Concussion Knowledge in High School Football Players

Janie Cournoyer, MSc, ATC, CAT(C); Brady L. Tripp, PhD, LAT, ATC

University of Florida, Gainesville

Context: Participating in sports while experiencing symptoms of a concussion can be dangerous. An athlete’s lack of knowledge may be one factor influencing his or her decision to report symptoms. In an effort to enhance concussion education among high school athletes, legislation in Florida has attempted to address the issue through parental consent forms.

Objective: To survey high school varsity football players to determine their level of knowledge about concussions after the initiation of new concussion-education legislation.

Design: Cross-sectional study.

Setting: Descriptive survey administered in person during a team meeting.

Patients or Other Participants: A total of 334 varsity football players from 11 high schools in Florida.

Main Outcome Measure(s): Participants completed a survey and identified the symptoms and consequences of a concussion among distractors. They also indicated whether they had received education about concussions from a parent, formal education, neither, or both.

Results: The most correctly identified symptoms were headache (97%), dizziness (93%), and confusion (90%), and the most correctly identified consequence was persistent headache (93%). Participants reported receiving education from their parents (54%) or from a formal source (60%). Twenty-five percent reported never receiving any education regarding concussions. No correlations were found between the method of education and the knowledge of symptoms or consequences of concussion.

Conclusions: The high school football players we surveyed did not have appropriate knowledge of the symptoms and consequences of concussions. Nausea or vomiting, neck pain, gogginess, difficulty concentrating, and personality or behavioral changes were often missed by participants, and only a small proportion correctly identified brain hemorrhage, coma, and death as possible consequences of inappropriate care after a concussion. Even with parents or guardians signing a consent form indicating they discussed concussion awareness with their child, 46% of athletes suggested they had not.

Key Words: head injuries, education, symptoms, consequences, adolescent

Key Points
- High school football players did not have adequate knowledge of the symptoms and consequences of concussions.
- Athletic trainers should educate high school athletes about concussions and perform a comprehensive evaluation any time they suspect a concussion because athletes may not report the injuries.

According to the Centers for Disease Control and Prevention (CDC), more than 300,000 patients present to emergency departments each year for sport-related traumatic brain injuries. However, 1.6 to 3.8 million concussions occur each year during sports and recreation, and more than half can be attributed to football. Evidence suggests that high school football players may not be reporting or recognizing the signs and symptoms of a concussion, leading to improper management of the injury, which can increase the risk for post concussion syndrome and second-impact syndrome.

Unreported or unrecognized concussions are particularly concerning in adolescents, who are more susceptible to the negative consequences of concussions than adults because of differences in brain physiology. They have an increased risk for a secondary injury, such as second-impact syndrome, which disproportionately affects adolescents because they are subject to longer and more diffuse cerebral swelling. One possible reason the adolescent brain responds differently from that of an adult is that the former is 60 times more sensitive to glutamate and N-methyl-D-aspartate, 2 components of the metabolic chain reaction that occurs after a concussion. This increased sensitivity leads to an ionic shift that raises the demand for glucose, which in turn increases the vulnerability to a secondary injury. Although the literature remains inconclusive, factors postulated to increase adolescents’ vulnerability to secondary injury include a larger head-to-body ratio, thinner cranial bones, decreased neck strength, reduced cerebral blood volume, larger subarachnoid space, immature nervous system, incomplete myelination, and elasticity of the skull vault.

Adolescent athletes’ lack of knowledge about concussions may be one of the main predictors of a premature return to play after sustaining a concussion. Evidence also suggests that young athletes, parents, and coaches do not have the knowledge needed to assess and manage concussions and make return-to-play decisions.

The lack of parent and athlete education is a major focus of recent concussion legislation. In 2012, the Florida High School Athletic Association implemented a new concussion consent form that was mandatory for all parents and
either the CDC’s literature review and expert review, consisted of 3 sections.

