

MR Arthrography of the Hip in Femoral Acetabular Impingement

T. A. Laird¹

¹Department of Radiology, Saint Marys Regional Medical Center, Reno, Nevada, United States

Purpose:

Hip pain is a common complaint. Until recently our knowledge and understanding of osteoarthritis of the hip has been quite limited. The acetabular labrum has been recognized as a source for hip pain, but why and how labral tears occur has not been well understood. Direct intra-operative observations led to a description of a mechanical cause for labral tears and osteoarthritis of the hip from repetitive acetabular impingement secondary to anatomical variations of the proximal femur. Femoral-acetabular impingement leads to a spectrum of pathologies that affect the hip which are important to understand and characterize, prior to considering the patient for available surgical joint preserving therapies. This review was undertaken to document the pathologies found in patients with a clinical presentation of femoral-acetabular impingement.

Method:

69 patients with clinically positive Hip Impingement tests underwent MR Hip arthrograms. Hip arthrography was performed under fluoroscopic guidance over the lateral third of femoral neck. Mixture of a 1:1 dilution of 10cc non-ionic contrast (iohexol 300) mixed with 10 cc of 1% lidocaine containing 0.1cc gadolinium contrast was utilized. Contrast volume of 10-13cc was injected. Phased Array surface coils were placed directly over the hip to be imaged. GE 1.5T LX2 Horizon MR System was then utilized to obtain T1 Axials, FSE PD and FSE PD Fat Sat orthogonal Sagittal and Coronal, and FSE PD Radial acquisitions were then performed with a small 16-20 cm FOV and high resolution matrix. Studies were reviewed by the author and the spectrum of pathologies found including the loss of anterolateral femoral headneck offset/bony protuberance, presence and location of labral tears, presence and location of cartilage fibrillation/erosions/clefts/ and delamination, osseous metaplasia of the labrum, intraosseous and extra-articular ganglion cysts, anterolateral femoral neck erosions/herniation pits, acetabular rim fractures, and acetabular version were documented.

Results:

All 69 patients had a positive Hip impingement test with pain on flexion, abduction, and external rotation of the involved hip. Abnormal anterolateral femoral headneck offset was found in 61 (88%) patients. Labral tears were found in the anterosuperior labrum in 58 (84%) patients and 38% (19) of these patients demonstrated extension of the labral tears posteriorly. 50 patients (72%) had both an abnormal head-neck offset and labral tear. 34 patients (49%) had the triad of abnormal head-neck offset, anterosuperior labral tear, and anterosuperior articular cartilage injury. 47 patients (68%) had articular cartilage injury seen predominately anterosuperior, 18 patients had cartilage damage both anterosuperior and posterior-inferior, and 5 patients had posterior-inferior cartilage damage only. 13% of the patients with articular damage (6 patients) had MR detectable presence of delamination with contrast between the cartilage and the acetabular roof. Intraosseous ganglion cysts were found in the anterosuperior acetabular roof and lateral acetabular margin in 40% of the patients with articular cartilage injury. 23% of the patients had cortical erosions/herniation pits in the anterolateral femoral neck. No femoral head-neck offset lesion was found in 8 patients (12%), yet all had labral tears on MRa of the Hip and four of these patients were noted to have acetabular retroversion resulting in over coverage and subsequent femoral impingement. 11 patients with abnormal femoral head-neck offset had no evidence of a labral tear, yet 9 of these patients had articular cartilage damage and 1 patient had extensive osseous metaplasia replacing the normal labral structures. Only 1 patient had no other findings besides an abnormal femoral head-neck junction but the patient's hip pain was relieved by intra-articular lidocaine during the arthrogram procedure.

Discussion:

There are two basic mechanisms of Femoral Acetabular Impingement that have been described. These are Cam Impingement and Pincer Impingement. Cam Impingement results from impingement related to changes involving the femoral head and neck. These include loss of femoral head neck offset such as pistol grip deformity, non spherical femoral head and misalignment of the head and neck. These can be quite subtle with flattening of the head-neck junction or quite pronounced with large bony protuberances. The pattern of damage typically occurs in the anterosuperior acetabular roof involving the articular cartilage and labrum. In this study the overwhelming majority of findings were related to cam type impingement with findings in the anterosuperior hip joint. Pincer Impingement is secondary to acetabular causes more related to over coverage of the femoral head which can be found in coxa profunda, protrusio acetabuli, and retroversion. The pattern of acetabular damage is more circumferential, involving a narrow band of articular cartilage damage about the acetabular rim. There are contre-coup lesions, which are found posterior-inferiorly from ratcheting of the femoral head within the socket and osseous metaplasia of the labrum occurs frequently. This leads to a vicious circle of chronic impingement with reactive bone opposition at the rim leading to further deepening of acetabulum increasing impingement. Isolated pincer type impingement is less common and was found in only 4 patients in this study. Most commonly as damage progresses there are components of both types of impingement which was demonstrated in 18 patients who had articular cartilage damage both anterosuperiorly and posteriorly. These patients also had more extensive osseous metaplasia of the labral-acetabular rim complex leading to deepening of the acetabulum with over coverage of the femoral head.

Conclusion:

Femoral-acetabular Impingement results in spectrum of damage to the hip which initially may be an isolated labral tear or minimal cartilage injury and can progress to complete destruction of the joint leading to Total Hip Arthroplasty. Understanding of the pathology and mechanical basis of FAI must be mastered so patients with hip pain can be fully assessed to determine the pattern of involvement and extent of injury prior to consideration for surgical joint preservation therapies.

Bibliography:

1. Klaue K, Durin CW, Ganz R. The acetabular rim syndrome. A clinical presentation of dysplasia of the hip. *J Bone Joint Surg Br.* 1991 May;73(3):423-9. Review.
2. Leunig M, Casillas MM, Hamlet M, Hersche O, Notzli H, Slongo T, Ganz R. Slipped capital femoral epiphysis: early mechanical damage to the acetabular cartilage by a prominent femoral metaphysis. *Acta Orthop Scand.* 2000 Aug;71(4):370-5.
3. Leunig M, Werlen S, Ungersbock A, Ito K, Ganz R. Evaluation of the acetabular labrum by MR arthrography. *J Bone Joint Surg Br.* 1997 Mar;79(2):230-4.
4. Locher S, Werlen S, Leunig M, Ganz R. [MR-Arthrography with radial sequences for visualization of early hip pathology not visible on plain radiographs] *Z Orthop Ihre Grenzgeb.* 2002 Jan-Feb;140(1):52-7. German.
5. Myers SR, Eijer H, Ganz R. Anterior femoroacetabular impingement after periacetabular osteotomy. *Clin Orthop.* 1999 Jun;(363):93-9
6. Petersilge CA. From the RSNA Refresher Courses. Radiological Society of North America. Chronic adult hip pain: MR arthrography of the hip. *Radiographics.* 2000 Oct;20 Spec No:S43-52.
7. Plotz GM, Brossmann J, von Knoch M, Muhle C, Heller M, Hassenpflug J. Magnetic resonance arthrography of the acetabular labrum: value of radial reconstructions. *Arch Orthop Trauma Surg.* 2001 Sep;121(8):450-7.
8. Ganz R, Leunig M, Beck M, Siedebrock K, Notzli H. Oral presentations Bern Hip Course: Mammoth Mountain, Ca. 2002.