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MRI in Knee Evaluation: ESR's Best Practices and Recommendations

Magnetic Resonance Imaging (MRI) has become an essential tool in assessing and diagnosing knee-related conditions, particularly in cases of acute trauma and chronic knee issues. Given the complex anatomy of the knee, MRI provides crucial information about soft tissues, ligaments, cartilage, and bone marrow that cannot be visualised with other imaging modalities. Recent recommendations from the European Society of Musculoskeletal Radiology (ESSR) highlight key practices for optimising MRI protocols and reporting to enhance diagnostic accuracy. These recommendations aim to standardise practices among radiologists and ensure clear communication with clinicians. A recent ESR Essential paper published in European Radiology explores the best practices for knee MRI, covering protocol recommendations, clinical indications, and assessing fundamental structures such as menisci, ligaments, and cartilage.

MRI Protocol: Best Practices for Knee Imaging

The ESSR emphasises that knee MRI should be performed using a standardised protocol to ensure comprehensive joint imaging. MRI should be conducted in three orthogonal planes—sagittal, coronal, and transverse—so that critical pathologies are not overlooked. The sagittal plane is particularly important for visualising the anterior cruciate ligament (ACL) in its entirety, which is often implicated in sports injuries. T1- and T2-weighted sequences are integral to knee MRI, with the T1 sequence essential for identifying bone marrow abnormalities and differentiating between various pathologies. In contrast, the T2-weighted images detect oedema associated with both acute and chronic knee pain.

Fluid-sensitive sequences such as proton density (PD) images also play a significant role in assessing soft tissues, menisci, and bone marrow. These sequences should be tailored based on local scanner capabilities and radiologist preference. The inclusion of radiographs or computed tomography (CT) in cases of acute knee trauma is also recommended to avoid missing small bony injuries that may not be as apparent on MRI alone. A comprehensive imaging protocol that addresses both the hard and soft tissue components of the knee allows for a more accurate and holistic assessment.

Clinical Indications for Knee MRI

The indications for knee MRI vary significantly depending on the clinical context. MRI is most commonly employed in cases of acute trauma with suspected internal derangement or when other imaging modalities have failed to explain chronic knee pain. MRI is particularly useful in identifying soft tissue injuries, such as meniscal or ligament tears, which may not be visible on radiographs. In patients with unexplained chronic knee pain, MRI serves as a secondary diagnostic tool when initial radiographic findings are non-specific or inconclusive.

In sports-related injuries, MRI is invaluable for evaluating ligamentous integrity, particularly for diagnosing ACL and posterior cruciate ligament (PCL) tears. MRI can also detect subtle meniscal injuries that may require surgical intervention. Additionally, MRI is used to assess bone marrow pathology, such as bone contusions and osteochondral lesions, which may be associated with both trauma and degenerative conditions. Radiologists must be aware that clinical history significantly enhances the diagnostic accuracy of MRI, as the imaging findings must be correlated with the patient's symptoms to ensure an accurate diagnosis.

Menisci, Ligaments, and Cartilage: Key Structures in Knee MRI

The menisci, ligaments, and cartilage are crucial structures that must be thoroughly evaluated in every knee MRI. The menisci, which act as shock absorbers and stabilisers in the knee joint, are prone to tears, particularly following trauma. MRI can visualise these tears, often appearing as high-signal lines on PD or T2-weighted images. Meniscal tears are classified based on their orientation (horizontal, vertical, or complex) and location within the meniscus (anterior, mid-body, or posterior). Understanding the severity of the tear is critical, as some tears, particularly those with a gap greater than 5mm, may require surgical intervention.

Ligamentous injuries are another common finding in knee MRI, particularly in athletes. The ACL and PCL are the primary stabilisers of the knee and are frequently injured during high-impact sports. MRI can detect both full- and partial-thickness tears in these ligaments, although partial tears are more challenging to diagnose. MRI also helps identify associated injuries, such as bone contusions or Segond fractures, which are small avulsions at the tibial rim often seen in conjunction with ACL tears. The medial and lateral collateral ligaments (MCL and LCL) should also be assessed for signs of injury, such as thickening, increased signal, or discontinuity of fibres.

Cartilage evaluation is another critical component of knee MRI. Cartilage lesions may result from trauma or degenerative processes and can progress to osteochondral lesions, where both the cartilage and underlying bone are affected. MRI can detect the depth of cartilage lesions, classifying them as partial or full-thickness defects. However, it is important to note that MRI often underestimates the severity of cartilage damage compared to findings at arthroscopy. Proper grading of these lesions is important for treatment planning, especially when surgical options are being considered.

Conclusion

MRI of the knee is an indispensable tool in the diagnosis and management of both acute and chronic knee conditions. Radiologists can provide clinicians with accurate and actionable information by following standardised imaging protocols and thoroughly evaluating key structures such as the menisci, ligaments, and cartilage. Implementing ESSR recommendations not only enhances the diagnostic accuracy of knee MRI but also promotes consistency in reporting practices, ultimately improving patient outcomes. Future advancements in MRI technology, including 3D imaging and artificial intelligence integration, promise to enhance knee MRI's diagnostic capabilities further. However, for now, adhering to the best practices outlined in this article will ensure that knee MRIs are both comprehensive and clinically useful.

Source: European Radiology

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