

■ CASE STUDY

Corridor Consult

Management of the Athlete with Concussion

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Abstract

The approach to and management of the athlete with concussion can be a challenging endeavor to physicians who care for athletes who have suffered a head injury—this group includes family physicians, pediatricians, internists, emergency medicine physicians, primary sports medicine physicians, orthopedic surgeons, neurologists, and neurosurgeons. Sometimes questions regarding the need for neurologic, psychological, or radiographic imaging can make the decision for return to play unclear. New legislation will undoubtedly increase physician visits for these athletes to return to play. Thus, the goal of this article is to review the latest guidelines regarding concussion management to help all physicians who care for athletes do so appropriately.

Introduction

Up to 250,000 concussions occur each year in high schools alone.¹ The approach to and management of the athlete with concussion can be a challenging endeavor to physicians who care for athletes who have suffered a head injury—this group includes family physicians, pediatricians, internists, emergency medicine physicians, primary sports medicine physicians, orthopedic surgeons, neurologists, and neurosurgeons. Sometimes questions regarding the need for neurologic, psychological, or radiographic imaging can make the decision for return to play unclear. New legislation will undoubtedly increase physician visits for these athletes to return to play. Thus, the goal of this article is to review the latest guidelines regarding concussion management to help all physicians who care for athletes do so appropriately. The following case illustrates a presentation of concussion in a young athlete in the primary care setting.

Case Report

A 17-year-old male football player presented to our primary care clinic on a Wednesday at the recommendation of his athletic trainer. His father accompanied him. The patient reported that he was involved in an on-field collision in the 4th quarter of the previous Friday night's football game. He did not recall much about the episode, but his father said that he was in the air attempting to catch a pass when an opposing player leapt headfirst into him, causing a helmet-to-helmet collision. He remained on the ground for about 5 to 10 seconds but then was able to stand on his own and make his way over to the sideline. The patient

reported that he did not feel dizzy or have a headache, but he felt a little "fuzzy" and slow. He was not allowed to complete the game. Since then, he has not practiced with his team but has been doing light jogging and running pass routes without any difficulty or complaint of any symptoms.

On physical examination, he appeared alert and oriented. His neurologic findings showed no deficits, and results of cardiovascular, pulmonary, and musculoskeletal examinations also were normal. The patient had normal results of a mental status examination. He requested clearance to return to play.

A concussion was diagnosed on the basis of the mechanism of injury and the patient's symptoms immediately after the injury. Because he did not have any "red flags," such as focal neurologic deficits, at the sideline or at the office visit, imaging was not warranted. Five days after injury, he had already been doing light jogging and running pass routes—essentially noncontact drills—without any symptoms. The next step would be to allow him to attempt full contact play in practice. If he were to experience any concussion symptoms, he was advised to stop playing and return for a follow-up visit. If he remained symptom-free, he could engage in full contact game play in the next Friday night's game.

Time was spent to educate the patient and his father about concussion and about the importance of this stepwise approach to ensure the safety of the athlete.

Discussion

This discussion reviews the latest guidelines regarding concussion management, with the goal of helping physicians who care for athletes after concussion do so appropriately.

According to the latest Consensus Statement from the 3rd International Conference on Concussion in Sport, held in Zurich, Switzerland, in 2008, concussion is defined "as a complex pathophysiological process affecting the brain induced by traumatic biomechanical forces."² A more colloquial expression among athletic trainers and coaches is having one's "bell rung." Although helmets help to reduce skull fractures and severe brain injury, they have not been shown to protect against concussion.³ Concussions often are underreported or unreported among athletes and coaching staff⁴ because of lack of knowledge regarding concussion as well as not wanting the athlete pulled from play.

If the athlete has a second concussion before recovering from the first one, a potentially fatal condition known as second-impact syndrome can result. For this reason, the California Interscholastic Federation passed a bylaw in 2010 allowing for

game referees to remove players from games when concussion is suspected⁵ and requiring medical clearance from a physician before returning to play.

The general approach to concussion in a game setting is to begin with the evaluation of the athlete in the same manner as for any patient who has undergone trauma: the ABCs of airway, breathing, and cervical spine precautions. Once an athlete's ABCs are confirmed clear, s/he should be moved to the sideline for further evaluation. Athletes may complain of headache, dizziness, nausea, a "foggy" or "slow" feeling, visual or balance disturbances, amnesia, or irritability. There may be loss of consciousness, convulsion, or even seizure. These concussion symptoms typically spontaneously improve within minutes of impact and resolve by about five to seven days, although in some cases they may persist for weeks.

