American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Chronic Hip Pain**

Variant 1: **Initial evaluation for chronic hip pain. First test.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray pelvis	9		☢☢
X-ray hip	9	AP and lateral views of the affected hip.	☢☢☢
MRI hip without contrast	1		O
MRI hip without and with contrast	1		O
US hip	1		O
CT hips without contrast	1		☢☢☢
CT arthrography hip	1		☢☢☢
MR arthrography hip	1		O
Tc-99m bone scan hip	1		☢☢☢
X-ray arthrography hip with anesthetic with or without corticosteroid	1		NS
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Variant 2: **Radiographs negative, equivocal or nondiagnostic, suspect osseous or surrounding soft-tissue abnormality, excluding osteoid osteoma.**

Radiologic Procedure	Rating	Comments	RRL*
MRI hip without contrast	9		O
MRI hip without and with contrast	6	If required after review of noncontrast study. See statement regarding contrast in text under "Anticipated Exceptions."	O
MR arthrography hip	3	If femoroacetabular impingement or labral tear is suspected, see variant 5.	O
US hip	2		O
CT hips without contrast	2		☢☢☢
CT arthrography hip	2		☢☢☢
X-ray arthrography hip with anesthetic with or without corticosteroid	2		NS
Tc-99m bone scan hip	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Clinical Condition: **Chronic Hip Pain**

Variant 3: **Radiographs negative, equivocal, or nondiagnostic, suspect osteonecrosis. Includes circumstance in which hip is asymptomatic but osteonecrosis is suspected due to known predisposing factors.**

Radiologic Procedure	Rating	Comments	RRL*
MRI hips with or without contrast	9	Contrast may be helpful in specific clinical situations such as differentiating subchondral fracture from osteonecrosis. See statement regarding contrast in text under "Anticipated Exceptions."	O
Tc-99m bone scan hip	5		☢☢☢
US hip	2		O
CT hips without contrast	2		☢☢☢
CT arthrography hip	2		☢☢☢
MR arthrography hip	2		O
X-ray arthrography hip with anesthetic with or without corticosteroid	2		NS
FDG-PET pelvis	1	Further work is needed for establishing the criteria in routine clinical workup. Attenuation correction by radionuclide methods or, more commonly, with CT is considered part of the examination.	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Variant 4: **Radiographs negative, equivocal or nondiagnostic. Suspect osteoid osteoma.**

Radiologic Procedure	Rating	Comments	RRL*
CT hips without contrast	9		☢☢☢
MRI hips with or without contrast	7		O
Tc-99m bone scan hip	2		☢☢☢
CT arthrography hip	2		☢☢☢
X-ray arthrography hip with anesthetic with or without corticosteroid	2		NS
US hip	1		O
MR arthrography hip	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Clinical Condition: **Chronic Hip Pain**

Variant 5: **Radiographs negative, equivocal, or nondiagnostic. Suspect labral tear with or without clinical findings consistent with or suggestive of femoroacetabular impingement.**

Radiologic Procedure	Rating	Comments	RRL*
MR arthrography hip	9	May be combined with anesthetic with or without corticosteroid. Use of high resolution (3T) in the future may obviate the need for contrast. See statement regarding contrast in text under "Anticipated Exceptions."	O
CT arthrography hip	7	May be combined with anesthetic with or without corticosteroid. An alternative if MRI is not available or contraindicated.	☢☢☢
MRI hip without contrast	6	Use of high resolution (3T) in the future may obviate the need for contrast.	O
MRI hip with contrast (indirect arthrography)	5	See statement regarding contrast in text under "Anticipated Exceptions."	O
CT hips without contrast	1		☢☢☢
US hip	1	Can be used to guide hip injections.	O
Tc-99m bone scan hip	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Variant 6: **Radiographs negative, equivocal, nondiagnostic, or mild osteoarthritis. Suspect referred pain but wish to exclude hip.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray arthrography hip with anesthetic with or without corticosteroid	9		NS
MRI hip without contrast	5	If another imaging study is indicated, MRI is the study of choice.	O
CT hips without contrast	2		☢☢☢
MR arthrography hip	2		O
CT arthrography hip	2		☢☢☢
US hip	2		O
Tc-99m bone scan hip	2		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Clinical Condition: **Chronic Hip Pain**

