RESEARCH PAPER

PREVALENCE OF DEGENERATIVE MENISCAL LESIONS IN PATIENTS WITH KNEE OSTEOARTHRITIS: AN MRI-BASED OBSERVATIONAL STUDY

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Abstract

Background: Degenerative meniscal lesions are frequently observed in patients with knee osteoarthritis (OA). Magnetic resonance imaging (MRI) provides detailed visualization of the menisci and allows assessment of the location and morphology of meniscal abnormalities. However, the prevalence and characteristics of these lesions may vary according to age, sex, body mass index (BMI), and radiological severity of OA.

Aim: To evaluate the prevalence and MRI characteristics of degenerative meniscal lesions in patients with knee osteoarthritis and their association with demographic and radiological factors.

Materials and Methods: This observational study was conducted in the Department of Orthopaedics, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, from June 2025 to January 2026. A total of 320 patients aged ≥40 years with knee osteoarthritis who were willing to undergo MRI were included. Patients with traumatic knee injury, terminal malignancy, previous knee replacement, rheumatoid arthritis, use of walking aids, or contraindications to MRI were excluded. MRI of the right knee was performed using a 1.5-Tesla scanner with a phased-array knee coil. Medial and lateral menisci were systematically evaluated for tears involving the anterior horn, body, and posterior horn. Meniscal lesions were classified as horizontal, oblique, longitudinal, radial, complex, or root tears. Weight-bearing knee radiographs were assessed using the Kellgren–Lawrence (KL) grading system. Statistical analysis was performed using appropriate statistical tests, with $p<0.05$ considered statistically significant.

Results: Among the 320 participants, 195 (61%) were females and 125 (39%) were males. The mean age was 57.8 ± 7.6 years, and the mean BMI was 28.5 ± 5.2 kg/m². MRI demonstrated one or more meniscal tears in 276 patients (86.25%). Medial meniscal involvement was significantly more common than lateral involvement (52% vs 34%, P<0.001). Among patients with meniscal tears, medial meniscal tears were most frequent (67.86%), followed by lateral tears (21%) and combined medial and lateral tears (9%). The posterior horn was the most commonly affected site (66%), followed by the body (52%) and anterior segment (10%). Complex tears were the most common morphological pattern (38%), followed by radial (16%) and oblique tears (13%). Meniscal damage increased significantly with advancing age (P<0.001) and was substantially higher in patients with KL grade 3–4 OA compared with lower grades (84% vs 26%, P<0.001). Among females, patients with meniscal tears had significantly higher BMI than those without meniscal injury (28.9 vs 26.4 kg/m², P<0.001).

Conclusion: Degenerative meniscal lesions were highly prevalent among patients with knee osteoarthritis, with predominant medial and posterior horn involvement. Meniscal damage was significantly associated with increasing age and greater radiological severity of osteoarthritis. MRI is valuable for identifying the location and morphological pattern of meniscal degeneration and may provide additional information regarding the structural burden of knee OA.

Keywords: Knee osteoarthritis; Meniscal tear; Degenerative meniscus; Magnetic resonance imaging; Kellgren–Lawrence grade; Medial meniscus; Posterior horn.

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Introduction

Magnetic resonance imaging (MRI) is an established non-invasive imaging modality that uses magnetic fields and radiofrequency signals to generate high-resolution multiplanar images of anatomical structures. Unlike conventional radiography and computed tomography, MRI does not involve ionizing radiation, making it particularly useful for repeated evaluation of musculoskeletal disorders. Its excellent soft-tissue contrast allows detailed visualization of articular cartilage, ligaments, menisci, bone marrow, and surrounding soft tissues, making MRI an important investigation in the assessment of knee pathology.[1,2]

The menisci are crescent-shaped fibrocartilaginous structures located between the femoral condyles and

tibial plateau. The medial and lateral menisci consist of anterior and posterior horns connected by a central body. They play an essential role in normal knee biomechanics by distributing load, absorbing shock, improving joint congruency, contributing to joint stability, and facilitating lubrication of the articular surfaces.[3] Preservation of meniscal tissue is therefore important for maintaining normal knee function and protecting the articular cartilage from excessive mechanical stress.

