Femoroacetabular impingement: A classic case of cam-type impingement in a 21-year-old soldier

Eric Royston, DO, MPH, CPT, MC, and Lisabeth Bush, MD, LTC, MC

We describe a case of femoroacetabular impingement (FAI) in a 21-year-old male U.S. Army Private. Pre-operative radiographs demonstrated a dysplastic bump at the right head-neck junction. The patient underwent arthroscopy and resection of the bump, resulting in an improved contour of the femoral head-neck junction. After standard recovery, he is now able to ambulate and flex his right hip without pain and has returned to full duty.

Case report

A 21-year-old man (a U.S. Army Private First Class) presented with chronic right hip pain that had been occurring for 4 months. He described the pain as deep and radiating into his back. The pain started shortly after a ruck march during his Basic Training.

He described himself as very active and gave no previous history of injury or trauma to the hip. His past medical and family history were otherwise unremarkable. Physical examination elicited painful flexion of the right hip. No bony abnormality was palpated, and gait was normal. Leg lengths were equal.

Further evaluation and initial workup included radiographs (Figs. 1 and 2), which demonstrated a dysplastic bump at the femoral head and neck junction bilaterally.

MR imaging (Figs. 3 and 4) demonstrated the bump on the right as well as some articular cartilage damage consistent with FAI.

Figure 1. Anteroposterior radiograph of the pelvis (preoperative) demonstrating bilateral dysplastic bumps (arrows) at the femoral head-neck junctions.

In this young soldier with chronic right hip pain and FAI on clinical exam with concordant anatomic findings by imaging, surgical options were pursued. The patient underwent arthroscopy to recontour the femur. By removing the dysplastic femoral bump and creating a normal concavity at the femoral head-neck junction, the focus of abnormal impingement was expected to be removed. This was expected to provide symptomatic relief and prevent progression to osteoarthritis. Fig. 5 is an intra-operative fluoro-
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Abnormal contact, or if both are at fault. If the contour of the femoral head-neck is the major contributor, the condition is described as cam-type. Acetabulum-related impingement is referred to as pincer-type; a combination of the two is known as a mixed type (2). Patients who have these types of impingement are generally young, active people who experience a gradual onset of hip pain.

Discussion

Femoroacetabular impingement (FAI) is seen when there is an abnormal morphological contact between the femur and the acetabulum causing impingement upon the labrum, which abnormally distributes force through the adjacent articular cartilage of the acetabulum. This dynamic causes pain at the endpoint of range of motion and ultimately can lead to labral injury and early osteoarthritis of the hip (1). FAI morphology is categorized by whether the femur or the acetabulum is the major contributor to scopic video that demonstrates the osteotomy of the dysplastic bump.

http://uwmsk.org/rcr_media/781-10795-1-SP.mov

Postoperative radiographs (Figs. 6 and 7) demonstrated improved contour of the femoral head-neck junction. After standard recovery, the patient is now able to ambulate and flex his right hip without pain and has returned to full duty.

Figure 2. Frog-leg radiograph of the right hip demonstrating the dysplastic bump of the cam-type morphology in the femoroacetabular impingement syndrome.

Figure 3. Axial, proton-density, fat-saturation imaging showing the dysplastic bump on the right (arrow).

Figure 4. Proton-density, fat-saturation coronal sequence demonstrating the bony prominence at the femoral head-neck junction (arrow). Also evident is a subtle, adjacent articular cartilage signal irregularity consistent with chondrosis.

Figure 6. Postoperative anteroposterior radiograph of the pelvis demonstrating the site of removal of the dysplastic bump (arrow) on the right.

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Cam-type impingement arises from a morphological abnormality of the femur. There is a lack of normal concavity at the femoral head-neck junction; this may appear either as abnormal flattening or a dysplastic bump at the junction of the head and neck of the femur. This region of bone at the anterosuperior aspect of the femoral neck can impinge on the acetabulum during movement of the hip, particularly hip flexion and internal rotation (3). The pathology arises with hip flexion, where the abnormal femoral neck impinges on the anterosuperior aspect of the acetabular labrum and puts an increased stress on the adjacent acetabular cartilage (3). One caution is that the morphology may be seen in completely asymptomatic persons and does not necessitate impingement or equate to the diagnosis of FAI. In one study, it was found that the prevalence of cam-type morphology in asymptomatic patients was 14% (2). The rate is much higher in men, where it was seen to be 27.4% male vs 5.4% female prevalence (2).

