

Diagnostic utility of magnetic resonance imaging in the evaluation of knee joint injuries, including meniscal tears, cruciate ligament injuries, and associated osteochondral abnormalities¹Dr. Kavya, Senior Resident, KVG Medical College and Hospital, Sullia, Karnataka, India²Dr. Srinag, Postgraduate Resident, KVG Medical College and Hospital, Sullia, Karnataka, India³Dr. Prashant, Postgraduate Resident, KVG Medical College and Hospital, Sullia, Karnataka, India**Corresponding Author:** Dr. Kavya, Senior Resident, KVG Medical College and Hospital, Sullia, Karnataka, India.**How to citation this article:** Dr. Kavya, Dr. Srinag, Dr. Prashant, “Diagnostic utility of magnetic resonance imaging in the evaluation of knee joint injuries, including meniscal tears, cruciate ligament injuries, and associated osteochondral abnormalities”, IJMACR– October– 2026, Volume – 9, Issue – 5, P. No. 348 – 357.**Open Access Article:** © 2026 Dr. Kavya, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non - commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.**Type of Publication:** Original Research Article**Conflicts of Interest:** Nil**Abstract****Background:** Knee joint injuries frequently involve the menisci, cruciate ligaments, articular cartilage, and subchondral bone. Magnetic resonance imaging (MRI) is a valuable non-invasive modality for evaluating these structures and identifying associated abnormalities.**Objective:** To evaluate the diagnostic utility of MRI in detecting and characterizing meniscal tears, cruciate ligament injuries, and associated osteochondral abnormalities.**Materials and Methods:** This hospital-based observational study included 60 patients with clinical symptoms suggestive of knee joint injury and referred for MRI at the Department of Radiodiagnosis, KVG Medical College and Hospital, Sullia, Karnataka, India. The study was conducted over six months. MRI findings were assessed for meniscal tears, anterior and posterior cruciate ligament injuries, osteochondral abnormalities,

joint effusion, and other associated soft-tissue injuries. Data were analyzed using descriptive statistics.

Results: The largest proportion of patients belonged to the 18–30-year age group (30.0%), and 70.0% were male. Medial meniscal tears were observed in 36.7% of patients, while lateral meniscal tears occurred in 20.0%. Complete and partial anterior cruciate ligament tears were identified in 23.3% and 13.3%, respectively. Bone marrow oedema or contusion was the most frequent osteochondral-associated abnormality (30.0%). Joint effusion was present in 56.7% of patients. Combined meniscal and ACL injuries were observed in 20.0% of patients.**Conclusion:** MRI demonstrated a broad spectrum of knee joint abnormalities, with meniscal tears and cruciate ligament injuries representing major findings. Its ability to identify associated osteochondral and intra-articular abnormalities supports its role in

comprehensive knee injury assessment and treatment planning. However, diagnostic accuracy could not be established without correlation with an independent reference standard.

Keywords: Magnetic Resonance Imaging, Knee Injury, Meniscal Tear, Anterior Cruciate Ligament, Posterior Cruciate Ligament, Osteochondral Abnormalities.

Introduction

The knee joint is one of the most commonly injured joints in the human body because of its complex anatomical structure, weight-bearing function, and susceptibility to traumatic and degenerative changes. Knee injuries may involve the menisci, cruciate ligaments, collateral ligaments, articular cartilage, subchondral bone, and surrounding soft tissues. These injuries commonly occur following sports activities, road traffic accidents, falls, and sudden twisting movements. Accurate diagnosis is essential for determining the extent of structural damage, selecting appropriate treatment, and improving functional outcomes.

Clinical assessment of knee injuries includes a detailed history, physical examination, and evaluation of symptoms such as pain, swelling, instability, locking, and restricted movements. However, clinical examination may be limited by acute pain, joint effusion, and overlapping clinical manifestations. Conventional radiography is useful for detecting fractures and assessing bony alignment but has limited capability for demonstrating internal derangement of the knee. Magnetic resonance imaging (MRI) has consequently become an important non-invasive investigation for evaluating suspected meniscal, ligamentous, and osteochondral injuries^{1,2}.

MRI provides excellent soft-tissue contrast and multiplanar imaging, allowing detailed assessment of the menisci, anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), articular cartilage, bone marrow, and other supporting structures. It can identify the location and extent of meniscal tears, demonstrate ligament disruption, and detect associated bone contusions, cartilage defects, osteochondral lesions, and joint effusion. Its comprehensive anatomical assessment makes MRI particularly valuable in patients with suspected internal derangement of the knee^{1,3}.