Meniscal abnormalities may be traumatic or degenerative. Acute meniscal tears are commonly associated with sports-related injuries involving twisting, pivoting, or sudden loading of the knee, whereas degenerative meniscal changes generally develop gradually with increasing age and chronic mechanical stress.[4] Degenerative meniscal lesions are particularly common in individuals with knee osteoarthritis (OA), and their presence may reflect the overall degenerative process occurring within the knee joint. Meniscal extrusion, tears, maceration, and loss of meniscal substance can alter load distribution across the tibiofemoral joint and may contribute to progression of structural osteoarthritic changes.[5]

Knee osteoarthritis is a chronic, multifactorial disorder characterized by progressive changes involving the articular cartilage, subchondral bone, synovium, and periarticular structures. Meniscal pathology is increasingly recognized as an important component of the structural disease process in OA. Degenerative meniscal tears are frequently identified on MRI in patients with radiographic knee OA, even in individuals with relatively mild symptoms. However, the clinical significance of these abnormalities can be difficult to determine because meniscal lesions may occur as part of the normal aging and degenerative process.[6]

Clinical evaluation of meniscal pathology includes assessment of pain, swelling, restricted range of motion, joint-line tenderness, clicking, locking, and other mechanical symptoms. Physical examination manoeuvres such as the McMurray, Apley compression, and Thessaly tests may provide additional information; however, their diagnostic accuracy varies according to the clinical setting and underlying knee pathology.[7] Consequently, imaging plays an important role when the diagnosis or extent of structural damage remains uncertain.

MRI is considered particularly valuable for detecting and characterizing meniscal abnormalities because it provides detailed information regarding the morphology, location, and extent of meniscal lesions. MRI can also demonstrate associated cartilage defects, bone marrow lesions, ligament abnormalities, joint effusion, and other features of knee OA.[8] Importantly, MRI may identify meniscal abnormalities that are not apparent clinically or on plain radiographs, allowing a more comprehensive assessment of structural knee damage.

Understanding the prevalence and characteristics of degenerative meniscal lesions among patients with established knee OA is clinically relevant because these lesions may be associated with pain, functional impairment, disease severity, and progression of structural changes. Therefore, the present study was undertaken to evaluate the prevalence and MRI characteristics of degenerative meniscal changes in patients with knee osteoarthritis and to assess their association with relevant clinical and radiological parameters.

Aim

To evaluate the prevalence and MRI characteristics of degenerative meniscal lesions in patients with knee osteoarthritis and assess their association with the severity of osteoarthritis.

Objectives

To determine the prevalence of degenerative meniscal lesions among patients diagnosed with knee osteoarthritis using MRI.

To identify the type, location, and pattern of meniscal degeneration or tears on MRI.

Materials and Methods

This observational study was conducted in the Department of Orthopaedics, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, from June 2025 to January 2026. Patients of either sex aged 40 years or older who were newly diagnosed or previously diagnosed with knee osteoarthritis and attending the Orthopaedics outpatient department were considered for inclusion. Patients willing to participate and provide written informed consent were enrolled. Patients with a history of traumatic knee injury or other knee pathology that could affect the menisci, terminal malignancy, previous knee replacement, rheumatoid arthritis, dependence on assisted walking devices such as a cane or walker, or contraindications to MRI were excluded. Demographic and relevant clinical data were recorded using a pre-approved and pre-validated data collection proforma. Eligible participants who were willing to undergo MRI underwent evaluation of the medial and lateral menisci of the right knee.