Subjects by the University of Florida. Review Board for the Protection of Human Research season. This study was approved by the Institutional to distribute our questionnaire in the first half of the 2012 knowledge about concussion. Eleven schools agreed to questionnaire evaluating their varsity football team’s level of Florida to ask permission to distribute a written question-

METHODS

We contacted 13 local high schools in North Central Florida to ask permission to distribute a written question-

RESULTS

We distributed and collected a total of 334 question-

Symptoms

The most commonly identified symptoms related to concussions were headache (97%), dizziness (93%), and confusion (90%) (Table 2). Loss of consciousness was selected as a symptom by 81% of participants, whereas nausea or vomiting was recognized by only 53%. Few participants correctly identified symptoms such as behavior and personality change (40%), trouble falling asleep (36%), being more emotional (30%), and being nervous or anxious (27%). The most commonly identified distractors were muscle spasms in the neck and jaw pain (24% and 20%, respectively).

Consequences

Persistent headache (93%) was the most widely recognized consequence of inappropriate care of a concussion (Table 3). Only 60% to 70% of participants correctly identified brain hemorrhage, coma, and death as possible consequences. Early-onset dementia (64%), early-onset Alzheimer disease (47%), and early-onset Parkinson disease (28%) are long-term consequences of repetitive concussions or improper management that were only identified to a moderate degree. Participants improperly
identified increased risk of blindness with age (50%) and increased risk of stroke (38%) as consequences of improper care of a concussion.

Education

Fifty-four percent of participants stated they had discussed concussion with their parents, whereas almost 60% said they had formal education about concussion either in class or online. Twenty-five percent indicated they had never received any form of education about concussions.

Influence of Education on Knowledge Regarding Concussion

We used a linear regression to quantify the correlation between the method of education and the overall score. The $R^2$ value was 0.032 ($1 - \beta = 0.82$), indicating a poor correlation.

We used a binary logistic regression to evaluate if the method of education was significantly correlated with the identification of specific symptoms and consequences. Analysis revealed a Cox-Snell $R^2$ for the following symptoms: being nervous or anxious (0.007), nausea or vomiting (<0.001), fatigue or low energy (0.001), being more emotional (0.010), “just not feeling right” (0.006), and trouble falling asleep (0.023). No relationship was evident between the method of education regarding concussion and the identification of any symptoms. We performed the same analysis to assess the correlation between the method of education regarding concussion and the recognition of these possible consequences: brain hemorrhage (0.001), coma (<0.001), and death (0.003). Again, no association was observed between the method of education and the ability to identify these possible consequences.

DISCUSSION

Concussions are common in the young athletic population. Continued participation despite experiencing symptoms of a concussion can be detrimental and result in a range of sequelae from prolonged symptoms (postconcussion syndrome) to second-impact syndrome and death. Of concern are the facts that fewer than half of athletes are likely to report a concussion and almost 25% of football players participated in their sport while experiencing symptoms of a concussion. One of the main factors responsible for athletes not reporting their injury to an appropriate health care professional is a lack of knowledge about the signs, symptoms, and consequences of concussions. Our findings confirm that athletes have very poor recognition of nausea or vomiting, neck pain, grogginess, difficulty concentrating, and personality or behavioral changes as symptoms of a concussion. A small proportion of the participants did identify brain hemorrhage, coma, and death as possible consequences of inappropriate care after a concussion.

We believe that the lack of knowledge about concussions was the result of a lack of a quality education on this topic. Our results suggest that 25% of participants never received education about concussions and only 54% had discussed it with their parent(s) or guardian(s). When we assessed the relationship between education and knowledge, we found no correlation. This suggests that the education provided to our student–athletes did not promote a better knowledge about the symptoms and consequences of a concussion. Our results seem to indicate that student–athletes are now more knowledgeable regarding concussions than was reported by previous authors, who found that 25% of the adults and 25% to 50% of the players were either not able to name any symptom of a concussion or could only name 1. The participants in our study were able to correctly identify major symptoms of concussions, such as headache, dizziness, and loss of consciousness. However, few of the varsity high school football players correctly identified behavioral symptoms (27%–40%) or nausea and vomiting (53%). Apart from lack of knowledge, other factors impede an athlete’s ability to recognize the symptoms of a concussion. Symptoms may be subtle, resemble other conditions such as dehydration and heat exhaustion, or resolve in less than 15 minutes or appear a few days later. We also observed that consequences such as brain hemorrhage, coma, and death were not identified by more than 30% of participants, suggesting that more education should be directed toward those consequences and risks associated with concussions. Although we did not
assess them in our study, other factors that may influence knowledge about concussion are age and level of competition. Older athletes and those in more competitive leagues show greater knowledge about concussion.

