Research

Clinical Brief: Femoroacetabular Impingement Syndrome

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Abstract

Femoroacetabular Impingement Syndrome is an increasingly recognized pathology associated primarily with young, active individuals. It is appropriate that health care providers are well educated and knowledgeable in the anatomical aspects, the clinical presentation, and management options when confronted with a patient suffering from Femoroacetabular Impingement Syndrome.

INTRODUCTION

Femoroacetabular Impingement Syndrome (FAI) is a pathologic entity described as an abnormal orientation of the femur head-neck junction and/or the acetabular rim, and its associated symptoms, signs and radiographic features. Resulting impingement from this orientation occurs during terminal hip range of motions. This syndrome can be classified into two distinct categories; cam and pincer.¹ Cam type impingement is defined by a bony abnormality of the femur head-neck junction, described as “pistol grip” deformity, and its associated signs and symptoms. Pincer type impingement results from an improper shape and/or orientation of the acetabulum and the pelvis, resulting with a deep acetabular socket (coxa profunda or protrusio acetabuli) and excessive coverage of the femur head (Figure 1). At this point in time, FAI remains a relatively newly recognized clinical entity and its prevalence is not fully known. The notion of FAI was first introduced in the 1930’s,³,⁴ however increasing recognition has not occurred until the early 1990’s.² FAI can be associated with femur neck fractures, Legg-Calve’ Perthes’, slipped capital femoral epiphysis, insult to the adjacent cartilage and acetabular labrum, and early onset hip osteoarthritis, particularly when the cam abnormality is present.⁴-²⁰ Proper recognition and diagnosis
are essential for patients to receive appropriate management. Many practitioners lack knowledge and understanding thus fail to recognize FAI, which may compromise appropriate patient care. In one study, it was reported patients suffering from FAI were evaluated by an average of 4.2 providers before proper diagnosis and 13 percent of patients underwent an unsuccessful surgery at another anatomical location.\(^{21}\)

Figure 1:
Anatomical illustration depicts a posterior view of a normal right femoroacetabular joint (A) as well as the two pathological orientations affiliated with femoroacetabular impingement. The two distinct classifications are cam (B) and pincer (C) deformities. The cam type impingement is defined by a bony abnormality of the femur head-neck-junction (*). The pincer deformity describes an improper shape of the acetabulum; that is, a deep acetabular socket with excessive coverage of the femur head (arrow). (Original anatomical illustration created by Frank Scali, D.C.)

**CLINICAL PRESENTATION**

FAI more commonly occurs in young, active individuals, typically in association with frequent sports activity and/or participation in sports requiring repetitive movements of one or a combination of hip flexion, internal rotation and adduction (i.e. cycling, soccer, martial arts, ballet, ice hockey).\(^{5, 10, 22-24}\) Individuals suffering from FAI usually present with insidious onset of groin pain with possible hip pain and restricted hip joint motion. The nature of pain is typically described as a dull or achy sensation, often exacerbated by activity or long periods of sitting.\(^{10}\) A “clicking” sensation may additionally be present and reported with the exacerbating behaviors.\(^{4, 24}\) The following associated tests typically yield positive results: Impingement Test (The patient lies supine. The hip and knee of the affected limb are passively flexed to 90°. The leg is then adducted and internally rotated. Occurrence of sudden exacerbation of pain, typically in the groin, is recognized a positive test),\(^{10}\) C Sign (The patient indicates the painful region by gripping the lateral hip, just superior to the greater trochanter, between the abducted thumb and index finger)\(^{10}\) and Patrick Fabere Test (The tested leg is flexed, abducted and
externally rotated. If pain results, this is considered a positive Patrick Fabere Test.). Awareness and investigation into hip pathologies that may possibly be associated with FAI should be conducted (femur neck fractures, Legg-Calve’ Perthes’, slipped capital femoral epiphysis, early onset OA). Additionally, pelvic orientation is an important aspect of examination, as anterior pelvic orientation may be associated with pincer type FAI. Radiographic features further assist in establishing FAI as a proper diagnosis and MRI may also help to distinguish FAI from other considerations; however patient history and clinical examination are the key factors that should be considered in order to properly diagnose FAI.

CAM TYPE IMPINGEMENT

This type of impingement results from an aspheric shape of the femur head-neck junction impinging upon the adjacent cartilage and acetabular labrum during end range hip flexion and internal rotation. This form of hip impingement is more commonly seen in men 20–30 years of age and is mainly associated with larger areas of labral and cartilage avulsion. According to Emary, cam type impingement can be recognized on plain film radiographs and is characterized on radiographs by “an aspheric femoral head with morphologic rounding (i.e. lack of concavity) of the anterolateral head-neck junction, creating a decreased femoral head-neck offset.” MRI can also be of use to examine the a-angle and the femur head-neck ratio. It has been reported that patients with cam type impingement exhibit a larger a-angle.