Variant 7: **Radiographs positive, arthritis of uncertain type. Infection not a consideration.**

Radiologic Procedure	Rating	Comments	RRL*
MRI hips with or without contrast	5	If process is monoarticular or atypical.	O
CT hips without contrast	2		☢☢☢
US hip	2		O
CT arthrography hip	2		☢☢☢
MR arthrography hip	2		O
Tc-99m bone scan hip	2		☢☢☢
X-ray arthrography hip with anesthetic with or without corticosteroid	2		NS
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Variant 8: **Radiographs positive, suggestive of pigmented villonodular synovitis or osteochondromatosis.**

Radiologic Procedure	Rating	Comments	RRL*
MRI hip without contrast	9		O
CT arthrography hip	5	If MRI is not available or contraindicated.	☢☢☢
MRI hip without and with contrast	2		O
US hip	2		O
CT hips without contrast	2		☢☢☢
MR arthrography hip	2		O
Tc-99m bone scan hip	2		☢☢☢
X-ray arthrography hip with anesthetic with or without corticosteroid	2		NS
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Expert Panel on Musculoskeletal Imaging: Mihra S. Taljanovic, MD[1]; Richard H. Daffner, MD[2]; Barbara N. Weissman, MD[3]; Marc Appel, MD[4]; Erin Arnold, MD[5]; Laura W. Bancroft, MD[6]; D. Lee Bennett, MD, MA[7]; Judy S. Blebea, MD[8]; Michael A. Bruno, MD[9]; Ian Blair Fries, MD[10]; Curtis W. Hayes, MD[11]; Mark J. Kransdorf, MD[12]; Jonathan S. Luchs, MD[13]; William B. Morrison, MD[14]; Christopher J. Palestro, MD[15]; Catherine C. Roberts, MD[16]; David W. Stoller, MD[17]; Michael J. Tuite, MD[18]; Robert J. Ward, MD[19]; James N. Wise, MD[20]; Adam C. Zoga, MD.[21]

Summary of Literature Review

Introduction/Background

Chronic hip pain and/or groin pain is a perplexing clinical problem. Symptoms may be related to numerous etiologies, including trauma, neoplasms, and arthropathies. Pain may be due to osseous, intra-articular, periarticular, or soft-tissue pathology. Referred pain from the lumbar spine, sacroiliac joints, or knee may add to the potentially confusing clinical picture. Very few references deal specifically with chronic hip pain, although the imaging of specific disorders has been the subject of many articles.

Radiography

Clinical data are essential for selecting the most appropriate imaging techniques in patients with chronic hip pain. Range of motion, gait abnormalities, locking or snapping, duration of symptoms, and pain patterns (eg, worse at night, increased with exercise, relieved by aspirin) can be very useful for reducing the potentially long list of differential diagnoses. Radiographs should be obtained first in most if not all cases [1] and may provide specific information for common disorders such as osteoarthritis (OA) or less common disorders such as primary bone tumors. Whether the radiographs are normal or not, they are often of considerable value for the selection of additional techniques and for comparison with studies such as magnetic resonance imaging (MRI) examinations and radionuclide bone scans [2].

Magnetic Resonance Imaging, Positron Emission Tomography, Computed Tomography

MRI is frequently performed after initial radiographs to detect osseous, articular, or soft-tissue abnormalities [3-27]. It is both highly sensitive and specific for detecting many abnormalities involving the hip or surrounding soft tissues and should in general be the first imaging technique used following radiographs [3,6-7,9-12,14,17,19-20,27-28]. Osteonecrosis (ON) is probably the most common cause of chronic hip pain for which MRI is routinely used and the disorder for which the appearance and accuracy of MRI have been most thoroughly demonstrated in the literature [4,13,18,29-32]. Contrast enhancement in the segment proximal to the low-signal band in the femoral head may serve as a supplemental diagnostic measure for differentiating subchondral insufficiency fracture (SIF) from ON [33]. Additionally, the shape of the low-signal-intensity band with frequent concavity of the articular surface in ON may help in distinguishing this entity from SIF, which commonly shows an irregular convexity of the articular surface [34]. Positron emission tomography (PET) with fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG) may have potential utility in the evaluation of early ON of the femoral head and may be ordered when there is high clinical suspicion and negative MRI, but further work is needed for establishing the criteria in routine clinical workup [35]. This imaging modality may be especially useful if ON is present after resurfacing hip arthroplasty because ON would not be visible on radiographs and would not be detected on MRI secondary to artifact [36].