As with every research project, our study had some limitations. We recruited local high schools, each of which had access to a licensed athletic trainer. It would be helpful to see similar studies done in high schools without access to an athletic trainer. In addition, we distributed the questionnaire to large groups of young athletes at the same time; even though the researchers and coaches monitored data collection, some participants may have assisted each other in identifying answers.

CONCLUSIONS

High school football players did not have appropriate knowledge regarding the signs, symptoms, and consequences of concussions. Symptoms such as headache, dizziness, confusion, and balance problems were adequately identified by the participants. However, other major symptoms, such as nausea, neck pain, grogginess, difficulty concentrating, and personality changes, were missed by almost half of the respondents. Severe consequences such as brain hemorrhage, coma, and death were identified by a low percentage. Many experts advocate education about concussion as one of the main components of prevention. We believe that having more knowledge about concussion would help athletes detect symptoms associated with concussions and having a better understanding of the consequences would encourage athletes to report their injuries to a health professional. Action should be taken to better educate athletes and to ensure the proper recognition and management of concussions. Because high school football players most frequently report their concussions to a certified athletic trainer when given the opportunity, one step toward preventing unwanted consequences of concussions and promoting education about concussions would be to place athletic trainers in every high school. Many other approaches can be used to provide quality information and education about concussions to young athletes, parents, and coaches. Preparticipation meetings, instructional videos, and Web-based programs are only a few examples that have already been suggested. Such approaches should be evaluated in the future to ensure their efficacy. Athletic trainers working in a high school setting should be aware of their athletes’ level of knowledge about concussions and take steps to help educate them as needed. Athletic trainers should always perform a comprehensive evaluation on any athlete suspected of having a concussion, and they should never assume the athlete will self-report symptoms. Furthermore, athletic trainers should not take for granted that concussion-education programs available to the parents, coaches, and athletes will result in well-educated athletes.

REFERENCES


Table 3. Frequency of Consequences of Inappropriate Care of Concussion Identification by High School Varsity Football Players

<table>
<thead>
<tr>
<th>Consequence</th>
<th>No. (%)</th>
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<tbody>
<tr>
<td>Persistent headache</td>
<td>288/309 (93)</td>
</tr>
<tr>
<td>Persistent dizziness</td>
<td>266/309 (86)</td>
</tr>
<tr>
<td>Persistent balance problems</td>
<td>264/307 (86)</td>
</tr>
<tr>
<td>Persistent difficulty concentrating</td>
<td>252/309 (82)</td>
</tr>
<tr>
<td>Persistent sensitivity to light</td>
<td>232/308 (75)</td>
</tr>
<tr>
<td>Brain hemorrhage</td>
<td>211/308 (69)</td>
</tr>
<tr>
<td>Persistent fatigue or low energy</td>
<td>198/307 (65)</td>
</tr>
<tr>
<td>Early-onset dementia</td>
<td>197/306 (64)</td>
</tr>
<tr>
<td>Death</td>
<td>196/308 (64)</td>
</tr>
<tr>
<td>Coma</td>
<td>193/308 (63)</td>
</tr>
<tr>
<td>Persistent sensitivity to noise</td>
<td>177/307 (58)</td>
</tr>
<tr>
<td>Early-onset Alzheimer disease</td>
<td>145/306 (47)</td>
</tr>
<tr>
<td>Persistent irritability</td>
<td>121/309 (39)</td>
</tr>
<tr>
<td>Early-onset Parkinson disease</td>
<td>85/306 (28)</td>
</tr>
<tr>
<td>Distractors:</td>
<td></td>
</tr>
<tr>
<td>Increased risk of blindness</td>
<td>152/306 (50)</td>
</tr>
<tr>
<td>Increased risk of stroke</td>
<td>117/306 (38)</td>
</tr>
</tbody>
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Address correspondence to Janie Cournoyer, MSc, ATC, CAT(C), University of Ottawa, A106, 200 Lees Avenue, Ottawa, Ontario, Canada K1S 5S9. Address e-mail to jcournoyer@ufl.edu.