A. Radiologic Perspective: Magnetic Resonance Imaging of the Athlete with Hip and Groin Pain

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As magnetic resonance (MR) has become increasingly more popular for assessment of hip and groin pain, our knowledge of the many pathologic conditions affecting the hip and pelvis has grown. Magnetic resonance has contributed significantly to our understanding of sports-related injuries as well as to underlying conditions such as femoroacetabular impingement, which can lead to pain and limited range of motion.

Localization of pain originating from the hip or pelvis is clinically difficult. Patients present with nonspecific complaints of hip pain, groin pain, pelvic pain, and even medial knee pain. As discussed in the previous chapter, the differential diagnosis includes internal derangements of the hip, femoroacetabular impingement, loose bodies, bursitis, stress injuries and stress fractures, musculotendinous injuries, tendon avulsions, sports hernias, as well as nerve injury, arthritis, and infection. The site of injury may be the hip joint, the symphysis pubis, the sacroiliac joint, the many sites of tendon origin and insertion, as well as the anterior abdominal wall and inguinal canal. The athletes most at risk for these injuries are those engaged in sports such as soccer, ice hockey, and track—sports that involve kicking, sprinting, and pivoting.

Imaging Anatomy

Joint

The hip is a ball-and-socket joint, a joint structure that enables a wide range of motion. The acetabulum is a spherical structure with an inferiorly oriented opening, the acetabular notch. The articular cartilage of the acetabular surface has an inverted-horseshoe configuration and resides at the outer margin of the joint. The central portion of this horseshoe is filled with fibrofatty pulvinar. The entire femoral head is covered with articular cartilage except for a small area on the center of the head known as the fovea capitis.

The joint capsule of the hip is much thicker than other joint capsules. Like other joints capsule it has several regions of focal thickening. These correspond to the extrinsic ligaments of the hip and include the longitudinally oriented pubofemoral, iliofemoral ligaments anteriorly, and the ischiofemoral ligament posteriorly. Similarly, the zona orbicularis represents a group of circularly oriented capsular fibers along its deep surface at the femoral head–neck junction. Anteriorly and posteriorly the joint capsule inserts at the base of the labrum, creating a small perilabral sulcus (perilabral recess) between the joint capsule and labrum. Superiorly the joint capsule inserts several millimeters above the base of the labrum, creating a more prominent superior perilabral recess. The hip joint communicates with the iliopsoas bursa in 14% of individuals via a deficiency between the pubofemoral and iliofemoral ligaments. A posterior outpouching between the ischiofemoral ligament and the zona orbicularis creates the obturator externus bursa.

The transverse ligament bridges the acetabular notch and at the margins of the notch this ligament merges with the labrum. The ligament serves to complete the deficiency of the osseous socket created by the acetabular notch. A sulcus may be created at the anteroinferior and posteroinferior margins of the joint where the transverse ligament and labrum join. This labroligamentous sulcus may be mistaken for a detachment. The ligamentum teres connects the transverse ligament and the femoral head. It attaches to the fovea capitus of the femoral head. The artery of the ligamentum teres, a minor blood supply, courses through the ligament. Lined by synovium, the ligamentum teres is considered an extraarticular structure. The role of the ligamentum teres is not well understood.

Labrum

The acetabular labrum projects laterally from the acetabular rim and deepens the acetabular socket. The labrum aids in distribution of the weight-bearing forces through the joint by maintaining a joint fluid layer between the articular cartilage of the femur and head, and by preventing lateral translation of the femur. The labrum is composed of fibrocartilaginous tissue and dense connective tissue. Histologically, three separate layers are identified within the labrum: a randomly oriented fibrocartilaginous layer at the articular surface, a central lamellar layer of collagen, and a circumferentially oriented layer along the capsular surface. The labrum is a relatively avascular structure, resulting in a limited ability to repair itself. The labrum is innervated, and damage directly to
Fig. 9.1. Normal magnetic resonance arthrogram (MRA) with fat suppressed T1–weighted images. (A) Axial image reveals several important features of the joint. Minimal filling of the iliopsoas bursa (arrowhead) is seen along the medial aspect of the iliopsoas tendon (asterisk). Anterior and posterior labra (small arrows) with small perilabral recesses are present. The cross section of the ligamentum teres is seen (large arrow). (B–E) Coronal images from anterior to posterior reveal the fibrofatty pulvinar (long arrow in B) and the fovea capitis of the femoral head (short arrow in B). The larger superior perilabral sulcus is seen (arrowhead in C). The long axis ligamentum teres is visible (long arrow in C). The insertions of the gluteus minimus onto the anterior facet of the greater trochanter (short arrows in C) and gluteus medius tendons onto the lateral (long arrow in D and E) and superoposterior facets (long arrow in E) of the greater trochanter are easily identified. The attachment of the piriformis and obturator internus to the inner aspect of the greater trochanter can be seen (“<”s in D). (F,G) Sagittal images from medial to lateral depict the transverse ligament as it spans the acetabular notch (arrows in F) and the anterior and posterior perilabral recesses (arrows in G).