Pincer-type impingement arises from a morphological abnormality of the acetabulum. It is typically seen in disorders of retroversion of the acetabulum, coxa profunda (deep acetabulum), and os acetabulum, a secondary ossification center at the acetabular rim (3). These morphologic types typically affect the anterior labrum and can lead to ganglion formation and ossification of the acetabular rim as well as adjacent cartilage injury (3).

FAI has recently become accepted as an etiology of early-onset osteoarthritis of the hip in patients who are generally athletic with no history of hip abnormalities (1). Additionally, FAI has been documented to be one of the leading causes of labral tears and osteoarthritis of the hip (3).

In this case, our patient was symptomatic on the right. He had a dysplastic femoral bump predisposing to cam-type impingement bilaterally, as well as an acetabular abnormality on the asymptomatic left side. This case highlights an important reminder that imaging findings alone are not FAI, and reinforce the mantra of treating the patient, not the radiograph (4, 5). Diagnosis and management are predicated by the clinical exam. Although the patient's left hip also demonstrated an abnormal morphology consistent with a predisposition to mixed-type FAI, this was asymptomatic and was not pursued.

Pathogenesis

Cam-type morphology occurs when an abnormally shaped femoral head/neck has a region of increased radius forming a bump or ridge (1). During motions of flexion and internal rotation, an increased amount of shear stress is placed on the labral cartilage by the abnormal contact with the enlarged femoral head/neck (2).

Pincer-type morphology is caused by an abnormality of the shape of the acetabulum where there is overcoverage of the femoral head (3). When the acetabulum is too deep and the hip is placed in motion, there is contact with the femur, causing impingement (3). Thus, the acetabular labrum is the first structure that is typically injured in pincer-type morphology (1). The area of impingement is generally small; however, with excessive use there, degeneration may result in tears, ganglion formation, or ossification of the acetabular rim (1).

The progression to osteoarthritis in FAI is thought to occur by repetitive damage over time. With continued abnormal contact between the femur and the acetabulum, there is progressive destruction of cartilage, which ultimately results in osteoarthritis (1).

Imaging

The initial imaging of FAI is an anterioposterior view of the pelvis and frog-leg lateral radiographs of the hip (3). Dunn-lateral views may also be helpful. Although findings may be subtle and are not specific for symptomatic FAI, these constitute the optimal initial assessment of the morphology of the femoral head-neck junction. Normal concavity, abnormal asphericity, or even a dysplastic osseous convexity can be determined radiographically. Acetabular characteristics are often best determined radiographically. Underdevelopment of the acetabulum (characteristic of dysplasia), overcoverage, or abnormal posterior orientation of the acetabulum (also called retroversion) can be described. In some patients, an accessory ossole (or os acetabulum) may contribute to impingement. In others, an osicle may form in the traumatized labrum. The angulation of the femoral head and neck coxa vara or valga can also have impact on the range of motion allowable prior to bony impingement of the labrum and secondary impact on the acetabular cartilage and formation of an impaction.
lesion, osseous cyst, or osteophytosis at the site of impaction (3).

Magnetic resonance arthrography (MRA) is the imaging of choice in aiding the diagnosis of FAI (3). Intra-articular contrast improves visualization of chondral defects, and intravasation of contrast into the labrum increases the conspicuity of labral tears (3).

Treatment

Nonsurgical treatment options include decreasing activities that put stress on the hip joint, and NSAID medication. Physical therapy, with the goal of increasing range of motion, has not proven to be particularly helpful, as at the endpoint of physiologic range of motion, bony impingement on the labrum, continues to cause damage to the labrum and the adjacent cartilage (1).

Surgery has been shown to be more effective in the treatment of FAI than nonsurgical treatment (1). Historically, surgery for FAI was quite invasive, as it required dislocation of the femur from the acetabulum to pare down the bump on the femoral head-neck junction in cam-type impingement, or to reduce the acetabular overcoverage in pincer-type impingement. Currently, a less invasive option is favored, as arthroscopy of the hip is demonstrating good results with both pincer and cam-type impingement as well as with cases that are determined to be simple labral tears (absent an osseous dysplasia, which predisposes to labral injury) (1).

Conclusion

This 21-year-old soldier was a young, active male who had pain while performing motions of hip flexion on the right for 4 months. Upon radiographic imaging, it was found that he had a cam-type morphology predisposing to femoroacetabular impingement syndrome, which was concordant with his symptoms and physical exam. He then underwent arthroscopic surgery to correct his anatomic abnormality and improved tremendously.

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