PINCER TYPE IMPINGEMENT

A common cause associated with pincer type impingement is retroversion of the acetabulum, in which the acetabular cup is positioned in a more posterior direction within the pelvis in the sagittal plane. An anterior orientation of the pelvis in the coronal plane is a potential variable in the radiological analysis of pelvic retroversion and may contribute to FAI syndrome. Pincer-type impingement most commonly is recognized in women 30–40 years of age. Plain film radiographs commonly display the “crossover sign” of the posterior and anterior walls of the pelvis (Table 1).
Table 1: Femoroacetabular Impingement Types, Characteristics, and Diagnostic Features on Radiographs

<table>
<thead>
<tr>
<th>FAI Type</th>
<th>Characteristics</th>
<th>Radiographic Features</th>
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<tbody>
<tr>
<td>Cam Impingement</td>
<td>• Higher incidence in men 20-30 years of age</td>
<td>• Radiographs reveal an aspheric femoral head with lack of concavity of the anterolateral head-neck junction</td>
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<tr>
<td></td>
<td>• Commonly associated with labral and cartilage avulsion</td>
<td>• MR images depict a larger than normal α-angle</td>
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<td></td>
<td>• Abnormality at femur head-neck junction</td>
<td></td>
</tr>
<tr>
<td>Pincer Impingement</td>
<td>• Higher incidence in women 30-40 years of age</td>
<td>• Radiographs reveal the &quot;crossover sign&quot; of the posterior and anterior walls of the pelvis</td>
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<tr>
<td></td>
<td>• Abnormal shape and/or orientation of the acetabulum and pelvis</td>
<td></td>
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<td></td>
<td>• Deep acetabular socket creates excessive coverage of the femoral head</td>
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CONSERVATIVE MANAGEMENT

FAI merits the consideration of conservative management prior to a surgical approach. As mentioned, FAI commonly presents in individuals participating in sport activities that require repetitive end range hip flexion, internal rotation, and/or adduction movements. Activity modification to address these movements is a logical consideration and a must as a first management option. A trial of conservative treatment consisting of NSAID therapy, manual and physical therapy (particularly addressing hip flexor tightness which is correlated with FAI and efforts to maintain physical activity that does not aggravate symptoms to diminish muscular deconditioning), and corticosteroid injections as needed is a warranted conservative management approach. A conservative treatment prescription may be an effective strategy for short-term pain relief and individuals who are compliant with activity modification. However, this approach fails to address the cause of the musculoskeletal abnormalities present in FAI. Therefore, if exacerbating activity resumes, pain and disruption to hip joint integrity will continue. Additionally, if insult to the adjacent cartilage and acetabular labrum associated with FAI is significant, surgical consultation should be considered. The option of surgery may additionally be a consideration in the interest of attempting to halt the progression of the condition.

SURGICAL MANAGEMENT
Considering that FAI is a relatively newly defined clinical entity, so too are surgical techniques performed by surgeons without extensive experience in the surgical management of FAI. Evaluation of OA advancement and labral and cartilage conditions are essential in treating surgical candidates to ensure resolution of the impingement. The primary goal for surgical outcome in patients without advanced OA is to increase hip motion while alleviating the femoral impingement against the acetabular rim.\(^5\) In cam-type FAI, resection of the femur head-neck junction is performed to increase the clearance between the bone and the acetabular rim.\(^4,31,32\) This may be performed by open surgery with hip dislocation or by arthroscope. Pincer-type FAI requires an approach to the acetabular abnormalities that may be associated with periacetabular osteotomy to correct retroversion.\(^4,33\) In order to address the excessive coverage from a deep acetabular cup, resection of the superior anterior acetabular rim with preservation of the labrum is recommended (Table 2).\(^4,34\)

**Table 2: Therapeutic options for patients with FAI**

<table>
<thead>
<tr>
<th>Conservative Management</th>
<th>Surgical Management</th>
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<td>Considered prior to surgical management and includes:</td>
<td>Considered if insult to the adjacent cartilage and acetabular labrum is associated with FAI and/or to halt the progress of the condition.</td>
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<tr>
<td>- Patient activity modification</td>
<td>- Cam-type: resection of the femur head-neck junction via open surgery or arthroscope</td>
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<tr>
<td>- NSAIDs</td>
<td>- Pincer-type: periacetabular osteotomy (to correct retroversion), resection of superior anterior acetabular rim with preservation of the labrum (to address excessive coverage)</td>
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<td>- Corticosteroid injections</td>
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<td>- Manual/physical therapy: address hip flexor tightness</td>
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**CONCLUSION**

FAI is a relatively unrecognized condition that is drawing increasing awareness. It is important to recognize FAI due to the associated musculoskeletal pathologies that have been correlated with this syndrome. Increased knowledge and recognition of the associated clinical manifestations needs to be addressed, as improper diagnosis and care is high in patients presenting with FAI. More research needs to be conducted in order to identify the etiology of this syndrome and awareness of FAI needs to be facilitated amongst all health providers.

**References**


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