MRI of the knee was performed using a 1.5-Tesla Siemens MRI scanner with a phased-array knee coil. Meniscal integrity was assessed using sagittal T1-weighted spin-echo sequences and sagittal and coronal fat-saturated proton-density-weighted turbo spin-echo sequences. The MRI examinations were independently reviewed by a musculoskeletal radiologist and an orthopaedic surgeon. The readers were blinded to the clinical and radiographic findings of the participants. The anterior horn, body, and posterior horn of both the medial and lateral menisci were systematically evaluated. A meniscal tear was defined by increased intrameniscal signal extending to the superior, inferior, or free articular surface and persisting on at least two consecutive images. A radial tear was considered present when the lesion was identified on both sagittal and coronal images. Meniscal tears were classified according to their morphology as horizontal, oblique/parrot-beak, longitudinal, radial, complex, or root tears. Horizontal tears were defined as tears parallel to the tibial plateau separating the meniscus into superior and inferior components; oblique tears were oriented obliquely to the circumferential collagen fibres;

longitudinal tears were oriented perpendicular to the tibial plateau; radial tears originated from the central free margin and extended perpendicular to the tibial plateau and circumferential fibres; complex tears demonstrated more than one tear configuration; and root tears involved the anterior or posterior central meniscal attachment. Meniscal destruction was recorded when there was complete absence of meniscal tissue due to surgical resection or complete maceration.

Weight-bearing posteroanterior knee radiographs using a fixed-flexion protocol were obtained in participants with adequate MRI examinations. Radiographs were evaluated by a radiologist blinded to the clinical details of the participants. Radiographic severity of tibiofemoral osteoarthritis was assessed using the Kellgren–Lawrence (KL) grading system, which ranges from grade 0 to grade 4. A KL grade ≥2 was considered evidence of radiographic tibiofemoral osteoarthritis. The prevalence, location, morphology, and severity of meniscal abnormalities identified on MRI were subsequently correlated with the radiographic severity of knee osteoarthritis.

Statistical Analysis

Data were entered into a structured database and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range, depending on the distribution of the data. Categorical variables were presented as frequencies and percentages. The prevalence of medial and lateral meniscal abnormalities was calculated as a proportion of the total study population. Associations between categorical variables, including meniscal lesions and KL grades, were assessed using the chi-square test or Fisher's exact test, as appropriate. Continuous variables were compared using the Student's t-test for normally distributed data or the Mann–Whitney U test for non-normally distributed data. The relationship between patient characteristics, including age, sex, BMI, and duration of symptoms, and the presence of degenerative meniscal lesions was evaluated using appropriate correlation or regression analysis. Binary logistic regression analysis was performed to identify independent factors associated with the presence of meniscal tears, with results expressed as odds ratios (ORs) with 95% confidence intervals (Cis). Where appropriate, ordinal logistic regression was used to assess the association between meniscal pathology and increasing KL radiographic grade. A two-tailed p-value <0.05 was considered statistically significant.

Result:

A total of 320 patients diagnosed with osteoarthritis willing to undergo MRI scan were included in the study. Among them, 61% (n = 195) were women and 39% (n = 125) were men. The mean age of the subjects was 57.8 ± 7.6 years. The mean body mass index of the participants was 28.5 ± 5.2.

Prevalence of meniscal tears

Among the 320 subjects suffering from osteoarthritis, 276 participants (86.25%) had one or more meniscal tear in their right knee. The prevalence of medial meniscal tear was more common as compared to the lateral meniscal tear (prevalence 52% vs 34%, $P < 0.001$), which was statistically significant. Out of the 276 participants with meniscal damage, meniscal tear was present in 81.16% (n = 224) and meniscal destruction was seen in the remaining 18.84% (n = 52) subjects.

