

Magnetic resonance arthrography of femoroacetabular impingement: a case report

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Abstract: Diagnostic radiographers in clinical practice undertake radiological investigations for patients who present with hip pains and diverse pelvic pathologies. This case report provides an insight into one of the clinical indications for undertaking such procedures. It discusses femoral acetabular impingement (FAI) which is a clinical indication for plain-film radiography and magnetic resonance imaging (MRI) of the hip bone. FAI is a concept where there is a structural or spatial abnormality of the femur (cam) or acetabulum (pincer) with damages to the chondrolabral structures during normal joint movement. It could occur either singularly as a cam, pincer or a mixed-cam-pincer pathology along the anterior femoral neck and the anterior-superior acetabular rim of the hip bone.

Keywords: hip pain, cam and pincer impingement, alpha angle.

Case report

A 26 year old athletic female patient presented with a history of pain and stiffness in her left hip joint. She complained of limited internal and external rotation of the hip over a six month period. Using a combination of femoral adduction internal and external rotation, orthopaedic examination indicated decreased flexion, rotation, and adduction with hard end-feel. Adduction of the joint did not produce a soft end-feel during physical examination to suggest a lesion in the capsule or muscle. Pain was produced in a separate flexion, adduction with forced internal rotation and external rotation of the leg at 90° of flexion. The patient was then referred for radiological investigation after clinical evaluation indicated femoroacetabular impingement (FAI).

In view of her age, magnetic resonance imaging (MRI) was undertaken to avoid use of ionising radiation of her gonads. Using a 1.5T Siemens MRI scanner, post-instillation of intra-articular gadolinium, MRI was performed. The left hip was examined with fat saturation proton density (PD) weighted sequences in sagittal, coronal and axial planes. High resolution sagittal PD, T2 weighted coronal stir and axial sequences were also performed. The left hip alpha angle measured 60° at the femoral head-neck interface with a small bump at the interface. There was an anterior synovial herniation pit of the femoral head with a focal tear in the labrum. Appearances suggest cam morphology type of FAI (see Figures 1 and 2).

The patient underwent an arthroscopy procedure during which steroids were injected into her hip joint.

Discussion

FAI, also called acetabular rim syndrome or cervicoacetabular

impingement [1], is a major cause of early osteoarthritis of the hip, especially in young and active individuals. It is characterised by friction in the hip joint between the femoral head and acetabulum. This abnormality causes cartilage damage and labral tears associated with activities or

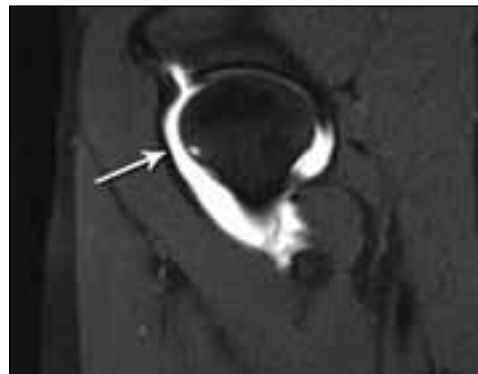


Figure 1: Sag T1 weighted image of the left hip indicating an anterior bump on the femoral head

