Traumatic Injuries of the Hip

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KEYWORDS

• Athletes • Traumatic injury • Hip • Sports medicine
• MR imaging • MR arthrogram

Imaging of the hip in the athlete has undergone a recent resurgence of interest and understanding because of the increasing accessibility and use of hip arthroscopy, which expands the treatment options available for intra-articular pathology. MR imaging and MR arthrography are the diagnostic tools best suited to guide the referring clinician in the diagnosis of intra-articular and extra-articular soft tissue, chondral, and osseous pathology.

Traumatic hip injury in the athletic population is not common, accounting for 5% to 8% of athletic injuries in adults[1,2] and 2% to 27%[3,4]% in children. Soccer players, runners, and dancers are particularly susceptible.[2,3] Soft tissue injuries (eg, contusions and sprains) are most frequent, typically self-limiting, and do not warrant further imaging. Although intra-articular lesions are uncommon, they do account for a significant amount of time lost from play, up to 120 days in one 10-year review of National Football League American football players.[5]

THE ROLE OF MR IMAGING

Plain radiography is an essential screening tool in the diagnosis of hip pathology and is often all that is required for fracture imaging. CT adds further information to allow operative intervention. Ultrasound is an invaluable tool not only in allowing dynamic assessments (as in snapping hip) but to guide intervention.

MR imaging has steadily been more frequently used, particularly given that arthroscopy is not without risks, with complication rates of 1.4% to 5% reported, including serious complications, such as sciatic or femoral nerve palsy and avascular necrosis (AVN).[6,7]

The accuracy of MR imaging when correlated with arthroscopic and surgical findings has increased over the years with improvements in field strength and techniques.[8] Three-Tesla MR imaging has limited published material pertaining to efficacy at this stage but early reports document improved visualization of labral and chondral pathology.[9]

TECHNIQUE

Standard MR imaging of the hip uses a large field of view for the entire pelvis with the use of an array coil. The authors perform coronal T1, spin echo, short tau inversion recovery (STIR), axial T1, proton density, and fast spin echo T2 fat-saturated sequences (**Table 1**). An oblique axial (also termed ''oblique sagittal'' in some of the literature) in the plane of the femoral neck is obtained to assess the femoral head neck offset in the assessment for femoroacetabular impingement and also allows for better assessment of the labrum. These standard sequences enable evaluation of the entire pelvis including pelvic viscera for extra-articular and potentially bilateral pathology including AVN, occult fracture, marrow abnormality, and musculotendinous and bursal pathology.

Imaging of the hip can be challenging because of the overlying soft tissues. Unilateral high-resolution imaging of the hip with a surface coil and smaller field of view (16–22 cm) produces better imaging of the labrum and chondral surfaces.

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In the absence of a hip joint effusion, diagnostic accuracy for intra-articular structures is significantly improved by MR arthrography. There is a higher sensitivity and accuracy as compared with standard MR imaging (90% and 91% versus 30% and 36%, respectively).[10]

Diagnosis is improved for labral and ligamentum teres tears, intra-articular bodies, osteochondral lesions, and preoperative assessment of developmental hip dysplasia.[11–13] Although MR arthrography is superior to standard MR imaging in detecting chondral loss, it still has a high false-negative rate particularly when advanced.[14–16] For this reason, some authors have suggested a negative MR arthrogram does not obviate the need for arthroscopy.[16] The routine use of intra-articular local anesthesia is suggested to allow a subjective assessment of pathology. Resolution of the pain can confirm an intra-articular location of pathology, with an accuracy of 90%[17] albeit as a nonspecific finding.[18] Conversely, a lack of a response in the face of a positive MR imaging examination implies that any diagnosed intra-articular pathology is likely not to be the cause of a patient's symptoms.[19] A lack of response does not entirely exclude the diagnosis of intra-articular pathology[20] possibly because of the lack of provoking stimulus during the period of action.

Instillation of contrast is performed under fluoroscopic control and using a sterile technique. A 22-gauge needle is placed into the joint and intra-articular position confirmed using a small amount of iodinated contrast. Thereafter, approximately 10 mL of a mixture consisting of 0.1 mL of gadopentetate dimeglumine (Magnevist; Berlex Laboratories, Wayne, New Jersey), 10 mL of normal saline, and 10 mL of 0.25% bupivacaine is then injected. Injection can be performed with a 45-degree anterior angled approach, anteriorly with a perpendicular approach to the skin, or a lateral approach. The authors favor an anterior perpendicular approach to avoid the femoral neurovascular bundle. It is important to avoid the inadvertent injection of air, which may result in magnetic susceptibility artifact, or the appearance of nondependent debris in the joint. Imaging is performed 30 minutes after injection (**Table 2**). Peak contrast-to-noise ratio and joint distention occurs at 30 minutes in the hip with steady decrease after this time.[21]

Use of T1 fat-saturated sequences allows maximum contrast between intra-articular contrast and adjacent soft tissues. STIR or T2 fat-saturated imaging is routine to allow detection of other unsuspected pathology including extra-articular fluid collections and bone marrow lesions.

Table 1
Standard MR imaging hip sequences

	Pelvis				Hip			
	Coronal T1	Coronal STIR	Axial T2 FS	Axial T1	Coronal T2 FS	Sagittal PD FS	Axial PD FS	Axial Oblique T2 FS
TR (ms)	600	—	3000	600	3000	3000	3000	3000
TE (ms)	14	—	90	14	90	30	30	90
IR	—	—	—	—	—	—	—	—
Slice thickness (mm)	5	5	5	5	—	—	—	—
FOV (cm)	36	36	34	34	22	16	16	16
Image matrix size	320 × 256	320 × 256	384 × 224	384 × 224	320 × 256	320 × 224	384 × 224	384 × 224

Abbreviations: FOV, field of view; FS, fat-saturated; PD, proton density; STIR, short tau inversion recovery.