2015

On-Field Signs and Symptoms Associated With Recovery Duration After Concussion in High School and College Athletes: A Critically Appraised Topic

Jaebin Shim
*Old Dominion University*

Deanna H. Smith
*Old Dominion University*

Bonnie Van Lunen
*Old Dominion University*, bvanlune@odu.edu

Follow this and additional works at: [https://digitalcommons.odu.edu/pt_pubs](https://digitalcommons.odu.edu/pt_pubs)

Part of the Rehabilitation and Therapy Commons, and the Sports Sciences Commons

Repository Citation


https://digitalcommons.odu.edu/pt_pubs/55

Original Publication Citation


This Article is brought to you for free and open access by the Physical Therapy and Athletic Training at ODU Digital Commons. It has been accepted for inclusion in Physical Therapy and Athletic Training Faculty Publications by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.
On-Field Signs and Symptoms Associated With Recovery Duration After Concussion in High School and College Athletes: A Critically Appraised Topic

Jaebin Shim, Deanna H. Smith, and Bonnie L. Van Lunen

Clinical Scenario: Over the past decade, sport-related concussions have received increased attention due to their frequency and severity over a wide range of athletics. Clinicians have developed return-to-play protocols to better manage concussions in young athletes; however, a standardized process projecting the length of recovery time after concussion has remained an elusive piece of the puzzle. The recovery times associated with such an injury once diagnosed can last anywhere from 1 wk to several months. Risk factors that could lead to protracted recovery times include a history of 1 or multiple concussions and a greater number, severity, and duration of symptoms after the injury. Examining the possible relationship between on-field or sideline signs and symptoms and recovery times would give clinicians the confident ability to properly treat and manage an athlete’s recovery process in a more systematic manner. Furthermore, identifying factors after a head injury that may be predictive of protracted recovery times would be useful for athletes, parents, and coaches alike.

Focused Clinical Question: Which on-field and sideline signs and symptoms affect length of recovery after concussion in high school and college athletes?

Keywords: adolescent, return to play, head injury

Clinical Scenario

Over the past decade, sport-related concussions have received increased attention due to their frequency and severity over a wide range of athletics. Clinicians have developed return-to-play protocols to better manage concussions in young athletes; however, a standardized process projecting the length of recovery time after concussion has remained an elusive piece of the puzzle. The recovery times associated with such an injury once diagnosed can last anywhere from 1 wk to several months. Risk factors that could lead to protracted recovery times include a history of 1 or multiple concussions and a greater number, severity, and duration of symptoms after the injury. Examining the possible relationship between on-field or sideline signs and symptoms and recovery times would give clinicians the confident ability to properly treat and manage an athlete’s recovery process in a more systematic manner. Furthermore, identifying factors after a head injury that may be predictive of protracted recovery times would be useful for athletes, parents, and coaches alike.

Summary of Search, “Best Evidence” Appraised, and Key Findings

• The literature was searched for studies of level 3 or higher evidence that investigated the relationship between on-field or sideline signs and symptoms and recovery outcome measures in high school or college athletes.
• The literature search identified 6 possible studies related to the clinical question; 2 cohort studies2,3 and 1 case-control study4 met the inclusion criteria and were included.
• Of the included published articles, 2 studies2-4 reported that amnesia and/or mental-status changes persisting for >5 minutes correlated with increased symptoms reported and decreased memory composite scores at 2, 4, and/or 7 days postinjury in high school and college populations.
• One article noted that only dizziness was associated with protracted (≥21 d) recovery time in the high school population.3

**Clinical Bottom Line**

There is moderate evidence to suggest that dizziness, disorientation, or amnesia (retrograde or posttraumatic) as identified during the on-field or sideline assessment after injury can be used as a predictor of prolonged recovery duration after concussion in high school and college athletes. Athletic trainers involved in the acute examination and management of concussed athletes should consistently evaluate and monitor these clinical symptoms.

**Strength of Recommendation:** Grade B evidence exists that amnesia (retrograde and posttraumatic) and disorientation or dizziness at the time of injury affect recovery duration after concussion in high school and college athletes.

**Search Strategy**

**Terms Used to Guide Search Strategy**
- Patient/Client group: high school athletes with concussion or collegiate athletes with concussion
- Intervention: on-field signs and symptom ratings
- Comparison: control
- Outcome: recovery duration

**Sources of Evidence Searched**
- EBSCO Host
- MEDLINE/PubMed
- CINAHL Library
- SPORTDiscus
- Academic Search Complete
- Health Source: Nursing/Academic Edition
- Additional resources obtained via hand search

**Inclusion and Exclusion Criteria**

**Inclusion Criteria**
- Studies that included an on-field assessment and recovery outcomes
- Studies published within past decade (2003–2013)
- High school or college athletic population
- Level 3 evidence or higher
- Limited to English language

**Exclusion Criteria**
- Research studies that did not include an on-field or sideline assessment of the concussed athlete
- Lack of documentation regarding time of assessment preinjury and postinjury

**Results of Search**

Three relevant published studies were located and categorized as shown in Table 1 (based on levels of evidence, Centre for Evidence Based Medicine, 2009).