Among the 224 subjects with meniscal tear, the most common type of tear was medial meniscus tear (67.86%, n = 154). This was followed by 21% (n = 49) having lateral tear and 9% (n = 21) had both medial and lateral tears. The most common site of meniscal tear was posterior horn of meniscus (66%) in both the medial and lateral menisci, this was followed by 52% in the body segment and 10% in anterior segment. Figure 1 shows the characterization of meniscal tears. The most common type of tear was a complex meniscal tear in 38% subjects followed by radial tear in 16% and oblique tear in 13% patients (the total percentage does not add up to 100% as the meniscal tears may involve more than one segment of meniscus; also, the same knee may have more than one type of meniscal tear).

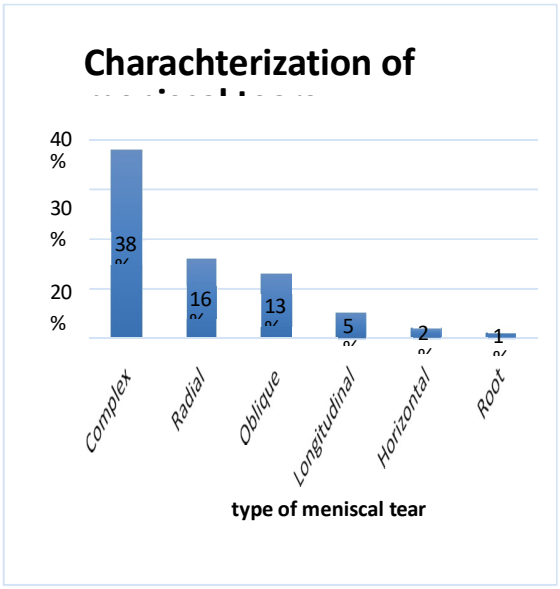
As shown in figure 2, the prevalence of meniscal injury was found to significantly increase with increasing age of the patients (P < 0.001). It was most common in the 60 onwards age group (54%) followed by 48% in 50-59 years' age group. The prevalence was higher in males as compared to females (67% vs 46%) which was statistically significant (P < 0.001).

Also, as depicted in figure 3, the prevalence of meniscal damage increased significantly with increase in the grade of osteoarthritis as measured using Kellgren and Lawrence grade. The meniscal damage was higher among subjects with Kellgren and Lawrence grade 3 or 4 as compared to those with grade 2 or lower tibiofemoral osteoarthritis (84% vs 26%, P < 0.001).

Among the subjects, females with at least one meniscal tear had significantly higher body mass index as compared to females without meniscal injury (28.9 vs 26.4, P <0.001). This was not significant in males with and without meniscal damage (28.8 vs 28.6, P = 0.84).

Figure 1. Characterization of meniscal tears. (n = 224)

Figure 2. Prevalence of meniscal injury in different age groups (n = 224).



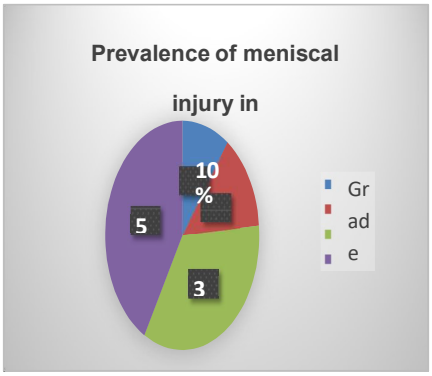


Figure 3. Prevalence of meniscal injury in osteoarthritic patients (n = 224).

Discussion

The present study evaluated the prevalence and MRI characteristics of degenerative meniscal lesions among 320 patients with knee osteoarthritis. The study population had a mean age of 57.8 ± 7.6 years, with a female predominance (61%) and a mean BMI of 28.5 ± 5.2 kg/m². The relatively high mean BMI is clinically relevant because obesity increases mechanical loading across the knee and is an established risk factor for the development and progression of knee osteoarthritis.[8]

A major finding of the present study was the high prevalence of meniscal tears, with 276 of 320 participants (86.25%) demonstrating one or more meniscal tears on MRI. This high prevalence is consistent with the observation that meniscal abnormalities are extremely common in individuals with radiographic knee osteoarthritis. Englund et al. reported that meniscal damage was frequently observed on MRI in middle-aged and older adults, including individuals with and without knee symptoms, emphasizing that degenerative meniscal abnormalities can occur as part of the ageing process.[9] The high prevalence observed in the present study therefore supports the close relationship between meniscal degeneration and structural knee osteoarthritis.

