOMAC) questionnaires. Differences in T1(rho) and T2 values between the three subject groups were calculated by using two-tailed t tests, and receiver operating characteristic analyses were performed. Correlations of meniscal T1(rho) and T2 values with age, cartilage-derived T1(rho) and T2 parameters, and WOMAC scores were calculated. Significant differences between the three subject groups were found: Mean T1(rho) values were 14.7 msec +/- 5.5, 16.1 msec +/- 6.6, and 19.3 msec +/- 7.6 for the healthy, mild OA, and severe OA groups, respectively. Mean T2 values were 11.4 msec +/- 3.9, 13.5 msec +/- 4.7, and 16.6 msec +/- 8.2 for the healthy, mild OA, and severe OA groups, respectively. Correlations of meniscal T1(rho) and T2 values with subject age ($R(2) = 0.18$, for correlation with T2 only), cartilage-derived parameters ($R(2) = 0.14-0.29$), and WOMAC scores ($R(2) = 0.11-0.45$) were significant. They concluded that meniscal T1(rho) and T2 values correlate with clinical findings of OA and can be used to differentiate healthy subjects from patients with mild or severe OA.[12]

CONCLUSION

There exists a significant correlation between Radiography findings and cartilage abnormality (On MRI) in patients of osteoarthritis of knee.

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