**Best Evidence**

The included studies (Table 2) were identified as the best evidence and selected for inclusion in this critically appraised topic (CAT). These studies were selected because they had a level of evidence of 3 or higher, included high school or college athletes diagnosed with a concussion, and examined the relationship between on-field assessment and recovery duration.

**Implications for Practice, Education, and Future Research**

The 3 studies2–4 included in this CAT examined the relationship between certain on-field and sideline signs and symptoms and recovery duration in the high school and college athletic population. The studies2–4 categorized the concussed individuals into 2 subgroups that were associated with the signs and symptoms assessed on the field or sideline and included less severe or severe,2 rapid recovery or protracted recovery,3 and good presentation or poor presentation.4 Poorer outcomes were associated with more mental-status changes (retrograde and posttraumatic amnesia, disorientation) in 2 of the earlier studies2,4 but were not linked to prolonged recovery in the most recent examination of sideline signs and symptoms.3 Lau et al3 conducted a detailed assessment of several on-field signs and symptoms and found that only dizziness was associated with poorer outcomes and lengthened recovery. The inclusion of these additional factors may have provided further insight into the role that on-field and sideline assessments play for recovery duration after concussion. The sample population of interest

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Summary of Study Designs of Articles Retrieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of evidence</td>
<td>Study design</td>
</tr>
<tr>
<td>2b</td>
<td>Cohort</td>
</tr>
<tr>
<td>2b</td>
<td>Cohort</td>
</tr>
<tr>
<td>3b</td>
<td>Case control</td>
</tr>
<tr>
<td><strong>Table 2</strong> Characteristics of Included Studies</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Lovell et al</strong>²</td>
<td><strong>Lau et al</strong>³</td>
</tr>
<tr>
<td><strong>Study design</strong></td>
<td>Prospective cohort</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>64 (60 male, 4 female) high school athletes who had suffered a concussion and 24 (16 male, 8 female) high school athletes who had not. Exclusion criteria included any learning disabilities, ADHD, history of alcohol or drug abuse, or on-field LOC.</td>
</tr>
<tr>
<td><strong>Intervention investigated</strong></td>
<td>Athletes were sorted into 2 groups based on duration of on-field symptoms (severe and less severe). The group with more severe concussion (n = 13) was defined as those presenting for more than 5 min with retrograde amnesia, posttraumatic amnesia, or disorientation. The less severe concussion group (n = 43) either had no mental-status changes or exhibited these changes for less than 5 min. The missing participants from these totals had LOC on the field and were included from the final results. Additional evaluations that included ImPACT and symptom scores were conducted at 36 h and 4 and 7 d postinjury. Additional interventions were investigated but were not included in this CAT because they did not relate to our clinical question.</td>
</tr>
</tbody>
</table>
Lovell et al, Lau et al, Collins et al

| Outcome measure | Presence and duration of on-field mental-status changes were documented by a certified athletic trainer or team physician. Athletes were sorted into 2 groups based on duration of on-field symptoms (severe and less severe).
| | Additional outcomes were assessed but were not included in this CAT because they did not relate to our clinical question. |
| Main findings | Duration of on-field mental-status changes such as retrograde amnesia and posttraumatic confusion was related to the presence of memory impairment at 36 h and 4 and 7 d postinjury and was also related to slower resolution of symptoms.|
| | Duration of symptoms of <5 min revealed significant declines in memory impairment at 36 h and 4 d postinjury. |
| Level of evidence | 2b |
| Validity score | Strobe 15/22 |
| Conclusion | Athletes who exhibit on-field mental-status changes for more than 5 min have longer-lasting postconcussion symptoms and memory decline. |

Lau et al

| Recovery time was defined as the period between day of injury and clearance to RTP. RTP was determined by resolution of symptoms and return of preinjury cognitive function. |

Collins et al

| Good postinjury presentation was defined as no measurable change, relative to baseline, in terms of both ImPACT memory and symptom composite scores. Poor presentation was defined as a 10-point increase in symptom reporting and 10-point decrease in memory functioning. |

Main findings

Duration of on-field mental-status changes such as retrograde amnesia and posttraumatic confusion was related to the presence of memory impairment at 36 h and 4 and 7 d postinjury and was also related to slower resolution of symptoms. The most common sign or symptom observed at the time of injury was headache (94.9%, n = 93). The least common sign or symptom was LOC, with only 13.3% (n = 13) reporting this symptom. Dizziness at the time of injury was associated with a 6.34 odds ratio (95% confidence interval = 1.34–29.91, \( \chi^2 = 5.44, P = .02 \)) of a protracted recovery from concussion. The remaining on-field signs and symptoms were not associated with an increased risk of prolonged recovery. The mean recovery times in days for the rapid and protracted groups were 4.31 (SD = 1.74) and 29.61 (SD = 6.65), respectively.

