Imaging of Soft Tissue Abnormalities About the Hip

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KEYWORDS

• Hip • Joint capsule • Tendons • Plica • Capsule • Myotendinous strain
• Ischiofemoral impingement

KEY POINTS

- Selection of appropriate imaging modalities and solid knowledge-base of imaging anatomy and functional roles of various soft tissue structures are essential for radiologists to make accurate diagnosis of soft tissue abnormalities about the hip.
- Identification of the intra-articular or extra-articular location is a critical first step in the evaluation of soft tissue abnormalities about the hip.
- Common intra-articular pathologic conditions about the hip include synovial plicae, and inflammatory and proliferative disorders of the synovium; common extra-articular abnormalities include bursitis and muscular or tendinous pathologic conditions, which can be further categorized according to the mechanism of injury and the anatomic or functional compartments affected.

IMAGING TECHNIQUES

Radiography

Plain radiography remains an important imaging modality for the initial assessment of soft tissue abnormalities of the adult hip in many cases. At the authors' institution, the standard views include anteroposterior and frog-leg lateral views of the symptomatic hip. An elongated femoral neck view is included when femoroacetabular impingement is the clinical question. In addition, an anteroposterior view of the pelvis is often included to assist in assessment of hip pain. The presence of intra-articular osteocartilaginous bodies, mineralization within the soft tissue abnormality, and associated periosteal reaction or bony destruction can be visualized. The presence of a joint effusion can be inferred from displacement of fat pads about the hip, including the gluteus, iliopsoas, and obturator internus fat pads, although bulging of a fat pad is recognized as an insensitive secondary sign of joint effusion.[1]

Ultrasonography

As a cost-effective and readily available technique, ultrasonography (US) allows real time cross-sectional interrogation of soft tissue structures about the hip. Usually, targeted US examination in the area of the patient's symptoms or palpable abnormality is performed. The size, location, and echotexture of the abnormalities can be characterized, and vascularity can be evaluated with color Doppler. US can also be used to detect hip joint effusion and guide various soft tissue interventions. Because there is no ionizing radiation involved, US is a particularly valuable tool in the evaluation of soft tissue abnormalities in the pediatric population. In addition, US allows dynamic evaluation of soft tissue structures and is, therefore, the modality of choice in the evaluation of suspected snapping hip syndrome.[2]

CT

The leading indication for performing CT in patients with hip pain is trauma. Owing to its

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cross-sectional capability, and high-quality multiplanar and volumetric reformations, CT is also helpful in the further delineation of soft tissue abnormalities and associated mineralization, and secondary osseous changes initially detected on plain radiographs. CT is the preferred imaging modality in the evaluation of soft tissue pathology in patients who have contraindications to MR imaging or who have surgical hardware in the region of clinical concern.

MR Imaging

MR imaging of the hip and the pelvis is commonly performed in patients who present with hip pain. Dedicated imaging of the symptomatic hip is preferred in most cases because it provides better spatial resolution and higher signal-to-noise ratio, due to the small field of view and the use of a dedicated surface coil. When patients have bilateral symptoms or the clinical entity is a systemic process or metastatic disease, imaging of the pelvis including both hips can be performed.

At the authors' institution, when performing hip MR imaging, we first survey the pelvis using a coronal short tau inversion recovery (STIR) sequence. Higher resolution MR images of the hip can be then obtained by placing a local surface coil (eg, body matrix coil, dedicated hip coil) over the symptomatic hip and using a small field of view (16–20 cm). Four imaging planes are routinely used and different types of sequences are included: coronal T2 fat-saturated fast spin echo, coronal T1 fast spin echo, sagittal proton density (PD) fast spin echo, axial PD fast spin echo, and oblique axial fat-saturated PD fast spin echo, prescribed along the long axis of the femoral neck (**Table 1**). When the patient presents with a palpable abnormality, or when there is clinical concern for a neoplastic or infectious process, we use a specific protocol that requires the technologist to place a skin marker over the area of palpable abnormality or clinical symptoms, and center the scan accordingly. The sequences that we routinely use in this protocol include fast spin echo coronal and axial T1, fast spin echo sagittal T2 with fat saturation, axial fast spin echo T2 with fat saturation, and postgadolinium axial and coronal or sagittal fast spin echo T1-weighted fat-saturated sequence if there is concern for a neoplasm.

For magnetic resonance (MR) examinations of the pelvis, we use the following sequences: coronal T1-weighted fast spin echo, coronal STIR, axial PD fast spin echo, and axial and sagittal T2 fat-suppressed fast spin echo sequences. The acetabulum, proximal femora, and pelvic structures should always be adequately covered.

In cases of suspected intracapsular or capsular abnormalities, direct MR arthrography is the modality of choice. For direct MR arthrography, we use diluted MR contrast agent, created by adding 0.8 mL of gadopentetate dimeglumine to 100 mL of normal saline. Ten mL of this solution is mixed with 5 mL of nonionic iodinated contrast and 5 mL of lidocaine 1% (final dilution ratio of 1:250) within a 20-mL syringe. A 22-gauge needle is placed within the hip joint and approximately 10 to 12 mL of solution is injected to achieve capsular distension. The use of iodinated contrast enables fluoroscopic confirmation of intra-articular needle placement, as well as detection of extracapsular contrast extravasation. A surface coil is positioned over the hip to decrease the field of view and improve spatial resolution. Our protocol for MR

Table 1
Routine hip MR imaging protocol

Sequence	FOV (mm)	Matrix	TR (ms)	TE (ms)	TI (ms)	Bandwidth (kHz)	Echo Train Length
Coronal STIR (pelvis)	360	320 × 192	4060	48	200	200	7
Axial PD FSE	200	256 × 256	2730	9	–	300	5
Coronal T1 FSE	200	384 × 307	650	15	–	303	5
Coronal T2 FSE FS	200	256 × 256	3070	60	–	250	11
Sagittal PD FSE	200	384 × 307	3500	43	–	303	7
Oblique axial PD FSE FS	160	384 × 257	3640	48	–	303	5
Axial T2 FSE FS	200	256 × 154	4000	69	–	250	11

Routine hip MR imaging protocol is performed with a local surface coil (body matrix coil or dedicated hip coil) on a 3 Tesla MR scanner.

Abbreviations: FOV, field of view; FS, fat saturation; FSE, fast spin echo; TE, echo time; TR, repetition time.