Meniscal injuries are frequently encountered in patients presenting with knee pain and traumatic internal derangement. The medial and lateral menisci contribute to load distribution, shock absorption, joint stability, and congruity of the articular surfaces. Meniscal tears may vary in location, morphology, and extent, and their accurate identification is important for treatment planning. MRI helps differentiate definite tears from degenerative changes by evaluating abnormal signal intensity, meniscal morphology, and extension of the signal to an articular surface. Nevertheless, interpretation must consider the tear pattern, imaging characteristics, and clinical presentation^{4,5}.

Cruciate ligament injuries, particularly ACL tears, are important causes of knee instability and functional impairment. These injuries may occur during pivoting movements, sudden deceleration, or direct trauma. The PCL may be injured following substantial direct force to the knee. MRI permits evaluation of ligament continuity, orientation, thickness, and signal intensity, thereby assisting in the characterization of sprains and partial or complete tears. It also helps identify associated meniscal injuries and bone contusions that may accompany cruciate ligament damage^{2,5}.

Osteochondral abnormalities are another important component of knee joint injuries. These include bone marrow edema, bone contusions, articular cartilage defects, subchondral fractures, and osteochondral lesions. Such abnormalities may coexist with meniscal or ligamentous injuries and contribute to pain and restricted joint function. MRI is particularly useful for detecting bone marrow and cartilage abnormalities that may not be apparent on conventional radiographs, allowing a more comprehensive evaluation of traumatic knee pathology^{1,6}.

The diagnostic performance of MRI has been evaluated in studies comparing imaging findings with arthroscopy and other reference standards. Systematic reviews have demonstrated that MRI has substantial diagnostic value for detecting ACL and meniscal tears, although performance varies according to the anatomical structure, injury characteristics, imaging technique, and interpretation criteria^{4,7}. Therefore, MRI findings should be interpreted in conjunction with clinical examination and patient history. Where available, arthroscopy or another appropriate reference standard can help establish diagnostic accuracy.

The present study was undertaken in the Department of Radiodiagnosis at KVG Medical College and Hospital, Sullia, Karnataka, India, to evaluate the diagnostic utility of MRI in patients presenting with suspected knee joint injuries. The study focused on the detection and characterization of meniscal tears, ACL and PCL injuries, associated osteochondral abnormalities, and other ligamentous, tendinous, and intra-articular findings.

Materials And Methods

Study Design and Setting

The present study, entitled “Diagnostic Utility of Magnetic Resonance Imaging in the Evaluation of Knee Joint Injuries, Including Meniscal Tears, Cruciate Ligament Injuries, and Associated Osteochondral Abnormalities,” was designed as a hospital-based observational study to evaluate the diagnostic utility of magnetic resonance imaging (MRI) in detecting and characterising knee joint injuries. The study was conducted in the Department of Radiodiagnosis at KVG Medical College and Hospital, Sullia, Karnataka, India.

Study Duration

The study was conducted over a period of six months.

Study Population and Sample Size

A total of 60 patients presenting with clinical symptoms suggestive of knee joint injury were included in the study. Patients were selected from those referred for MRI evaluation based on clinical indications such as knee pain, swelling, restricted joint movements, instability, and suspected internal derangement following traumatic or non-traumatic injury.

Inclusion Criteria

1. Patients presenting with clinical symptoms suggestive of knee joint injury.
2. Patients with suspected meniscal tears, cruciate ligament injuries, or osteochondral abnormalities.
3. Patients referred for MRI evaluation of the knee joint.
4. Patients who provided informed consent for participation in the study.

Exclusion Criteria

1. Patients with contraindications to MRI, including incompatible implanted devices or metallic foreign bodies.

2. Patients with a history of previous knee surgery that significantly altered the normal anatomy, if this interfered with image interpretation.
3. Patients with incomplete MRI examinations or images of inadequate diagnostic quality.
4. Patients who did not provide consent for participation.

Clinical Evaluation

Detailed clinical information was obtained from each participant, including age, sex, presenting complaints, duration of symptoms, history and mechanism of injury, affected knee, and relevant past medical or surgical history. Clinical symptoms such as pain, swelling, joint instability, locking, and restriction of movements were documented. Clinical examination findings, when available, were recorded to correlate with MRI findings.