Odds ratios revealed that athletes demonstrating poor presentation at 2 d postinjury were over 10 times more likely (\( P < .001 \)) to have exhibited retrograde amnesia after concussive injury than athletes exhibiting good presentation. Similarly, athletes with poor presentation were over 4 times more likely (\( P < .013 \)) to have exhibited posttraumatic amnesia and at least 5 min of mental-status change. There were no differences between good and poor presentation groups in terms of on-field loss of consciousness.

Level of evidence | 2b |
| Validity score | Strobe 18/22 |
| Conclusion | Assessment of on-field dizziness may help identify high school athletes at risk for a protracted recovery. |

The presence of retrograde amnesia and prolonged disorientation without amnesia (>5 min) appears predictive of symptom and neurocognitive deficits after concussion in athletes and is indicative of a poorer outcome on immediate assessment (average of 2 d).

Table 2 (continued)

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Lovell et al</th>
<th>Lau et al</th>
<th>Collins et al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence and duration of on-field mental-status changes were documented by a certified athletic trainer or team physician. Athletes were sorted into 2 groups based on duration of on-field symptoms (severe and less severe).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional outcomes were assessed but were not included in this CAT because they did not relate to our clinical question.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery time was defined as the period between day of injury and clearance to RTP. RTP was determined by resolution of symptoms and return of preinjury cognitive function.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good postinjury presentation was defined as no measurable change, relative to baseline, in terms of both ImPACT memory and symptom composite scores. Poor presentation was defined as a 10-point increase in symptom reporting and 10-point decrease in memory functioning.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: RTP, return to play; LOC, loss of consciousness; PTA, posttraumatic amnesia; CAT, critically appraised topic.
was different in respect to the sport venues in which the concussions were incurred. The concussed individuals in 2 studies\textsuperscript{2,4} were broad with respect to sport venue, while 1 was limited to high school football athletes in 1 state over a 4-year time frame,\textsuperscript{3} making it more difficult to generalize the findings of dizziness for other types of athletes. Furthermore, Lau et al\textsuperscript{3} suggest that the addition of objective measures related to dizziness, such as the Dizziness Handicap Inventory, may elucidate the link between subjective reports and objective findings.

Two research investigations eliminated some of their subject sample due to athletes either not returning to play or being lost to follow-up (69 athletes),\textsuperscript{3} or no information was reported for exclusion (61 athletes).\textsuperscript{4} Although Lovell et al\textsuperscript{2} did not exclude individuals, their inclusion criteria only pertained to those with “mild” concussions; individuals with loss of consciousness were automatically excluded. When loss of consciousness was included as a factor, it was not related to recovery duration\textsuperscript{3,4}; however, excluding these individuals at the onset may have affected the other variables that were examined for analysis.

Athletic trainers are often the first to evaluate the signs and symptoms after concussion, and therefore careful consideration and documentation of the presentation of these factors must be performed. The cumulative effect of these on-field and sideline signs and symptoms should be considered even though this presented evidence suggests that retrograde and posttraumatic amnesia, disorientation,\textsuperscript{2,4} and dizziness\textsuperscript{3} may affect the recovery duration. The Consensus Statement on Concussion in Sport\textsuperscript{5} emphasizes the need for a standardized objective assessment on the field of play while keeping in mind that concussion is an evolving injury in the acute phase with rapidly changing clinical signs and symptoms. Use of a standardized tool such as the Acute Concussion Evaluation\textsuperscript{6} may provide further insight on the role that all of the factors lend to recovery duration. Recovery duration after concussion is affected by a multitude of issues, so monitoring the condition systematically over time is essential.

Future research investigations should be completed to differentiate between immediate on-field or sideline and delayed assessment factors that are associated with other history components such as prior concussion, learning disabilities, attention deficit disorders, psychological disorders, and headaches or migraines. This would help athletic training practitioners link which factors may predict recovery duration and may then lead to the development of a clinical prediction rule that would help identify individuals who may have prolonged recoveries. This would allow clinicians to take a more systematic approach in the management of concussions.

This CAT should be reviewed in 2 years to determine whether additional best evidence has been published that may change the clinical bottom line for this specific clinical question.

References