The Radiographic Prevalence of Structural Hip Deformities in Female Collegiate Athletes

Ashley L. Kapron, Christopher Pelt, Christopher L. Peters, James T. Beckmann, Jill Erickson, Mike Anderson, Stephen K. Aoki
Department of Orthopaedics
Disclosure: Ashley Kapron, PhD

- I have no financial relationships to disclose.
Structural deformities of the hip, including femoroacetabular impingement (FAI) and hip dysplasia, often limit athletic activity.\textsuperscript{1-2}

Previous studies report an increased prevalence of radiographic cam FAI in male athletes,\textsuperscript{3-9} but data on the prevalence of structural hip deformities in females athletes is lacking.

Relationships between hip function and radiographic measures have not been defined for female athletes, which may assist diagnosis and screening if females are shown to have a high prevalence of radiographic findings.
Objectives

- Quantify the prevalence of radiographic FAI and hip dysplasia in 65 female collegiate athletes from three University of Utah teams:
  - 24 soccer athletes
  - 13 volleyball athletes
  - 28 track & field athletes

- Identify possible relationships between radiographic measures of hip morphology and hip function, quantified by range of motion measurements and clinical outcome measures.
Methods

- Radiographic imaging
  - Anteroposterior Film
  - Frog-leg Lateral Film

- Patient reported function
  - Hip Outcome Score

- Physical exam
  - Pain during impingement exam
  - Hip rotation measured supine in 90° of hip & knee flexion

- Statistical Analysis
  - Random-effects linear regression used for group comparisons to account for left and right limb observations
  - P values adjusted following Finner’s procedure \(^{10}\)
Radiographic Measures of Femoral Morphology

**Introduction**

**Alpha Angle**

- Cam FAI > 50°

**Head-neck Offset**

- Cam FAI < 8 mm
Radiographic Measures of Acetabular Morphology

Acetabular Index

- Pincer FAI < 0°
- Dysplasia > 10°

Lateral Center Edge Angle (LCEA)

- Pincer FAI > 40°
- Dysplasia < 20°
Cam morphology most common finding

4% of hips had radiographic mixed FAI (at least 1 pincer and 1 cam finding)

### Prevalence of Radiographic Findings

<table>
<thead>
<tr>
<th>Radiographic Morphology</th>
<th>Measure</th>
<th>All Subjects</th>
<th>Soccer</th>
<th>Track &amp; Field</th>
<th>Volleyball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cam</td>
<td>Alpha Angle &gt; 50°</td>
<td>29%</td>
<td>11%</td>
<td>52%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Head-neck Offset &lt; 8 mm</td>
<td>49%</td>
<td>36%</td>
<td>68%</td>
<td>31%</td>
</tr>
<tr>
<td>Pincer</td>
<td>Lateral Center Edge Angle &gt; 40°</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Acetabular Index &lt; 0°</td>
<td>10%</td>
<td>4%</td>
<td>13%</td>
<td>15%</td>
</tr>
<tr>
<td>Dysplasia</td>
<td>Lateral Center Edge Angle &lt; 20°</td>
<td>18%</td>
<td>13%</td>
<td>16%</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>Acetabular Index &gt; 10°</td>
<td>8%</td>
<td>6%</td>
<td>9%</td>
<td>12%</td>
</tr>
</tbody>
</table>
Track and field athletes had greater alpha angles (50.7° ± 7.0°) compared to:
- Soccer (42.0° ± 6.4°, p<0.001)
- Volleyball players (41.6° ± 5.6°, p<0.001)

No significant correlations between the radiographic measures and:
- Internal/external rotation (all p>0.170)
- Hip Outcome Score (all p >0.766)

No significant differences (all p > 0.193) in radiographic measures between hips that were painful (n=28) during the impingement exam and those that were not.
While the symptoms of FAI can affect both male and female athletes, these female collegiate athletes had a lower prevalence of radiographic cam FAI compared to previously reported values for male athletes.

<table>
<thead>
<tr>
<th>Author</th>
<th>Gender</th>
<th>Sport</th>
<th>% with Alpha Angle greater than:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>50°</td>
</tr>
<tr>
<td>Present Study</td>
<td>Female</td>
<td>Volleyball</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soccer</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Track and Field</td>
<td>52%</td>
</tr>
<tr>
<td>Kapron⁵</td>
<td>Male</td>
<td>Football</td>
<td>54%</td>
</tr>
<tr>
<td>Ayeni⁴</td>
<td>Both</td>
<td>Hockey</td>
<td>55%</td>
</tr>
<tr>
<td>Silvis⁹</td>
<td>Male</td>
<td>Hockey</td>
<td></td>
</tr>
<tr>
<td>Philippon⁶</td>
<td>Male</td>
<td>Skiing</td>
<td></td>
</tr>
<tr>
<td>Siebenrock⁸</td>
<td>Male</td>
<td>Hockey</td>
<td></td>
</tr>
<tr>
<td>Johnson¹¹</td>
<td>Male</td>
<td>Soccer</td>
<td></td>
</tr>
<tr>
<td>Gerhardt¹²</td>
<td>Male</td>
<td>Soccer</td>
<td></td>
</tr>
<tr>
<td>Philippon⁶</td>
<td>Male</td>
<td>Hockey</td>
<td></td>
</tr>
<tr>
<td>Siebenrock¹³</td>
<td>Male</td>
<td>Basketball</td>
<td></td>
</tr>
<tr>
<td>Agricola²</td>
<td>Male</td>
<td>Soccer</td>
<td></td>
</tr>
</tbody>
</table>
In the present study, 18% hips had an LCEA < 20°, higher than the prevalence in previous population studies:
- 1199 Norwegian females\(^\text{14}\): 4.3%
- 2430 Danish females\(^\text{15}\): 3.5%

No female athletes had pincer FAI defined by LCEA > 40°
- Previous study of 67 male football players, 7% had LCEA > 40°
- Surprising as symptomatic pincer FAI more common in females\(^\text{16,17}\)
Limitations

- 3d imaging may provide better assessment of morphology
- Limited consensus on radiographic cutoffs to define FAI

Take Home Message

- Clinicians should expect to see a greater degree of variability in femoral and acetabular morphology in female athletes. This variability may translate into increased difficulty with surgical decision making.
References