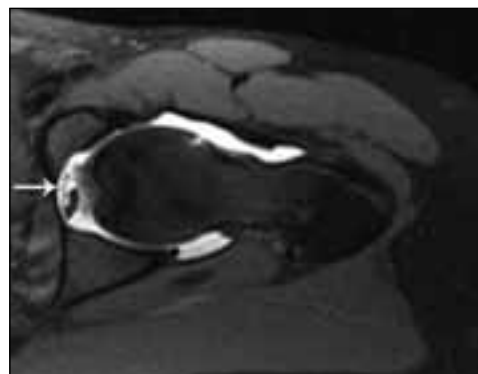
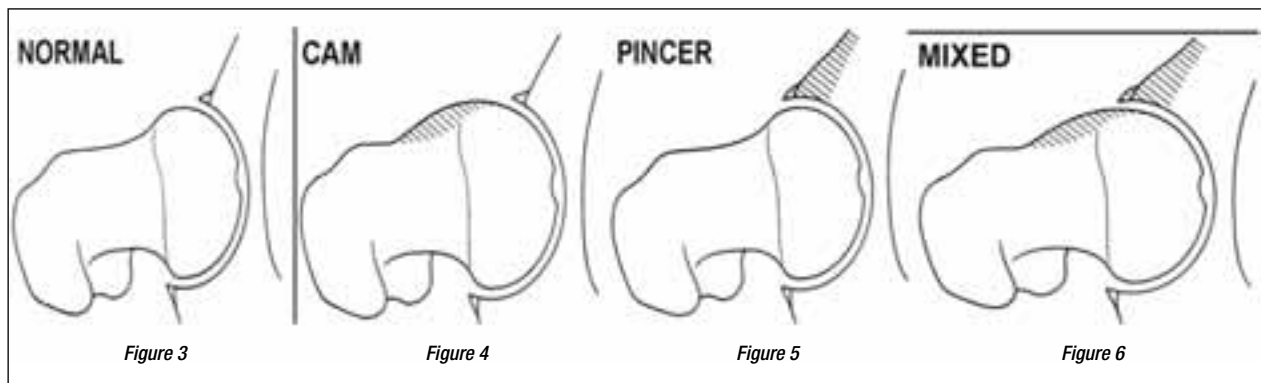


Figure 2: Anterior synovial herniation pit of the femoral head with a resultant focal compromise of the articular labrum



Figures 3-6: Schematic diagram outlining Femoral Acetabular Impingement Forms by (Lavinge *et al.*, 2004). Accessed: 07/11/09. Available at: <http://www.hipfai.com/>.
 Figure 3 shows a normal femur and acetabulum outline. Figure 4 shows a derangement of the hip with the femoral head-neck involvement. Figure 5 indicates that the cause is from the rim of the acetabulum. Figure 6 shows how FAI is caused as a result of involvement of both the femoral head-neck interface and the rim of the acetabulum of the hip joint.

sports such as rowing, kayak, jumping, etc. The occurrence of FAI is usually indicative of early signs of osteoarthritis of the hip from activities or sport exercises [2]. It can also occur from just normal day to day activities without any history of aggressive exercise on the hips. It occurs as a combination of the cam and pincer type impingements although occurrences of either of these are common as reported in our case report. Figures 3-6 depict femoral acceptable impingement forms as discussed by Lavinge *et al.*, 2004 [3].

FAI as indicated above could result from over-coverage of the front-top rim of the femoral head by the acetabulum. This could result in the labral cartilage being 'pinched' between the rim of the socket and the anterior femoral head-neck junction. While pincer impingement is acetabular in nature [4] and characterised by focal or general over coverage of the femoral head, cam type impingement is femoral in nature. This is usually due to an aspherical outline of the acetabulum not covering the femoral head-neck enough. The aetiology of FAI is idiopathic in nature [5]. It is unclear if it is a congenital disease or one acquired during the period of growth. The role of genetics and environment in its occurrence has also not been fully researched. However, it is known as a condition in which there is friction in the hip joint between the femoral head and acetabulum with resultant degeneration of the articular cartilages and labrum.

While FAI can be diagnosed with a combination of a good history taking, physical examination, plain x-ray films and high resolution non-arthrographic MRI [6], MR arthrography plays a significant role in the management of this hip condition. It is particularly good in indicating the true status of the articular cartilages and labrum [7]. The presence of intra-articular gadolinium visibly indicates if there is any labral tear or to what extent there is a compromise, if any, of articular cartilage. As discussed in this case report, MR arthrography clearly indicated the presence of an anterior synovial herniation pit of the femoral head with a resultant focal compromise of the labrum at that site (see Figures 7-9).

