Sport-Specific Yearly Risk and Incidence of Anterior Cruciate Ligament Tears in High School Athletes: A Systematic Review and Meta-Analysis

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Objectives

Establish evidence-based incidence and yearly risk of ACL tears in high school athletes by gender and sport.

Methods

- Conducted a systematic review of PubMed, EMBASE, and Cochrane Central Register of Controlled Trials to identify all articles reporting ACL tears per athlete exposure in HS athletes.
- Excluded irrelevant and outdated articles and those that had no ACL-specific injury information or described elite, collegiate, or professional athletes.
- 10 studies met inclusion criteria and were included in qualitative synthesis and meta-analysis to calculate ACL injury incidence rates (IRs) by sex and sport.
- Utilized Pennsylvania state high school athletic association guidelines to determine number of exposures per season in order to calculate seasonal risk of ACL tears.

Results

- 10 studies reviewed in meta-analysis
  - 6 male sports: basketball, lacrosse, soccer, baseball, football, wrestling
  - 6 female sports: basketball, lacrosse, soccer, softball, field hockey, volleyball
- 699 ACL injuries in 11,227,878 exposures
- Incidence Rate = 0.062 injuries /1,000 exposures
- Males: highest injury risks per season: football, lacrosse, and soccer
- Females: highest injury risks per season: soccer, basketball, and lacrosse.
- Females had a significantly higher rate of injury per exposure than males
  - Relative Risk = 1.6

ACL Tear Incidence and Injury Risk per Season

<table>
<thead>
<tr>
<th>Sport</th>
<th>Female Incidence</th>
<th>Male Incidence</th>
<th>Female Risk/season</th>
<th>Male Risk/season</th>
<th>Female RR</th>
<th>Male RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td>0.091</td>
<td>0.024</td>
<td>0.091</td>
<td>0.03</td>
<td>3.8</td>
<td>2.5-5.8</td>
<td></td>
</tr>
<tr>
<td>Field Hockey</td>
<td>0.048</td>
<td>0.089</td>
<td>0.048</td>
<td>0.04</td>
<td>2.0</td>
<td>1.3-3.2</td>
<td></td>
</tr>
<tr>
<td>Football</td>
<td>0.070</td>
<td>0.058</td>
<td>0.070</td>
<td>0.05</td>
<td>1.2</td>
<td>0.3-4.2</td>
<td></td>
</tr>
<tr>
<td>Soccer</td>
<td>0.148</td>
<td>0.040</td>
<td>0.148</td>
<td>0.03</td>
<td>3.7</td>
<td>2.6-5.3</td>
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<tr>
<td>Softball/Baseball</td>
<td>0.027</td>
<td>0.003</td>
<td>0.027</td>
<td>0.03</td>
<td>7.9</td>
<td>2.3-41.7</td>
<td></td>
</tr>
<tr>
<td>Volleyball</td>
<td>0.018</td>
<td>0.021</td>
<td>0.018</td>
<td>0.02</td>
<td>1.6</td>
<td>1.3-1.8</td>
<td></td>
</tr>
<tr>
<td>Wrestling</td>
<td>0.021</td>
<td>0.021</td>
<td>0.021</td>
<td>0.02</td>
<td>1.0</td>
<td>1.0-1.0</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>0.081</td>
<td>0.052</td>
<td>0.081</td>
<td>0.04</td>
<td>1.6</td>
<td>1.3-1.8</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions

- There is significant risk of ACL tear in both male and female high school athletes, particularly in high-risk sports such as soccer, football, basketball, and lacrosse.
- There is an approximately 1.6 times greater rate of ACL tears per athletic exposure in high school females than males.
- This is the first study to fully delineate ACL injury incidence and yearly risk for male and female high school athletes by sport and sex.
- Knowledge of sport-specific yearly risk is essential for future injury-reduction programs, parent-athlete decision-making, and accurate physician counseling.
- This methodology may be used to quantify and describe yearly risk of injury for a variety of other high-school sports injuries.

Discussion

- There is significant risk of ACL tear in both male and female high school athletes, particularly in high-risk sports such as soccer, football, basketball, and lacrosse.
- There is an approximately 1.6 times greater rate of ACL tears per athletic exposure in high school females than males.