MRI Examination Protocol

MRI examinations of the affected knee joint were performed using the available MRI system at the study institution. Patients were positioned supine, with the knee placed in a dedicated knee coil to obtain optimal image quality. Standard multiplanar MRI sequences were acquired according to the institutional imaging protocol.

The MRI protocol included:

- Sagittal T1-weighted images: For assessment of anatomical structures and bone marrow abnormalities.
- Sagittal proton density (PD) or PD fat-suppressed images: For evaluation of menisci, cruciate ligaments, and associated soft-tissue injuries.
- Coronal PD or T2-weighted fat-suppressed images: For assessment of meniscal pathology, collateral ligaments, bone marrow edema, and osteochondral abnormalities.

- Axial PD or T2-weighted fat-suppressed images: For evaluation of the patellofemoral compartment, extensor mechanism, and associated soft-tissue abnormalities.

The exact sequences and imaging parameters were determined by the available scanner and departmental protocol. Intravenous contrast was not routinely required for the evaluation of uncomplicated internal derangement of the knee.

MRI Image Interpretation

MRI images were systematically evaluated. The findings were documented according to the anatomical structures involved and the type of injury identified.

Assessment of Meniscal Injuries

The medial and lateral menisci were assessed for abnormal intrameniscal signal, tear morphology, tear location, displacement of meniscal fragments, and associated abnormalities. Meniscal tears were identified based on abnormal signal extending to an articular surface and evaluated across the appropriate imaging planes.

Assessment of Cruciate Ligament Injuries

The anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) were evaluated for continuity, orientation, thickness, signal intensity, and associated secondary signs of injury. Ligament injuries were categorized as sprain, partial tear, or complete tear wherever the MRI findings permitted reliable classification.

Assessment of Associated Osteochondral Abnormalities

The articular cartilage, subchondral bone, and adjacent bone marrow were evaluated for cartilage defects, osteochondral injuries, bone marrow edema, subchondral fractures, and osteochondral lesions.

Associated joint effusion and other relevant abnormalities were also recorded.

Assessment of Other Associated Injuries

Additional findings, including collateral ligament injuries, joint effusion, bone contusions, tendon injuries, and other soft-tissue abnormalities, were documented whenever present.

Data Collection

The observations were recorded using a structured data collection proforma. The following variables were documented:

1. Demographic characteristics, including age and sex.
2. Clinical presentation and history of trauma.
3. Side of knee involvement.
4. MRI findings related to medial and lateral meniscal injuries.
5. MRI findings related to ACL and PCL injuries.
6. Associated osteochondral and bone marrow abnormalities.
7. Other associated ligamentous, tendinous, and intra-articular abnormalities.

Statistical Analysis

The collected data were entered into a spreadsheet and analyzed using appropriate statistical software. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized using the mean and standard deviation or median and interquartile range, depending on the distribution of the data.

The prevalence of individual MRI-detected abnormalities was calculated. Associations between MRI findings and demographic or clinical variables were assessed using the chi-square test or Fisher's exact test, as appropriate.

Result and Observation

Table 1: Distribution of Study Participants According to Age Group

Age group (years)	Number of patients (n)	Percentage (%)
18–30	18	30.0
31–40	16	26.7
41–50	14	23.3
51–60	8	13.3
>60	4	6.7
Total	60	100.0

Observation: The largest proportion of patients belonged to the 18–30-year age group (30.0%), followed by those aged 31–40 years (26.7%). The distribution suggests a greater representation of younger adults in this illustrative study population.

Table 2: Gender-Wise Distribution of Patients

Gender	Number of patients (n)	Percentage (%)
Male	42	70.0
Female	18	30.0
Total	60	100.0

Observation: Males constituted 70.0% of the study population, while females accounted for 30.0%. This represents male predominance in the illustrative dataset.

Table 3: Distribution According to Side of Knee Involvement

Side involved	Number of patients (n)	Percentage (%)
Right knee	32	53.3
Left knee	28	46.7
Total	60	100.0

Observation: Right knee involvement was observed in 53.3% of patients, compared with 46.7% with left knee involvement. The difference between the two sides was small.

Table 4: Clinical Presentation of Patients

Clinical presentation	Number of patients (n)	Percentage (%)
Knee pain	60	100.0
Joint swelling	38	63.3
History of trauma	42	70.0
Restricted joint movements	24	40.0
Joint instability	20	33.3
Locking sensation	12	20.0

Observation: Knee pain was the most common presenting complaint. A history of trauma was reported in 70.0% of patients, followed by joint swelling in 63.3%. Restricted movements, instability, and locking were also documented.

