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European Journal of Radiology 63 (2007) 29–35

EJR
EUROPEAN JOURNAL OF RADIOLOGY

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Femoroacetabular impingement

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Received 8 March 2007; received in revised form 9 March 2007; accepted 12 March 2007

Abstract

Femoroacetabular impingement is a relatively recently appreciated "idiopathic" cause of hip pain and degenerative change. Two types of impingement have been described. The first, cam impingement, is the result of an abnormal morphology of the proximal femur, typically at the femoral head–neck junction. Cam impingement is most common in young athletic males. The second, pincer impingement, is the result of an abnormal morphology or orientation of the acetabulum. Pincer impingement is most common in middle-aged women. This article reviews the imaging findings of cam and pincer type femoroacetabular impingement. Recognition of these entities will help in the selection of the appropriate treatment with the goal of decreasing the likelihood of early degenerative change of the hip.

Keywords: Hip; Impingement; Labrum; MR; Arthrography; MR arthrography; Femoroacetabular; MRI; Cam; Pincer

1. Introduction

Hip pain is a common complaint among patients of all ages. The role of the acetabular labrum and cartilage has been recognized not only as a source of pain but also as having a central role in the development of degenerative change of the hip [1]. Femoroacetabular impingement is a recently recognized cause of hip pain in all age groups and a proposed mechanism in the development of early osteoarthritis [2].

Femoroacetabular impingement refers to abnormal contact between the femur, typically the junction between the anterior/superior femoral head and neck, and the acetabular rim. Those repetitive contacts may instigate chondral lesions and labral tears leading to early degenerative disease. A number of predisposing conditions have been described with deformities of the femur and/or the acetabulum which result in abnormal contact between these two structures. Entities, such as Legg-Calvé-Perthes, slipped capital femoral epiphysis, coxa magna, hip dysplasia, and fractures of the femoral neck are known to predispose to femoroacetabular impingement. However, a subset of patients who have no history of developmental or acquired disease of the hip joint may also be predisposed to femoroacetabular impingement. Clinical evidence of femoroacetabular impingement is characterized by anterior inguinal pain and decreased range of motion with flexion, adduction and internal rotation. Classically, two types of femoroacetabular impingement have been described. The first has been labeled cam impingement and is most often seen in young athletic males. The second has been labeled pincer impingement and is more common in middle-aged and older females [3]. The purpose of this article is to review the imaging findings of femoroacetabular impingement.

2. Cam impingement

In pure cam type impingement of the hip, the predominant abnormality is in the contour of the anterior/superior femoral head–neck junction with a normal morphology of the acetabulum. Normally, the anterior/superior femoral head–neck junction has a concave configuration. However, this junction is either flattened or convex in cam type impingement. In addition, the femoral head may become somewhat aspherical due to this morphologic abnormality. During forceful motion, especially flexion, the non-spherical portion of the femoral head is squeezed under the acetabular rim. This abnormal contact results in damage predominately to the acetabular cartilage in a rather constant location along the anterosuperior acetabular rim. Chondral abrasion or avulsion in turn leads to a tear or detachment

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doi:10.1016/j.ejrad.2007.03.020

of the acetabular labrum. Repetitive osseous impingement can then result in osteophyte formation on the anterior femoral neck, further exacerbating the problem.

The etiology of a decreased head–neck offset is not completely understood. Some have suggested that it may be due to a sub-clinical slipped capital femoral epiphysis. Recently, there is other evidence that suggests a developmental abnormality due to aberrant separation of the common physis of the femoral head and the greater trochanter that may result in the decreased femoral head–neck offset and a non-spherical appearance of the femoral head [4].

Radiographs in patients with cam impingement may initially appear normal because the abnormalities can be subtle to the unsuspecting eye. Specific attention should be given to the morphology of the femoral head–neck junction. On an AP view of the hip, the normal concavity along the lateral aspect of the femoral head–neck junction becomes flattened or slightly convex. Traditionally, this has been referred to as the pistol-grip deformity and more recently as an abnormal epiphyseal extension. This is found in 40% of patients who develop osteoarthritis of the hip. This same abnormality can be seen on the frog lateral view although many times craniocaudal angulation must be employed in order to prevent the greater trochanter from obscuring visualization of the head–neck junction (Fig. 1). Loss of the normal concavity along the anterior femoral head–neck junction can also be appreciated on a true lateral view.

The same morphologic abnormalities can be seen at MR imaging. Epiphyseal extension is best seen on coronal sequences as they most closely approximate the AP view of the hip. However, the abnormal femoral head–neck offset on the anterior/superior head–neck junction is often best seen on oblique (a.k.a. oblique axial or oblique sagittal) images that parallel the femoral neck.

