Femoral retroversion in patients with femoroacetabular impingement: A cofactor in the development of hip osteoarthritis

Introduction

Femoroacetabular impingement (FAI) is, together with dysplasia, one of the main causes of hip osteoarthritis. Clinically, patients complain of hip pain and restricted range of motion of the hip. A positive impingement test is often present during the physical examination (pain associated with a limited internal rotation at 90° of flexion of the hip). Two main mechanisms of FAI have been described: i) Cam-type FAI, when there is a lack of offset at the femoral neck-head junction (i.e. a pistol grip femur) and ii) Pincer-type FAI, an overly prominent anterior wall causing impingement (i.e. acetabular retroversion or coxa profunda).

Femoral retroversion has also been reported as a cause of FAI and it is well established that a retroverted femur produces hip pain and alterations in external and internal rotation balance. However, no studies of femoral retroversion in patients with FAI have been reported. Furthermore, since the lack of internal rotation is a common feature in patients with FAI, it could be possible that femoral version abnormalities are present in these patients.

The purpose of this study is to describe the femoral version in a group of patients with FAI and assess its relation in the development of hip osteoarthritis.

Material and Methods

The patient history, x-rays and hip CT scans of one hundred and forty-two patients with FAI were reviewed. We defined FAI if the hip had an abnormal alpha angle (>49°) measured on the elongated femoral neck x-ray (Dunn projection), the presence of positive cross-over sign or protrusio acetabuli in the AP pelvis x-ray and the presence of diminished anteverision in the femur (<10°) or a retroverted femur (<0°) measured in the CT scan associated with a positive hip impingement test and lack of internal rotation at 90 degrees of flexion. All the patients presented with persistent hip pain and were evaluated clinically by the senior author, between January 2006 and July 2008. We documented the type of FAI (cam or pincer), the presence of acetabular dysplasia, coxa valga, coxa vara and the femoral version measured on the CT scan. The CT version measurements were performed by a musculoskeletal radiologist as part of the interpretation. The degree of osteoarthritis of the hip was scored using the Tönnis classification and was performed by a musculoskeletal radiologist as part of the interpretation. The age and gender were included as covariates. Regression analysis was conducted using SAS version 9.1.

Results

Two hundred and sixty-five FAI hips from 142 patients (73 females and 69 males) were analyzed. The average age was 36.7 years (15-69). The mean femoral version was 11.4° (-14.1° to 47°). We found 43 hips (16.6%) of the femora were retroverted and 133 hips (50%) had either diminished anteverision (<10°) or were retroverted (Fig.1). Only 58 hips (22%) were normally antverted (<10°) and 62 hips (23.3%) had excessive femoral anteverision (>20°). In 12 hips (0.05%) the only cause of FAI was the presence of a diminished anteverision or retroverted femur.

The statistical analysis shown that among these six predictors, both femoral retroversion (p=0.046) and coxa vara (p<0.001) were statistically significant for the presence of osteoarthritis. Compared with those whose do not have a femoral retroversion, patients having a retroverted femur had 1.6-fold odds of osteoarthritis. Compared with those whose did not have coxa vara, patients having coxa vara had 1.6-fold odds of osteoarthritis. The demographic variables age and gender were also significant for hip osteoarthritis (both p-values<0.001). Older patients had higher odds of osteoarthritis. Compared with female patients, male patients had 6.2-fold odds of osteoarthritis (Table I).

The purpose of this study is to describe the femoral version in a group of patients with FAI and assess its relation in the development of hip osteoarthritis.

Statistical Analysis

To account for the high correlation (p=0.83) between left hip and right hip within a patient, the generalized estimating equations (GEEs) method was considered. Logistic regression based on the GEEs approach was conducted to detect risk factors for the development of hip osteoarthritis using osteoarthritis as the outcome variable. Predictors are femoral retroversion, coxa vara, coxa valga, pincer-type FAI, cam-type FAI and dysplasia. Age and gender were included as covariates. Regression analysis was conducted using SAS version 9.1.

Table I: Risk factors for the development of hip osteoarthritis based on logistic regression.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.06</td>
<td>1.03-1.09</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex</td>
<td>6.22</td>
<td>2.71-14.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Femoral Version&lt;0º</td>
<td>1.55</td>
<td>1.01-2.38</td>
<td>0.047</td>
</tr>
<tr>
<td>Coxa Valga</td>
<td>0.82</td>
<td>0.6-1.12</td>
<td>0.218</td>
</tr>
<tr>
<td>Coxa Vara</td>
<td>1.55</td>
<td>1.12-2.14</td>
<td>0.008</td>
</tr>
</tbody>
</table>

C.I.: Confidence interval for Odds Ratio

Discussion

The presence of a retroverted femur is a cofactor in the development of hip osteoarthritis in patients with FAI. The orthopedic surgeons should be aware of the high frequency of femoral retroversion (16%) during the assessment of patients with hip impingement, in order to make the right diagnosis and choose the correct treatment.

It could be possible that this association between FAI and femoral retroversion is due to the fact that a common hip disease during skeletal maturation (i.e. slipped capital femoral epiphysis) produces both biomechanical alterations, a cam type FAI and a retroverted femur.

Various investigators consider normal femoral version to be in the range of 12 and 20 degrees. However, further studies are required in healthy population in order to determine the frequency of femoral retroversion.

References