Some investigators suggest that proton MRI spectroscopy may be a potential tool for predicting the risk for development of ON [37]. MRI can also accurately detect ON in the asymptomatic, contralateral hip in those cases in which ON of the other hip has been diagnosed by radiographs [22,38].

Other causes of a chronically painful hip for which MRI has been used with considerable success include radiographically occult fractures [6,8,19,21,39-42], acute and chronic soft-tissue injuries [7,9,12,17,19-20,43-45], infection and inflammation [14,46], and tumors [3,47-49]. Intravenous Gd-chelate agents are used to differentiate between joint fluid and synovitis [46,50]. Generally, if the arthritis has an atypical appearance on radiographs, MRI may be helpful for further characterization and the

[1]Principal Author, University of Arizona Health Sciences Center, Tucson, Arizona.
[2]Panel Chair, Allegheny General Hospital, Pittsburgh, Pennsylvania.
[3]Panel Vice-chair, Brigham & Women's Hospital, Boston, Massachusetts.
[4]Warwick Valley Orthopedic Surgery, Warwick, New York, American Academy of Orthopaedic Surgeons.
[5]Illinois Bone and Joint Institute, Morton Grove, Illinois, American College of Rheumatology.
[6]Florida Hospital, Orlando, Florida.
[7]University of Iowa Roy J and Lucille A Carver College of Medicine, Iowa City, Iowa.
[8]Cleveland Clinic, Cleveland, Ohio.
[9]Penn State Milton S. Hershey Medical Center, Hershey, Pennsylvania.
[10]Bone, Spine and Hand Surgery, Chartered, Brick, NJ, American Academy of Orthopaedic Surgeons.
[11]VCU Health System, Richmond, Virginia.
[12]Mayo Clinic, Jacksonville, Florida.
[13]Winthrop University Hospital, Mineola, New York.
[14]Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.
[15]Long Island Jewish Medical Center, New Hyde Park, New York, Society of Nuclear Medicine.
[16]Mayo Clinic, Phoenix, Arizona.
[17]California Pacific Medical Center, San Francisco, California.
[18]University of Wisconsin Hospital, Madison, Wisconsin.
[19]Tufts Medical Center, Boston, Massachusetts.
[20]University of Kentucky, Lexington, Kentucky.
[21]Thomas Jefferson University, Philadelphia, Pennsylvania.

Reprint requests to: Department of Quality & Safety, American College of Radiology, 1891 Preston White Drive, Reston, VA 20191-4397.

intravenous contrast is rarely needed. The only exceptions to the use of MRI as the primary technique following radiographs are cases of suspected osteoid osteoma, for which computed tomography (CT) should be performed [51]. Liu and collaborators reported that osteoid osteoma can be successfully imaged by dynamic contrast-enhanced MRI [52]. However, the opinion of this expert panel is that the MRI without and/or with intravenous contrast is not widely used and most of time is not needed in diagnosing osteoid osteoma and should be performed under discretion of radiologist if additional information is believed could be gained. For evaluating labral tears, MR arthrography should probably be used [53-56]. Direct MR arthrography with the intra-articular injection of a dilute (1:200) solution of Gd-chelate in saline has been established as a reliable technique for diagnosing acetabular labral tears [53-57] that are frequently associated with femoroacetabular impingement (FAI) syndrome [58-59] and may be an effective tool in assessing acetabular cartilage delamination [60]. However, several investigators suggest that high-resolution MRI with 3T may improve the visualization of the acetabular labrum and the hyaline articular cartilage [61-62], which may obviate the need for intra-articular contrast [63]. With appropriate operator expertise, ultrasound (US) may reliably diagnose most of the acetabular labral tears [64].