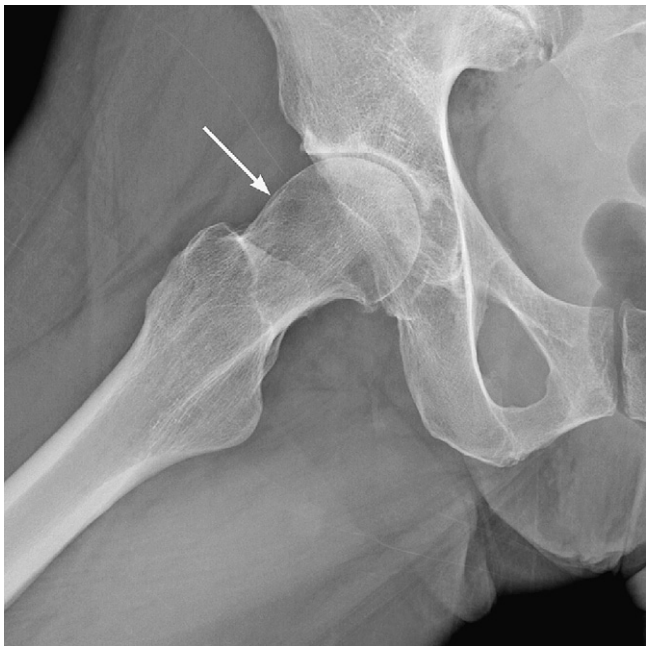

Fig. 1. Frog lateral radiograph view shows a loss of the normal concavity along the superior femoral head–neck junction (arrow).

Many quantitative methods have been described to measure the sphericity of the femoral head as well as the abnormal offset at the femoral head–neck junction. These include measurement of epiphyseal extension, the amount of femoral head–neck offset, and the alpha angle [4–6]. The alpha angle may be the simplest method to perform in a clinical setting as the necessary tools for measurement are available on most clinical workstations. The alpha angle can be measured in a matter of seconds with a high degree of intra- and inter-observer agreement [5].

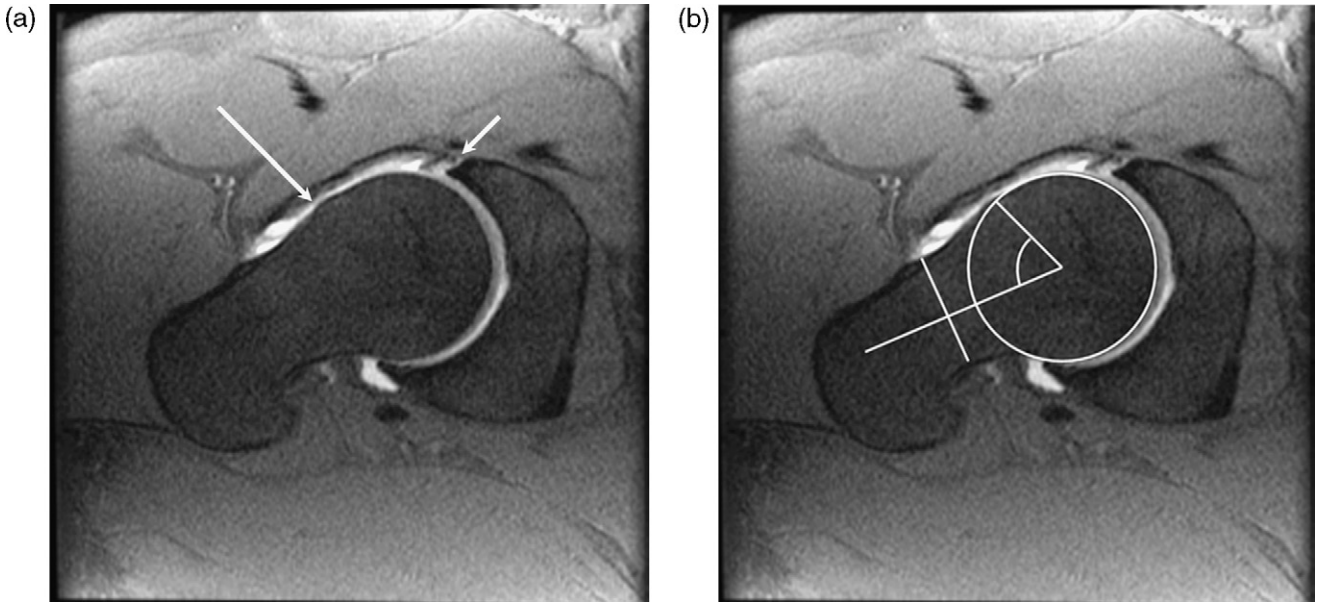

Fig. 2. (a) Oblique T1-weighted fat suppressed image shows abnormal anterior superior femoral head–neck offset (long arrow) and anterior superior labral tear (short arrow) and the lines (b) used for measuring alpha angle. Due to the abnormal femoral head–neck offset, the alpha angle measures 68°. An angle greater than 55° is considered abnormal.