Algorithm for Imaging the Hip in Adolescents and Young Adults

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KEYWORDS

• Algorithm • Imaging • Hip • Adolescents • Young adults • MRI

KEY POINTS

- Hip/groin pain in the prearthritic patient includes intra-articular, and/or extra-articular osseous, chondral or soft tissue lesions, with increasing role of the radiologist in the management algorithm of these patients.
- It is the role of imagers to facilitate and tailor the most appropriate imaging modalities and protocols to the clinical scenario of the patient.
- MR imaging should include large field of view imaging of the entire pelvis with dedicated high-resolution small field of view imaging of the involved hip to better assess both extra-articular and intra-articular causes of hip pain.
- Hallmark findings of cam-type femoroacetabular impingement is prominence at the anterosuperior femoral head/neck junction, as well as anterosuperior labral and cartilage tears.

INTRODUCTION

The hip is the last great frontier of untamed large joint injury in adolescents and young adults. Hip arthroscopy is still far less frequently performed than knee or shoulder arthroscopy, but it has become more mainstream in recent years. When the senior author (A.C.Z.) completed his musculoskeletal radiology fellowship in 2003, hip arthroscopy was exceedingly rare and our role as imagers was to identify periarticular lesions, developmental malalignments, or early arthritic conditions. This role has changed, as has radiology as a specialty. It is no longer an acceptable practice standard to ignore cartilage lesions and partial-thickness labrum tears at the femoroacetabular joint. Activity-related painful syndromes from internal derangements of the prearthritic hip are common, and, once accurately identified, often treatable. Simultaneously, extra-articular sources of pain mimicking internal derangements of the hip are also common, and amenable to both minimally invasive and noninvasive treatment regimens. Distinguishing intra-articular sources of pain from extra-articular or even referred sources can be clinically difficult, because many lesions can cause anterior symptoms radiating to the groin and are exacerbated by activity. In musculoskeletal radiology, hip imaging offers great opportunities to show the value of radiologists to the managing sports medicine clinicians and to the patients themselves. This article delineates an algorithm for imaging young patients with hip and groin pain and presents ideas on how imagers can contribute to treatment planning and return to play or to a pain-free life.

During the 2005 to 2006 academic year, the authors performed and interpreted 405 noncontrast MR imaging examinations of the hip and 145 direct or indirect MR arthrographic hip studies in our

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outpatient musculoskeletal radiology practice. In 2014 to 2015, we performed and interpreted 385 noncontrast MR imaging examinations of the hip, 636 direct MR arthrographic studies, and 78 indirect MR arthrograms. Our practice has changed over the years, but, during that same period, MR imaging examinations of the knee remained within the range of 3000 to 4000 each year. Imaging of the hip has increased significantly as part of our practice. At the same time, hip arthroscopy has increased in frequency in North America and throughout the industrialized world. In the United States, the annual number of billed arthroscopic hip procedures has increased precipitously, with more orthopaedic surgeons experienced in hip arthroscopy, more accepted arthroscopic techniques, and many more treatable prearthritic hip lesions. One series showed an increase of more than 600% in hip arthroscopic procedures performed by a cohort of newly trained surgeons taking the American Board of Orthopaedic Surgery Part II examination from 2006 to 2010.[1] Musculoskeletal imagers must embrace such operational changes in health management and work to help patients and managing clinicians arrive together at the optimal treatment plan. Establishing the value of advanced imaging in the setting of hip and groin pain in adolescents and young adults remains a major opportunity for musculoskeletal radiologists.

Not all intrinsic and periarticular lesions manifesting as hip and groin pain are surgical, and, of those that are, not all are best treated by an orthopaedic surgeon.[2] Referred sources of symptoms might respond well to directed physical therapy and strengthening programs. Periarticular maladies such as bursitis, tendinopathy, and nerve entrapment might be managed with image-guided percutaneous therapies. In addition, athletic pubalgia lesions or core muscle injuries might warrant evaluation and treatment by a subspecialized general surgeon. However, arthroscopic treatments have been proved effective for many internal derangements of the hip.[3] Physical examination is valuable, but accurately distinguishing intra-articular lesions from extra-articular sources of hip and groin pain can be daunting, even to experienced examiners. In this regard, musculoskeletal radiologists have a unique opportunity to not only effectively diagnose the underlying source of symptoms but also to guide patients toward the most appropriate subspecialist for treatment. The authors think that, in the setting of hip and groin pain in adolescents and the young adults, experienced musculoskeletal imagers are uniquely positioned to oversee treatment planning and therapeutic execution. Each case referred for imaging should be managed thoughtfully and systematically. When imaging is completed, the radiologist should almost always have a good idea of what treatment the patient needs next, and this decision should be conveyed in the imaging reports. For young, active patients with refractory deep hip and groin pain, musculoskeletal radiologists can therefore have great value in the management algorithm.

THE IMAGING PLAN

There are many options for imaging the hip, and no practitioner should be more familiar with the imaging options and indications for each of the various imaging protocols than musculoskeletal radiologists. The authors think that it would border on irresponsible to practice as if referrers, whether surgeons, primary care clinicians, or sports medicine experts, always know the most appropriate study to order. With this in mind, each order for imaging the hip or the musculoskeletal pelvis should be reviewed by the imager to ensure that an optimal examination and protocol is chosen. An 80-year-old emergency department patient with a suspected femoral neck fracture and equivocal radiographs should not endure imaging time or cost spent on high-resolution, small-field-of-view cartilage sequences dedicated to the ipsilateral hip when an inversion recovery sequence covering the entirety of the pelvis can diagnose the femoral neck fracture as well as other findings such as sacral insufficiency fractures or osseous metastases. Similarly, a teenaged girl with pincer impingement generally should not be exposed to the excessive ionizing radiation that accompanies high-resolution computed tomography (CT) of the pelvis using a bone algorithm when the needed anatomic information is available on high-quality radiographs. It is the job of imagers to facilitate appropriate imaging modalities and protocols.

Imaging of hip and groin pain should almost always begin with radiographs, but radiograph protocols can vary based on the clinical scenario. A hip fracture protocol can be as limited as a standing anteroposterior (AP) exposure of the pelvis and a frog lateral of the hip.[4] However, for young, active patients with activity-related hip or groin pain, a radiographic series should be built to identify developmental anatomic variations or syndromes, including developmental dysplasia of the hip, femoroacetabular impingement, slipped capital femoral epiphyses, and Legg-Calvé-Perthes. It should also allow the imager to identify lesions at the sacroiliac joints and the pubic symphysis. Our adolescent and young adult hip clinic radiograph protocol includes 5 views (**Fig. 1**):

1. Standing AP pelvis
2. Supine AP of hip only