Preseason Screening of Collegiate Football Players for Assessment of Injury Risk
Eric M. Mathis, MS, ATC, Ian A. Carruthers, MS, ATC, Gary B. Wilkerson, EdD, ATC

BACKGROUND AND PURPOSE

- Football players sustain an estimated 1.2 million injuries per year, 40% of which are sprains and strains
- Sports injury prevention is widely advocated, yet little research evidence supports specific risk-reduction methods
- Reduction of risk for sport-related musculoskeletal injuries may depend on individualization of interventions
- Functional tests, survey responses, and individual attributes may differentiate high-risk from low-risk athletes
- Research associating pre-season status and subsequent injury has not typically accounted for exposure duration
- The hazard imposed by high-risk pre-season status can be quantified by Cox regression analysis
- The purpose of this study was to identify any pre-season characteristics or performance deficiencies among college football players that may predict subsequent occurrence of a core or lower extremity (LE) sprain or strain

RESULTS

- Univariate analyses identified 9 variables that were associated with injury occurrence (Table 1)
- Logistic regression analyses identified different sets of predictors for the 2 injury definitions (Table 2)
- All Core or LE Sprains & Strains
- Lost Time Core or LE Sprains & Strains

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Cut-Point</th>
<th>Odds Ratio</th>
<th>P-value</th>
<th>Predictor</th>
<th>Cut-Point</th>
<th>Odds Ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter</td>
<td>≥ 1 game</td>
<td>4.55</td>
<td>2.51</td>
<td>Starter</td>
<td>≥ 1 game</td>
<td>3.96</td>
<td>2.46</td>
</tr>
<tr>
<td>RT*</td>
<td>≥ 765 ms</td>
<td>1.98</td>
<td>1.47</td>
<td>RT*</td>
<td>≥ 765 ms</td>
<td>1.80</td>
<td>2.08</td>
</tr>
<tr>
<td>BMI</td>
<td>≥ 25.2</td>
<td>1.80</td>
<td>1.46</td>
<td>BMI</td>
<td>≥ 25.2</td>
<td>0.32</td>
<td>0.43</td>
</tr>
<tr>
<td>HTH</td>
<td>≤ 52 s</td>
<td>2.10</td>
<td>1.83</td>
<td>HTH</td>
<td>≤ 52 s</td>
<td>5.21</td>
<td>3.89</td>
</tr>
<tr>
<td>MMOI</td>
<td>≥ 449 kg*m²</td>
<td>2.49</td>
<td>0.98</td>
<td>MMOI</td>
<td>≥ 449 kg*m²</td>
<td>6.32</td>
<td>0.43</td>
</tr>
<tr>
<td>RchAsym</td>
<td>≥ 2.8%</td>
<td>4.75</td>
<td>0.11</td>
<td>RchAsym</td>
<td>≥ 2.8%</td>
<td>5.00</td>
<td>0.11</td>
</tr>
<tr>
<td>ODI</td>
<td>≥ 4</td>
<td>2.39</td>
<td>0.05</td>
<td>ODI</td>
<td>≥ 4</td>
<td>2.01</td>
<td>0.13</td>
</tr>
<tr>
<td>HTH</td>
<td>≤ 52 s</td>
<td>2.36</td>
<td>0.70</td>
<td>HTH</td>
<td>≤ 52 s</td>
<td>2.43</td>
<td>0.89</td>
</tr>
<tr>
<td>MMOI</td>
<td>≥ 449 kg*m²</td>
<td>2.49</td>
<td>0.98</td>
<td>MMOI</td>
<td>≥ 449 kg*m²</td>
<td>6.32</td>
<td>0.43</td>
</tr>
<tr>
<td>Game Play</td>
<td>≥ 10 games</td>
<td>3.78</td>
<td>0.05</td>
<td>Game Play</td>
<td>≥ 10 games</td>
<td>3.17</td>
<td>0.21</td>
</tr>
<tr>
<td>HTH</td>
<td>≤ 52 s</td>
<td>2.01</td>
<td>0.70</td>
<td>HTH</td>
<td>≤ 52 s</td>
<td>2.43</td>
<td>0.89</td>
</tr>
<tr>
<td>MMOI</td>
<td>≥ 449 kg*m²</td>
<td>2.49</td>
<td>0.98</td>
<td>MMOI</td>
<td>≥ 449 kg*m²</td>
<td>6.32</td>
<td>0.43</td>
</tr>
</tbody>
</table>

- Variable analyses identified 8 variables associated with injury occurrence (Table 1)
- Multivariate analyses identified different sets of predictors for the 2 injury definitions (Table 2)
- Starter ≥ 1 game, RchAsym ≥ 2.8%, and ODI ≥ 4 included in both prediction models
- HTH ≤ 52 s included in 4-factor prediction model for all core or LE sprains and strains
- MMOI ≥ 449 kg*m² included in 4-factor prediction model for lost time core or LE sprains and strains
- Logistic regression analyses identified different sets of predictors for the 2 injury definitions (Table 2)

PARTICIPANTS AND PROCEDURES

- 85 NCAA Division I-FCS football players who were available for pre-participation screening
- Electronic injury documentation system used for injury surveillance throughout the season
- Separate analyses conducted with 2 different operational definitions of injury:
  1. Core or LE sprain or strain that required evaluation and also required some amount of treatment
  2. Core or LE sprain or strain that resulted in some amount of "lost time" from full sport participation
- Relative predictive power of exposure to game conditions and pre-participation measures of injury risks compared
- Anthropometric variables: Body Mass Index (BMI), Estimated Mass Moment of Inertia (MMOI)
- Core muscle endurance: Horizontal Trunk Hold (HTH), Wall Sit Hold (WSH; average of right & left extremities)
- Low back dysfunction: Oswestry Disability Index (ODI)
- Neuromuscular function: Visuomotor reaction time (RT), Y balance anterior reach (Rch)
- RT derived from Dynavision D2 system (Dynavision Intl., West Chester, OH), 60 s “Proactive” test
- Reach distance (average of right and left extremities) normalized to knee length (RchAsym)
- Reach asymmetry (RchAsym/bilateral difference between right & left extremities)
- Data analysis procedures for assessment of association between potential predictors and injury occurrence
- Receiver operating characteristic (ROC) analyses used to identify cut-points for dichotomization of variables
- Logistic regression analysis utilized to develop prediction models
- Cox regression analysis utilized to assess the hazard imposed by risk factors in relation to exposure time

CLINICAL RELEVANCE

- Preseason screening can classify the injury risk level of collegiate football players
- High-risk players exhibit greater injury hazard than low-risk players over the entire season
- Although high level of exposure to game conditions is clearly a major risk factor, players who possess multiple risk factors appear to sustain more injuries whether starters or non-starters

REFERENCES