

Original Research

Analysis of Radiographic Findings in Patients of Osteoarthritis of Knee: An Institutional Based Study

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ABSTRACT

Background: Knee osteoarthritis (OA), also known as degenerative joint disease, is typically the result of wear and tear and progressive loss of articular cartilage. Hence; the present study was conducted for evaluating MRI findings among osteoarthritis of knee patients.

Materials & methods: 100 patients were subjected to comprehensive radiographic and MR imaging evaluations. Informed consent was obtained from all the subjects/guardians before the study. The detailed clinical history regarding the onset of symptoms. The spectrum of findings was recorded as per the Kellgren-Lawrence scoring was done which was based on osteophyte formation, joint space narrowing, sclerosis, and joint deformity characteristics according to the five-level scale defined 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 and subchondral bone marrow edema and osteophytes along with other MRI parameters were evaluated.

Results: Mean age of the patients was 56.2 years with majority proportion of patients being males. 55 percent of the patients were of grade 0 as per KL grading. Minimal and moderate osteoarthritis was seen in 22 percent and 5 percent of the patients on radiographs. Cartilage abnormalities were seen 82 percent of the patients on MRI. Subchondral BME was grade 0 and grade 1 in 45 percent of the patients each on MRI. Similarly, osteophytes were absent on MRI in 60 percent of the patients.

Conclusion: Through MRI, the pathologic changes of pre-radiographic OA can be detected at an earlier stage of the disease. Physiologic changes within joint tissues can be assessed before morphologic changes become apparent.

Key words: Osteoarthritis, Knee, Magnetic resonance imaging

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INTRODUCTION

Knee osteoarthritis (OA), also known as degenerative joint disease, is typically the result of wear and tear and progressive loss of articular cartilage. It is most common in the elderly. Knee osteoarthritis can be divided into two types, primary and secondary. Primary osteoarthritis is articular degeneration without any apparent underlying reason. Secondary osteoarthritis is the consequence of either an abnormal concentration of force across the joint as with post-traumatic causes or abnormal articular cartilage, such as rheumatoid arthritis (RA).¹⁻³ OA has been depicted as the result of progressive articular cartilage degradation. Indeed, although the cartilage can

prevent biomechanical damage caused by severe loading, patients with OA hinder attempts at repair and result in disrupted cartilage homeostasis. For instance, cartilage cells' (i.e., chondrocytes') compositional and structural alterations—such as hypertrophy due to aging or oxidative stress—trigger the production of catabolic factors, enhancing cartilage debilitation. For decades, cartilage degradation resulting from the extracellular matrix's destruction has been depicted as one of the significant biological starters of the OA pathological process.^{4,5} Although non-pharmacological strategies are of paramount importance, less than 40% of patients with knee OA receive this kind of treatment approach,

indicating that the uptake of evidence-based guidelines in clinical practice and rehabilitation is still suboptimal. Instead, pharmacological strategies remain dominant, despite the fact that chronic use of many of these treatments has been associated with severe adverse side effects.⁶⁻⁸ The KL classification is typically applied specifically within the context of knee OA. The KL classification was originally described using AP knee radiographs. Although it is unclear from the original paper whether the radiographic descriptions are presented with the intent of demonstrating a linear disease progression of OA that begins with the formation of osteophytes and culminates in the altered shape of bone ends, other authors have criticized the KL system on the basis of this assumption.⁹⁻¹¹ Hence; the present study was conducted for evaluating MRI findings among osteoarthritis of knee patients.

MATERIALS AND METHODS

The present study was conducted for evaluating MRI findings among osteoarthritis of knee patients. Present study was conducted on 100 patients with presenting with knee pain and clinical suspicion of osteoarthritis. Detailed radiographic and MR imaging was done in all subjects. Patients were subjected to comprehensive radiographic and MR imaging evaluations. Informed consent was obtained from all

the subjects/guardians before the study. The detailed clinical history regarding the onset of symptoms. The spectrum of findings was recorded as per the perform. Kellgren-Lawrence scoring was done which was based on osteophyte formation, joint space narrowing, sclerosis, and joint deformity characteristics according to the five-level scale defined 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 and subchondral bone marrow edema and osteophytes along with other MRI parameters were evaluated. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

Mean age of the patients was 56.2 years with majority proportion of patients being males. 55 percent of the patients were of grade 0 as per KL grading. Minimal and moderate osteoarthritis was seen in 22 percent and 5 percent of the patients on radiographs. Cartilage abnormalities were seen 82 percent of the patients on MRI. Subchondral BME was grade 0 and grade 1 in 45 percent of the patients each on MRI. Similarly, osteophytes were absent on MRI in 60 percent of the patients.