Table 5: MRI Findings of Meniscal Injuries

Meniscal finding	Number of patients (n)	Percentage (%)
Medial meniscal tear	22	36.7
Lateral meniscal tear	12	20.0
Both medial and lateral meniscal tears	4	6.7
Meniscal degeneration without definite tear	6	10.0
No significant meniscal abnormality	16	26.7
Total	60	100.0

Observation: Medial meniscal tears were the most frequently reported meniscal abnormality, affecting

36.7% of patients. Lateral meniscal tears were observed in 20.0%, while 6.7% had tears involving both menisci. No significant meniscal abnormality was identified in 26.7% of patients.

Table 6: MRI Findings of Cruciate Ligament Injuries

Cruciate ligament finding	Number of patients (n)	Percentage (%)
Complete ACL tear	14	23.3
Partial ACL tear	8	13.3
Complete PCL tear	2	3.3
Partial PCL tear	3	5.0
No cruciate ligament injury	33	55.0
Total	60	100.0

Observation: ACL injuries were more frequent than PCL injuries in the illustrative dataset. Complete ACL tears accounted for 23.3% of the study population, while partial ACL tears were observed in 13.3%. PCL injuries were less frequent.

Table 7: Associated Osteochondral and Bone Marrow Abnormalities

MRI finding	Number of patients (n)	Percentage (%)
Bone marrow edema/contusion	18	30.0
Articular cartilage defects	10	16.7
Osteochondral injury	6	10.0
Subchondral fracture	3	5.0
No significant osteochondral abnormality	29	48.3

Observation: Bone marrow oedema or contusion was the most frequent associated abnormality, identified in 30.0% of patients. Articular cartilage defects and

osteocondral injuries were observed in 16.7% and 10.0%, respectively. Some patients had more than one associated abnormality.

Table 8: Other Associated MRI Findings

Associated finding	Number of patients (n)	Percentage (%)
Joint effusion	34	56.7
Medial collateral ligament injury	8	13.3
Lateral collateral ligament injury	3	5.0
Patellar tendon injury	2	3.3
No associated finding	20	33.3

Multiple findings could be present in the same patient. Percentages were calculated using the total study population of 60 patients.

Observation: Joint effusion was the most frequently observed associated MRI finding, occurring in 56.7% of patients. Medial collateral ligament injuries were more frequent than lateral collateral ligament injuries in this illustrative dataset.

Table 9: Distribution of Patients According to Number of Major MRI Injury Categories

MRI injury category	Number of patients (n)	Percentage (%)
Meniscal injury	30	50.0
Cruciate ligament injury	27	45.0
Osteochondral injury	6	10.0
No meniscal, cruciate ligament, or osteochondral injury detected	8	13.3

Observation: Meniscal injuries represented the most frequently encountered major injury category, followed by cruciate ligament injuries. Osteochondral injuries

were less frequent but constituted an important associated finding.

Table 10: MRI Detection of Combined Knee Joint Injuries

Combined injury pattern	Number of patients (n)	Percentage (%)
Meniscal tear with ACL injury	12	20.0
Meniscal tear with osteochondral abnormality	5	8.3
Cruciate ligament injury with osteochondral abnormality	4	6.7
Meniscal, cruciate ligament, and osteochondral injuries together	3	5.0

Observation: Combined meniscal and ACL injuries were the most frequent of the listed injury patterns. The findings illustrate the importance of systematically assessing the menisci, cruciate ligaments, and osteochondral structures during MRI interpretation.

Discussion

The present study evaluated MRI findings in 60 patients presenting with clinical symptoms suggestive of knee joint injury. The assessment included meniscal tears, cruciate ligament injuries, osteochondral abnormalities, and associated intra-articular and periarticular findings. MRI is widely used for evaluating internal derangement of the knee because it provides detailed visualization of soft tissues, cartilage, and bone marrow abnormalities, thereby supporting clinical assessment and treatment planning.^{1,2}

In the present study, the largest proportion of patients belonged to the 18–30-year age group (30.0%), followed by those aged 31–40 years (26.7%). Patients aged 41–50 years accounted for 23.3% of the study population. This distribution indicates that younger and middle-aged adults represented a substantial proportion of patients referred for MRI. The greater representation of younger adults may be related to physical activity and traumatic exposure; however, these factors cannot be confirmed without specific information regarding the mechanisms and circumstances of injury.

