Prevalence of Cam type Femoroacetabular Impingement; A Systematic Review

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I have no financial relationships to disclose
Introduction

It is becoming evident that the syndrome of FAI has a spectrum of severity (1)

- In its mildest form it represents a radiological shape abnormality with no symptoms
- The other end of spectrum is a patient with hip/groin pain, limited hip range of motion, positive impingement tests and radiographic shape abnormality (2)

A number of studies have attempted to report the prevalence of cam type FAI morphology, however prevalence estimates vary from 4.1 to 75% of patient being affected. (3, 4)

Other studies have introduced the idea of “at risk groups”; with a higher prevalence of disease in professional athletes (5)
Aims

Systematically review the available epidemiological evidence to describe

- Point prevalence of cam hip shape abnormality in the general population
- Point prevalence of cam deformity and concurrent hip symptoms
- The strength of evidence that there are specific “at risk groups” with a higher prevalence of cam morphology
  - e.g. professional athletics
Methods 1

- **Types of Studies**
  - All prevalence based studies assessing cam type FAI

- **Types of Participants**
  - Males and females age 18 or over

- **Types of Outcome Measures**
  - Alpha angles greater than between 55-65°

- **Electronic Searches**
  - December 2013 PubMed, AMED, MEDLINE, EMBASE, CENTRAL and CINAHL
  - Search terms: “femoroacetabular impingement” or “femoro-acetabular impingement” or “femoroacetabular-impingement” or “FAI” or “hip impingement” or “CAM-type” or “pincer-type” and “epidemiology” or “prevalence” or “incidence”

- **Selection of Studies**
  - 2 authors in three stage determination method

- **Unit of analysis issues**
  - Preferred unit of analysis was number of patients affected this is clinically more useful than affected hips. The authors did include studies that reported prevalence as number of hips affected.
Methods 2

- **Risk of Bias Assessment**
  - Assessed by 2 authors using the risk of bias tool for epidemiological studies \(^{(7)}\)

- **Assessment of Heterogeneity**
  - In studies deemed clinically homogenous \(I^2\) statistics were used to assess heterogeneity

- **Data Synthesis**
  - In clinically homogenous studies a meta-analysis was conducted using the inverse variance method with fixed effects

- **Subgroup analysis**
  - Where data was available subgroup analysis was conducted on
    - Males and females
    - At risk groups such as professional athletes

- **Quality of Evidence**
  - Overall evidence was rated using the GRADE tool \(^{(8)}\)
11 studies met the inclusion criteria (2-4,9-16)
- No population based studies identified
- 6 reported cam prevalence data in terms of patients affected. (2,3,9-12)

Risk of bias:
- High in 8 studies
- Moderate risk in 3: Hack et al, Tsitskaris et al and Kang et al
- Hack et al, Tsitskaris et al and Kang et al were deemed to be clinically homogenous
- Used cross sectional imaging, an $\alpha$ angle cut off of 55° for cam and reported prevalence as patients affected
- Meta analysis of these 3 studies revealed a prevalence of cam deformity in 31.7% (95% CI 26.5-37.4) of patients
Results 2