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	55	55
Grade 1	Doubtful Osteoarthritis	18	18
Grade 2	Minimal Osteoarthritis	22	22
Grade 3	Moderate Osteoarthritis	5	5
Grade 4	Severe Osteoarthritis	0	0
Total		100	100

Table 2: Distribution of patients according to cartilage abnormality (On MRI)

Grade (On MRI)	MRI Findings	Number of patients	Percentage of patients
Grade 0	Normal	18	18
Grade I	Intense signal intensity alteration	10	10
Grade II A	Defect of cartilage of less than 50%	16	16
Grade II B	Defect of cartilage of 50% to 99%	16	16
Grade III A	100% defect of cartilage with no bone ulceration	20	20
Grade III B	100% defect of cartilage with subjacent bone ulceration.	20	20
Total		100	100

Table 3: Distribution of patients according to Subchondral BME (On MRI)

Grade (On MRI)	MRI Findings	Number of patients	Percentage of patients
Grade 0	Normal	45	45
Grade 1	Largest diameter of less than 10 mm	45	45
Grade 2	Largest diameter of greater than 10 mm	10	10
Total		100	100

Table 4: Distribution of patients according to Osteophytes(On MRI)

Grade (On MRI)	MRI Findings	Number of patients	Percentage of patients
Grade 0	No osteophytes	60	60
Grade 1	Osteophytes less than 5 mm	38	38
Grade 2	Osteophytes of greater than 5 mm	2	2
Total		100	100

DISCUSSION

Osteoarthritis (OA) is a chronic disease affecting the joint and its tissues, primarily leading to progressive damage to articular cartilage and, subsequently, to the subchondral bone and surrounding synovial structures. OA is a disabling condition with increasing incidence and prevalence in the general population. As one of the most common orthopedic conditions, it is associated with a high health burden and implications not only for affected patients but also for healthcare systems. In cohort studies, standardized procedures to assign K/L scores include using a grading atlas, blinding readers to clinical features (e.g., pain), and reading radiographs paired with known sequence order. Reading single images (blinded to identity and sequence) is less sensitive to radiographic osteoarthritis progression compared to reading paired images, regardless of whether sequence is known. Reading paired images with known sequence has higher interrater reliability and sensitivity to ROA progression.¹⁰⁻¹² Hence; the present study was conducted for evaluating MRI findings among osteoarthritis of knee patients. Mean age of the patients was 56.2 years with majority proportion of patients being males. 55 percent of the patients were of grade 0 as per KL grading. Minimal and moderate osteoarthritis was seen in 22 percent and 5 percent of the patients on radiographs. Cartilage abnormalities were seen 82 percent of the patients on MRI. Subchondral BME was grade 0 and grade 1 in 45 percent of the patients each on MRI. Similarly, osteophytes were absent on MRI in 60 percent of the patients. A recent study conducted by Kornaat et al examined multiple imaging findings and their association with clinical symptoms. Their results suggest that only findings of a large-joint effusion or the presence of an osteophyte in the patellofemoral compartment were associated with pain and/or stiffness. They found no association between BME and symptoms of pain or stiffness.¹³ Three studies have reviewed the MR appearances with histopathology findings. Bergman and colleagues in their study found that subchondral bone marrow changes were present in seven of nine patients undergoing total knee replacement. The BME pattern consisted of normal tissue and a smaller proportion of several abnormalities including bone marrow necrosis, bone marrow fibrosis, abnormal trabeculae, BME, and bone marrow bleeding. They concluded that a BME pattern in knees with osteoarthrosis represents a number of non-characteristic histological abnormalities.¹⁴⁻¹⁶ Markhardt et al determined whether marginal osteophytes in compartments with normal

cartilage would be more frequently observed in knees with cartilage lesions and osteophytes in other compartments. Marginal osteophytes were seen in compartments with normal cartilage on MRI and arthroscopy in 60.5% of knees (75 of 124) with cartilage lesions and osteophytes in other compartments and accounted for all false-positive grade 2 and grade 3 osteophytes. Marginal osteophytes were seen in 12.7% of knees (13 of 102) that had no cartilage lesions in any compartment on MRI or arthroscopy, and all of these were grade 1 osteophytes. The presence of larger sized osteophytes in the compartments with cartilage lesions was associated with the presence of larger sized osteophytes in the compartments with normal cartilage. More severe cartilage lesions were associated with larger osteophyte size. Compartments with marginal osteophytes and normal cartilage are commonly seen in knees that have other compartments with osteophytes and cartilage lesions.¹⁷ Felson DT et al evaluated the effect of osteophyte size on radiographic progression in osteoarthritis (OA). Of 270 subjects who had 470 eligible knees with follow-up, 104 (22%) knees showed progression. Overall, osteophyte score modestly increased the risk of progression, but this effect weakened and became non-significant after adjustment for limb alignment (OR=1.3). Compartment osteophyte score was strongly associated with malalignment to the side of the osteophyte (e.g. medial osteophyte and varus). Compartment-specific osteophyte score markedly increased the risk of ipsilateral progression (e.g. medial osteophytes --> medial progression) and decreased the risk of contralateral progression, but these associations diminished when we adjusted for limb alignment.¹⁸

CONCLUSION

Through MRI, the pathologic changes of pre-radiographic OA can be detected at an earlier stage of the disease. Physiologic changes within joint tissues can be assessed before morphologic changes become apparent.

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