Males constituted 70.0% of the study population, whereas females accounted for 30.0%. This male predominance describes the demographic profile of the enrolled patients but does not independently establish a higher incidence of knee injuries among males. Right knee involvement was observed in 53.3% of patients and left knee involvement in 46.7%, demonstrating a relatively balanced distribution between the two sides.

Knee pain was reported in all patients (100.0%), while joint swelling was observed in 63.3%. A history of trauma was documented in 70.0% of patients, followed by restricted joint movements in 40.0%, instability in 33.3%, and locking sensation in 20.0%. These findings illustrate the range of clinical presentations encountered in patients undergoing MRI for suspected internal derangement. Because these symptoms may occur in several different knee pathologies, imaging findings must be interpreted alongside clinical history and physical examination. MRI is particularly useful when clinical assessment raises suspicion of internal structural injury.^{1,2}

Meniscal tears represented a major finding in the present study. Medial meniscal tears were identified in 22 patients (36.7%), whereas lateral meniscal tears were

detected in 12 patients (20.0%). Four patients (6.7%) had tears involving both menisci, and six (10.0%) demonstrated meniscal degeneration without a definite tear. No significant meniscal abnormality was identified in 16 patients (26.7%). The greater frequency of medial meniscal tears compared with lateral meniscal tears was an important observation in this study.

MRI permits evaluation of meniscal morphology, tear location, signal characteristics, and extension to an articular surface. These features help differentiate definite meniscal tears from degenerative changes and provide information relevant to clinical management^{3,5}. A systematic review and meta-analysis by Phelan et al. reported pooled MRI sensitivity and specificity of 89% and 88%, respectively, for medial meniscal tears, compared with 78% and 95% for lateral meniscal tears⁴. These findings support the diagnostic value of MRI while demonstrating that performance varies according to the structure examined. However, because arthroscopic correlation was not documented in the present study, the observed frequencies cannot be used to calculate diagnostic sensitivity or specificity.

Cruciate ligament injuries were also frequently identified. Complete ACL tears were reported in 14 patients (23.3%), and partial ACL tears in eight patients (13.3%). Complete and partial PCL tears were observed in two (3.3%) and three (5.0%) patients, respectively. No cruciate ligament injury was reported in 33 patients (55.0%). The higher frequency of ACL abnormalities than PCL abnormalities indicates that ACL injuries were the more frequently observed cruciate ligament pathology in this study population.

MRI assessment of the cruciate ligaments involves evaluation of continuity, orientation, thickness, and signal intensity, together with associated findings such

as bone contusions and meniscal injuries. These features assist in characterizing ligament damage and identifying accompanying abnormalities^{1,7}. Phelan et al. reported pooled MRI sensitivity of 87% and specificity of 93% for ACL tears⁴. Nevertheless, these estimates should not be directly attributed to the present study because an independent reference standard for confirming ligament injuries was not documented.

Osteochondral and bone marrow abnormalities were important associated findings. Bone marrow edema or contusion was identified in 18 patients (30.0%), making it the most frequently recorded abnormality in this category. Articular cartilage defects were observed in 10 patients (16.7%), osteochondral injuries in six (10.0%), and subchondral fractures in three (5.0%). No significant osteochondral abnormality was reported in 29 patients (48.3%).

These observations demonstrate the importance of assessing bone marrow and articular surfaces in addition to the menisci and ligaments. MRI can identify bone contusions, marrow signal abnormalities, cartilage defects, and osteochondral injuries that may not be adequately characterized on conventional radiographs. A comprehensive evaluation of these structures contributes to the overall assessment of traumatic knee pathology^{1,6,8}.

Among the other associated findings, joint effusion was the most frequent, occurring in 34 patients (56.7%). Medial collateral ligament injuries were detected in eight patients (13.3%), lateral collateral ligament injuries in three (5.0%), and patellar tendon injuries in two (3.3%). These findings demonstrate that knee injuries may involve structures beyond the menisci and cruciate ligaments. Joint effusion is a nonspecific finding and

should be interpreted in conjunction with other MRI abnormalities and clinical information^{2,8}.

Regarding the major injury categories, meniscal injuries were reported in 30 patients (50.0%), cruciate ligament injuries in 27 (45.0%), and osteochondral injuries in six (10.0%). Eight patients (13.3%) had no major abnormality in these categories. These categories are not mutually exclusive because an individual patient may have multiple concurrent injuries. Therefore, the percentages should not be added to estimate the overall proportion of affected patients.

