Relationship between patient-reported outcome measures (PROMs) and MRI abnormalities in early knee osteoarthritis

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INTRODUCTION:
Early knee osteoarthritis (KOA) is defined by the presence of knee symptoms without definitive radiographic abnormalities. Previous studies proposed classification criteria for early KOA based on knee pain, a Kellgren-Lawrence (KL) grade of 0 or 1, and either arthroscopic evidence of cartilage damage or MRI findings indicating cartilage degeneration, meniscal degeneration, and/or subchondral bone marrow lesions (BMLs). Subsequently, these criteria were revised to exclude MRI from the diagnostic process in standard clinical and primary care settings, due to the lack of consensus on MRI interpretation and the high prevalence of MRI-detected abnormalities in asymptomatic individuals. However, recent studies have highlighted the value of MRI in elucidating the pathology of early KOA, aiming to enhance early diagnosis and intervention. Nonetheless, the association between MRI-detected abnormalities and clinical knee symptoms in early KOA remains unclear. This study aimed to investigate the relationship between MRI abnormalities and the Knee Injury and Osteoarthritis Outcome Score (KOOS) in patients with early KOA classified as KL grade 0 or 1.
METHODS:
This nonrandomized, prospective, multicenter clinical trial included 157 patients with medial knee pain who were diagnosed with KL grade 0 or 1 based on plain radiographs and underwent MRI between 2018 and 2023. Patients were excluded if they had a history of knee trauma (e.g., ligament injury or fracture) or knee surgery. The MRI abnormalities included cartilage abnormalities, BMLs, subchondral bone cysts (BMC), subchondral bone attrition (SBA), osteophytes, synovitis/joint effusion, medial meniscus tears, medial meniscus extrusion (MME) > 3mm, and medial collateral ligament (MCL) bursitis. The MRI images were interpreted twice by the speaker, with a two-week interval. Medial meniscus injuries included horizontal, transverse, flap, and dorsal root tears. Horizontal tears were defined as Mink classification 3 or higher, while those classified as 2 or lower were considered normal. synovitis/joint effusion was considered abnormal if graded as 1 or higher. The Mann-Whitney U test was used to compare the mean values of each of the five KOOS subscales between two groups, categorized by the presence or absence of each MRI lesion. Furthermore, we performed a multiple regression analysis using each of the five KOOS subscales as an outcome variable, with age, body mass index, and MRI lesions, which were significantly different in the Mann-Whitney U test, as explanatory variables. Statistical significance was set at $p < 0.05$.
RESULTS:
There were 63 male and 94 female patients, with a mean age of 59.1 ± 11.7 years. The prevalence of cartilage abnormalities was observed in 148 cases (94.2%), BMLs in 67 cases (42.7%), BMC in 29 cases (18.5%), SBA in 93 cases (59.2%), osteophytes in 118 cases (75.2%), medial meniscus tears in 131 cases (83.4%), synovitis/joint effusion in 122 cases (77.7%), MME in 54 cases (34.4%), and MCL bursitis in 115 cases (73.3%). The Mann-Whitney U test showed that patients with BMLs had significantly lower scores on the KOOS Pain (p=0.004) and KOOS ADL (p=0.027). Patients with medial meniscus tears had significantly lower scores on the KOOS Symptom (p=0.007) KOOS Pain (p=0.0001), KOOS ADL (p=0.003), KOOS Sports(p=0.043), KOOS QOL(p=0.004). Patients with synovitis/joint effusion had significantly lower scores on the KOOS Symptom (p=0.017), KOOS ADL(p=0.032). Patients with MME had significantly lower scores on the KOOS Symptom (p=0.003), KOOS Pain(p=0.028), KOOS ADL (p=0.020), KOOS Sports(p=0.018) (Table 1). Multiple regression analysis showed that age (p=0.009), synovitis/joint effusion (p=0.050), medial meniscus tears (p=0.039), and MME (p=0.039) were significant factors related to KOOS Symptoms. Medial meniscus tears (p<0.001) and BML (p=0.015) were significantly associated with KOOS Pain. Medial meniscus tear (p=0.048) and MME (p=0.041) were associated with KOOS Sport. Medial meniscus tears (p=0.047) and age (p=0.003) were significantly related to KOOS QOL (Table 2).
DISCUSSION AND CONCLUSION:
In this study, cartilage abnormalities, osteophytes, and MCL bursitis showed high prevalence rates; however, they did not demonstrate significant associations with KOOS scores. Notably, cartilage abnormalities were observed in 94.2% of the cases, closely aligning with prior studies reporting nearly universal cartilage involvement in patients with early KOA. Conversely, medial meniscus tears, synovitis/joint effusion, MME and bone marrow lesions (BMLs) exhibited significant correlations with KOOS scores, reinforcing the findings of previous research indicating their impact on knee symptoms and pain. These MRI abnormalities likely represent active pathological processes contributing directly to symptomatic experiences in KOA patients. In conclusion, medial meniscus tears, synovitis/joint effusion, and BML were associated with KOOS.