Our experience and research shows plain film radiographs, namely a supine anteroposterior (AP) pelvis view and a hip cross table lateral view, are used to determine the shape of the ball and socket as well as assess the amount of joint space in the hip to see if they are sufficient [8]. Less

joint space is indicative of early arthritis with fullness or prominence of the head-neck region laterally on the AP view suggestive of any anterolateral disease. Research has also shown that an MRI of the hip undertaken with or without the injection of intra-articular gadolinium in the joint can be used to confirm a labral tear or damage to the joint surface [9].

MRI is useful in eliminating other hip pain differentials such as avascular necrosis, tumours, adult form of hip dysplasia, lumbar radiculopathy [10], sacroiliitis, trochanteric bursitis, iliopsoas tendinitis or tendinosis, groin pain and iliac apophysitis [11]. A pain test involving the use of a local anesthetic and omnipaque can also be used to diagnose FAI. While a computerised tomography (CT) scan is often helpful in understanding the anatomy of the bones of the hip joint, it is not essential to the diagnosis of FAI in view of the high dose of radiation involved. This may have explained why CT was not utilised in this patient to avoid irradiating her gonads.

A review of related literature shows that while the alpha angle is not essential to the diagnosis of FAI, it is an indication of how much cam impingement occurs. The larger the alpha angle, the larger the cam impingement lesion. It is generally accepted that angles greater than 55° are indicative of cam type morphology of FAI [12]. As indicated above, the alpha angle was 60° which indicated the classification of cam type morphology in the MRI findings. Lastly, an overview of the treatment of FAI indicates that two options are available: non-operative and operative managements. The former involves a change in lifestyle from an active to less active one and a commitment to maintaining hip strength although this may not change any underlying abnormal hip biomechanics of FAI [13]. Operative management of FAI involves either hip arthroscopy or open surgery with attendant complications. Such risks include deep vein thrombosis, infection, hip instability and dislocation [14]. Other risks are femoral neck fracture, avascular necrosis of the femoral head and heterotopic ossification, nerve injury involving sciatic, pudendal and scarring or adhesions.

Conclusion

FAI is a major cause for early primary osteoarthritis of the hip. Although it

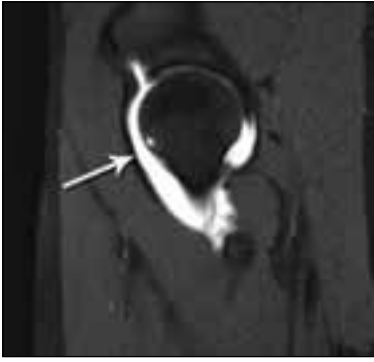


Figure 7: Sag T1 weighted image of the left hip indicating an anterior bump on the femoral head.

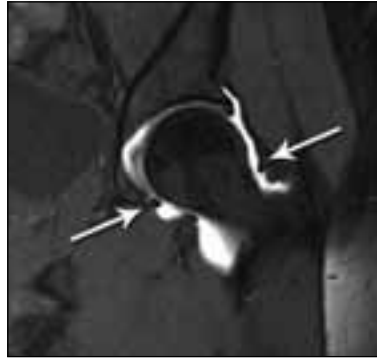


Figure 8: T2 weighted coronal image of the left hip showing reduced thickness of the articular cartilage of the acetabulum rim at the femoral head-neck interface.

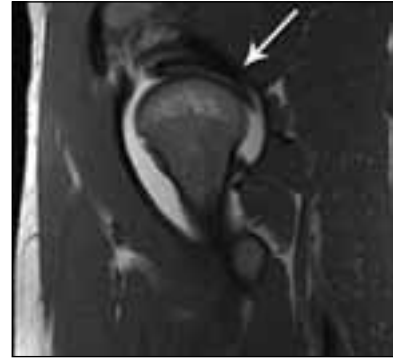


Figure 9: Sag T1 weighted image showing thinning of the articular cartilage of the acetabulum rim.

can easily be recognized on plain radiography films and high-resolution, non-arthrographic MRI, MR arthrography provides a further useful clear assessment of the capsule and articular cartilages in patients with clinically suspected FAI. The assessment of the alpha angle in this case report further confirmed the classification of CAM type morphology as discussed.

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