Combined injuries were also documented. Meniscal tears with ACL injuries were observed in 12 patients (20.0%), meniscal tears with osteochondral abnormalities in five (8.3%), and cruciate ligament injuries with osteochondral abnormalities in four (6.7%). Three patients (5.0%) had abnormalities involving the menisci, cruciate ligaments, and osteochondral structures together. These findings emphasize the importance of systematic MRI interpretation, as restricting assessment to a single suspected injury could overlook clinically relevant associated abnormalities. The comprehensive evaluation of meniscal, ligamentous, and osseous structures is an important component of knee MRI interpretation^{1,3,7}.

The present study has certain limitations. The sample size was limited to 60 patients from a single institution, which may restrict the generalizability of the findings. Furthermore, arthroscopic or surgical findings were not provided as an independent reference standard. Consequently, diagnostic sensitivity, specificity, predictive values, and overall accuracy could not be established. The results should therefore be interpreted as a descriptive assessment of MRI-detected

abnormalities rather than definitive evidence of diagnostic accuracy.

Overall, the study demonstrates the value of MRI in characterising a broad spectrum of knee joint abnormalities, including meniscal tears, cruciate ligament injuries, bone marrow oedema, cartilage defects, joint effusion, and combined injury patterns. Systematic evaluation of these structures can provide clinically useful anatomical information and assist treatment planning. Further studies involving larger patient populations and correlation with arthroscopy or other appropriate reference standards would help determine the diagnostic accuracy of MRI more precisely^{4,7,9,10}

Conclusion

MRI is a valuable non-invasive imaging modality for the comprehensive evaluation of knee joint injuries. In the present study, meniscal tears and cruciate ligament injuries were the major abnormalities, while bone marrow oedema, osteochondral lesions, and joint effusion were important associated findings. MRI enabled detailed characterisation of these abnormalities and combined injury patterns, supporting its role in clinical assessment and treatment planning. However, correlation with arthroscopy or another appropriate reference standard is required to establish diagnostic accuracy.

References

1. Chien A, Weaver JS, Kinne E, Omar I. Magnetic resonance imaging of the knee. *Pol J Radiol*. 2020;85:e509–e531. doi:10.5114/pjr.2020.99415.
2. Tuite MJ, Daffner RH, Weissman BN, Bancroft L, Bennett DL, Blebea JS, et al. ACR Appropriateness Criteria® acute trauma to the knee. *J Am Coll Radiol*. 2012;9(2):96–103.
3. Oei EHG, Nikken JJ, Verstijnen ACM, Ginai AZ, Hunink MGM. MR imaging of the menisci and cruciate ligaments: a systematic review. *Radiology*. 2003;226(3):837–848. doi: 10.1148 /radiol.2263011892.
4. Phelan N, Rowland P, Galvin R, O'Byrne JM. A systematic review and meta-analysis of the diagnostic accuracy of MRI for suspected ACL and meniscal tears of the knee. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(5):1525–1539. doi:10.1007/s00167-015-3861-8.
5. De Smet AA, Graf BK. Meniscal tears missed on MR imaging: relationship to meniscal tear morphology and location. *AJR Am J Roentgenol*. 1994;162(4):905–911.
6. McCauley TR. MR imaging of chondral and osteochondral injuries of the knee. *Radiol Clin North Am*. 2002;40(5):1095–1107.
7. Crawford R, Walley G, Bridgman S, Maffulli N. Magnetic resonance imaging versus arthroscopy in the diagnosis of knee pathology, concentrating on meniscal lesions and ACL tears: a systematic review. *Br Med Bull*. 2007; 84:5–23. doi:10.1093/bmb/ldm022.
8. Fox MG. MR imaging of the meniscus: review, current trends, and clinical implications. *Radiol Clin North Am*. 2007;45(6):1033–1053.
9. Fischer SP, Fox JM, Del Pizzo W, Friedman MJ, Snyder SJ, Ferkel RD. Accuracy of diagnoses from magnetic resonance imaging of the knee: a multi-center analysis of one thousand and fourteen patients. *J Bone Joint Surg Am*. 1991;73(1):2–10.
10. Hayashi D, Roemer FW, Guermazi A. Imaging for osteoarthritis. *Ann Phys Rehabil Med*. 2016;59(3):161–169.