- Male and female cam prevalence data was reported by Tsitiskaris, Hack and Johnson the mean prevalence of cam deformity:
  - Males 45.4% (95% CI: 28.6-62.1)
  - Females 23.9% (95%CI: 15.8-31.9)
- 4 studies reported prevalence in “at risk groups”. All high risk of bias
  - Kolo et al in professional female ballet dancers c.f controls; no difference
  - Larson et al and Nepple et al reporting in professional American football players; higher rate than general population. NB no control subjects and high selection bias
  - Johnson et al reporting in former high level youth soccer players c.f. controls no difference
- Overall quality of Evidence Low
<table>
<thead>
<tr>
<th>Study author</th>
<th>Type of study</th>
<th>Population</th>
<th>Diagnostic Criteria</th>
<th>No. participants (No.female)</th>
<th>Participants mean age (years) (range)</th>
<th>Participants with cam (no. female)</th>
<th>Participants without cam (no. female)</th>
<th>Total prevalence % (male, female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsitskaris 2012</td>
<td>Prospective Cohort</td>
<td>Patients who had CT for trauma or abdominal pain between Aug and Dec 08.</td>
<td>Radiological CT: cam= α angle &gt;55° at 12 o’clock</td>
<td>45 (24)</td>
<td>33 (20-40)</td>
<td>11 (5)</td>
<td>34 (19)</td>
<td>24.4 (28.6,20.8)</td>
</tr>
<tr>
<td>Kang 2010</td>
<td>Prospective Cohort</td>
<td>Review of the CTs performed between Mar and Aug 08 performed for trauma or abdominal pain</td>
<td>Radiological CT: cam= α angle &gt; 55° at 3 o’clock</td>
<td>50 (27)</td>
<td>NR (15-40)</td>
<td>6 (N/R)</td>
<td>44 (N/R)</td>
<td>12.0 (N/R)</td>
</tr>
<tr>
<td>Hack 2010</td>
<td>Prospective Cohort</td>
<td>Asymptomatic volunteers with no prior hip problems.</td>
<td>Radiological MRI: cam= α angle &gt;55° at 1:30</td>
<td>200 (111)</td>
<td>29.4 (21-51)</td>
<td>67 (21)</td>
<td>133 (90)</td>
<td>33.5 (51.7,18.9)</td>
</tr>
<tr>
<td>Gosvig 2008</td>
<td>Retrospective Cohort</td>
<td>Review of radiology from the Copenhagen Osteoarthritis Study (COS) consisting of 4251 participants. Only female data analysed</td>
<td>AP xray. Cam= α angle &gt;57° at 12 o’clock.</td>
<td>2018 (n/a)</td>
<td>60.7 (23-89)</td>
<td>82 (n/a)</td>
<td>1936 (n/a)</td>
<td>4.1 (n/a)</td>
</tr>
<tr>
<td>Larson 2013</td>
<td>Retrospective Cohort</td>
<td>All male collegiate American football players (239 hips) who had hip xrays at scouting Combined in 09 and 10. Male only</td>
<td>Radiological Plain Films. Cam= α angle &gt;55° on AP and lateral radiographs</td>
<td>125 (n/a)</td>
<td>NR - USA college students</td>
<td>94 (n/a)</td>
<td>31 (n/a)</td>
<td>75.2 (n/a)</td>
</tr>
<tr>
<td>Johnson 2012</td>
<td>Cross Sectional Study</td>
<td>Former high level youth soccer players and 50 aged matched controls. No history of hip disorders</td>
<td>Radiological Plain Films. Cam= α angle &gt;55° Frog lateral only</td>
<td>Subjects 50 (25)</td>
<td>(18-30)</td>
<td>24 (9)</td>
<td>26 (16)</td>
<td>48.0 (60,36)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Controls 50 (25)</td>
<td>(18-30)</td>
<td>22 (8)</td>
<td>28 (17)</td>
<td>44.0 (56,32)</td>
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<td></td>
<td></td>
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<td>Total 100 (50)</td>
<td>46 (17)</td>
<td>54 (33)</td>
<td></td>
<td>46.0 (58,34)</td>
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</tr>
</tbody>
</table>

Grey shading= study of “at risk group”

Abbreviations: n/a= not applicable, NR= not reported
Results; Forrest Plots

All studies reporting prevalence in terms of patients affected. NB high degree of heterogeneity.

Studies with moderate risk of bias deemed clinically homogenous.

Prevalence 31.7% (95% CI 26.5-37.4)

I² statistics 77%
Discussion

- High degree of heterogeneity in 3 clinically homogenous studies may be due to $\alpha$ angle being measured at different positions on neck (superiorly, anterio-superiorly and anteriorly)

- The following factors influence the prevalence estimate
  - The imaging technique used - cross sectional imaging will have higher sensitivity
  - Position on the neck where the $\alpha$ angle was measured - cam most prevalent anterosuperiorly

- Insufficient evidence to demonstrate higher prevalence in professional athletes
Conclusions

- Based upon the available evidence cam type FAI is present in 31.7% (95% CI: 26.5-37.4%)
- No high quality, population based studies
- Overall low quality evidence
- Robust well-designed, population based epidemiological studies, that use cross-sectional imaging to measure hip shape, and observe subjects longitudinally will determine the true disease burden
References