Other investigators have obtained satisfactory results in detecting labral and hyaline cartilage lesions with high-resolution MRI of the hip at 1.5T without intra-articular contrast [65-66]. Hip cartilage abnormalities also can be successfully evaluated by high-resolution CT arthrography [67-69]. Three-dimensional CT is an accurate tool for quantifying the femoral head-neck concavity, for providing a noninvasive assessment of hips at risk of FAI [70], and for assessing the femoral offset in OA hip [71]. CT is also useful in evaluating hip dysplasia [72-73], including the medial acetabular bone stock, in preoperative planning for hip replacement [74]. Radiotracer uptake in the superior or superomedial aspect of the acetabular rim on skeletal scintigraphy has been reported as a characteristic feature of a labral tear. Absence of this pattern carries a high negative predictive value for the diagnosis [75]. Focal radiotracer uptake on single-photon emission computed tomographic (SPECT) images localized to the superolateral acetrabular rim and/or anterolateral femoral head-neck junction shows a moderate sensitivity and specificity in diagnosis of FAI [76].

Indirect MR arthrography

Indirect MR arthrography, in which Gd-chelate contrast is administered by IV injection and diffuses into the joint space through the synovium, has been proposed as an alternative to direct MR arthrography for detecting intra-articular disorders [27,77-79]. It is faster and easier to perform than direct arthrography and does not require fluoroscopy. It suffers from less consistent enhancement of the joint space as well as inability to distend the joint capsule. Its value in assessing the hyaline articular cartilage and the acetabular labrum of the hip is uncertain.

Joint Injections

Diagnostic and therapeutic joint injections, which can be performed readily at the time of an MR arthrogram or as dedicated procedures, are useful tools for confirming the location of pain and in some cases helping in its control for a short period [80-81]. Joint aspiration is also critical in diagnosing the presence of infection [82-83] or crystal disease. Local articular and extra-articular injections can define the symptomatic site and exclude referred symptoms. Intra-articular injection of a small amount of iodinated contrast medium under fluoroscopic guidance is used to confirm needle position [84]. Sonography can also be used to localize fluid collections for aspiration and to guide therapeutic and/or diagnostic hip injections [85-86]. Sonography-guided iliopsoas bursal/peritendinous injections may be useful in determining the cause of hip pain [87].

Bone Scan

In the presence of normal radiographs, and in the absence of ready access to MRI, a bone scan may be a useful technique. Radionuclide bone scans are effective for detecting or excluding subtle osseous abnormalities.

Other Imaging Studies

Other techniques such as fluoroscopic motion studies (with or without intra-articular contrast) and US are useful to evaluate articular and periarticular conditions such as snapping iliopsoas tendon [48]. Cardinal et al [88] used real-time US to evaluate the snapping iliopsoas tendon. This method is noninvasive, which is an advantage compared with injection of the tendon sheath and fluoroscopic evaluation.

Summary and Recommendations

- Imaging of chronic hip pain is a broad subject, and the imaging assessment of numerous disorders has been described in the literature.
- Clinical data play an important role in patients with chronic hip pain.
- Radiographs should be obtained as the first imaging study and, in general, MRI should be obtained as the next imaging study except in cases of suspected osteoid osteoma or labral tear.
- Direct MR arthrography should be performed if acetabular labral tear is suspected, including patients with clinical evidence of FAI.
- Use of higher field MRI (3T) may obviate the need for intra-articular contrast.
- Other imaging techniques as well as image-guided aspiration have selected roles to play in certain disorders.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical

sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (ie, <30 mL/min/1.73m^2), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73m^2. For more information, please see the ACR *Manual on Contrast Media* [89].

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations		
Relative Radiation Level*	**Adult Effective Dose Estimate Range**	**Pediatric Effective Dose Estimate Range**
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢ ☢	0.1-1 mSv	0.03-0.3 mSv
☢ ☢ ☢	1-10 mSv	0.3-3 mSv
☢ ☢ ☢ ☢	10-30 mSv	3-10 mSv
☢ ☢ ☢ ☢ ☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as NS (not specified).		

Supporting Document(s)

- ACR Appropriateness Criteria® Overview
- Procedure Information
- Evidence Table

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