Medial meniscal involvement was significantly more frequent than lateral meniscal involvement (52% vs 34%, P<0.001). Among participants with meniscal tears, medial meniscal lesions accounted for the majority of abnormalities. This predominance may be explained by the greater mechanical loading experienced by the medial compartment, particularly in knees with varus alignment and medial compartment osteoarthritis. Previous studies have similarly demonstrated a strong association between medial meniscal pathology, meniscal extrusion, and progression of knee osteoarthritis.[10]

The posterior horn was the most frequently affected region, accounting for 66% of lesions, followed by the body (52%) and anterior segment (10%). Degenerative meniscal pathology commonly affects the posterior horn, particularly of the medial meniscus, where repetitive loading and altered biomechanics may contribute to progressive tissue degeneration. The most frequent morphological pattern in our study was a complex tear (38%), followed by radial (16%) and oblique tears (13%). The relatively high frequency of complex tears may reflect advanced degenerative changes rather than an isolated traumatic event. Degenerative meniscal tears often demonstrate multiple cleavage planes and irregular morphology, particularly in patients with established osteoarthritis.[11]

An important observation was the significant increase in meniscal damage with advancing age (P<0.001). Meniscal injury was most prevalent among patients aged ≥60 years, followed by those aged 50–59 years. This finding is consistent with the established relationship between ageing and meniscal degeneration. Age-related changes include reduced tissue hydration, altered collagen organization, diminished vascularity, and progressive loss of mechanical properties, which increase susceptibility to degenerative tearing.[12]

The prevalence of meniscal damage also increased markedly with radiological severity of osteoarthritis. Patients with Kellgren–Lawrence grade 3 or 4 disease had substantially greater meniscal damage than those with grade 2 or less (84% vs 26%, P<0.001). This finding supports the concept that meniscal degeneration and osteoarthritis are closely interconnected. Meniscal damage may impair load distribution and increase focal cartilage stress, while progressive osteoarthritic changes may simultaneously contribute to meniscal degeneration.[13]

The study also demonstrated a significant association between BMI and meniscal injury among females. Women with meniscal tears had a higher mean BMI than women without meniscal damage (28.9 vs 26.4 kg/m², P<0.001), whereas this difference was not significant among males. This sex-specific finding may reflect differences in biomechanics, body composition, alignment, and loading patterns, although further studies are required to establish the underlying mechanism.

Overall, the findings demonstrate that degenerative meniscal lesions are highly prevalent among patients with knee osteoarthritis, particularly in older individuals and those with advanced radiographic disease. MRI provides valuable information regarding the location and morphology of these lesions. However, because degenerative meniscal abnormalities are common and may occur without specific symptoms, MRI findings should always be interpreted alongside clinical and radiographic findings rather than considered an isolated indication for intervention.[14]

Conclusion

The present study demonstrated a high prevalence of degenerative meniscal lesions (86.25%) among patients with knee osteoarthritis evaluated by MRI.

Medial meniscal involvement was significantly more common than lateral meniscal involvement, with the posterior horn being the most frequently affected region and complex tears representing the predominant tear pattern. Meniscal damage increased significantly with advancing age and increasing Kellgren–Lawrence radiological grade, indicating a close association between meniscal degeneration and the severity of knee osteoarthritis. Higher BMI was also significantly associated with meniscal damage among female patients. These findings highlight the usefulness of MRI in identifying and characterizing meniscal abnormalities in patients with knee osteoarthritis. However, degenerative meniscal findings should be interpreted in conjunction with clinical symptoms and radiographic severity, as such abnormalities may also represent part of the natural degenerative process of ageing and osteoarthritis.

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