Once the patient is on the sideline or later in the examination room, useful tools such as the Standardized Assessment of Concussion (SAC)⁶ (available from: www.csmisolutions.com/PDFS/SAC%20Informational%20Kit.pdf) or the Sport Concussion Assessment Tool (SCAT2),⁷ which is part of the Zurich guidelines,² should be used. The SCAT2 can be downloaded as a PDF (www.csmfoundation.org/SCAT_Card.pdf) in full form for the clinic,⁸ printed in pocket form for the sideline, or downloaded as a smart phone application: Pocket SCAT2 (Inovapp, Inc; La Mesa, CA; available from: <http://itunes.apple.com/au/app/pocket-scat2/id453095629?mt=8&ign-mpt=uo%3D4>). The SCAT2 provides a standardized scoring system that takes into account symptoms, physical examination findings, cognitive function, balance, and coordination, as well as Glasgow Coma Scale scores. During sideline evaluation, alarming "red flags" of a head trauma include focal neurologic deficits, a deteriorating level of consciousness, prolonged confusion lasting greater than 30 minutes, or a loss of consciousness lasting greater than 5 minutes. These athletes do not have symptoms typical of concussion and should be brought to an emergency room urgently for immediate imaging. Although loss of consciousness was previously considered a marker of a more severe concussion, evidence does not support this conclusion; rather, amnesia has been shown to be most predictive of neurocognitive deficits.²

The diagnosis of concussion is largely based on the clinical examination, yet certain imaging studies can be considered, such as computed tomography or magnetic resonance imaging, if an intracranial bleed is suspected. Functional magnetic resonance images and positron emission tomographic scans have been used in concussion research but serve no role in the clinical management of concussion.^{9,10}

Commercial neuropsychologic testing programs (eg, ImPACT, ImPACT Applications Inc, Pittsburgh, PA; Axon Sports Computerized Cognitive Assessment Tool [CCAT, formerly CogSport], Axon Sports LLC, Wassau, WI; Automated Neuropsychological Assessment Metrics [ANAM], Vista LifeSciences, Parker, CO) have been advocated by some groups and schools as an aid in the return-to-play decision. These tests can help only when baseline testing is done and used for comparison to monitor improved test scores as an athlete recovers. However, no large well-designed studies have shown these commercial tests to

improve health outcomes over good clinical follow-up in concussed athletes.¹¹⁻¹⁴

The athlete found to have concussion on the sideline should be removed from play immediately and not allowed to return that day under any circumstances. It is recommended to perform serial examinations to monitor for worsening neurologic decline. These examinations should include testing of the cranial nerves, coordination, strength, and sensation. Any signs of deterioration should be presumed to indicate intracranial bleeding until proved otherwise. After completion of the game, the athlete and family should be advised of the diagnosis and given warning signs of which to be attentive.

The decision for return to play should take place in a stepwise fashion.^{15,16} The typical progression from rest to resumption of full activity lasts approximately six days (Table 1). This is based on the studies that show, despite denying symptoms, athletes often have balance or coordination issues lasting five to seven days in adults or up to ten days in children and adolescents.¹⁷ On day one, the athlete should have complete physical and cognitive rest. In this age of Internet use, social media, and gaming, the athlete and family should be advised of the importance of avoiding these neurologically stimulating activities as well as delaying schoolwork during this period. If the athlete remains asymptomatic after day one, s/he may attempt aerobic exercise on day two. If there are no symptoms, the athlete may attempt sports-specific exercises on day three. On day four, the athlete may perform noncontact training drills. Full contact training may be attempted on day five after medical clearance has been granted. If at any point during the progression, the athlete has any symptoms of concussion return, s/he must return to day one (rest) and restart the day-by-day progression. If the athlete remains asymptomatic through the five days of stepwise increasing activity, the athlete may be allowed to participate in competitive game play on day six. The patient and family should be educated about the importance of adhering to these steps.

Besides second-impact syndrome, postconcussive syndrome is another complication that can occur after a concussion, when neurologic deficits persist beyond two weeks. For athletes

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Table 1. Stepwise return to activity¹

Day	Activity allowed
1	No physical or cognitive activity until asymptomatic (rest)
2	Light aerobic exercise (eg, stationary bike)
3	Sport-specific exercise (eg, shooting free-throws, throwing football)
4	Noncontact drills (eg, running for passes, dribbling ball down court)
5	Full contact practice (after medical clearance)
6	Game play

¹ McCrory P, Meeuwisse W, Johnston K, et al. Consensus Statement on Concussion in Sport, 3rd International Conference on Concussion in Sport held in Zurich, November 2008. *Clin J Sport Med* 2009 May;19(3):185-200.

who have a history of persistent or worsening concussion symptoms for greater than two weeks or a history of multiple concussions, or for those who have persistent abnormal results of neuropsychological tests, a referral to a neurologist should be considered.¹⁸

The medical care of athletes can be an enjoyable experience. With a better understanding of concussion and the latest consensus recommendations for its management, physicians who care for athletes can be better equipped to keep them safe and healthy. ❖

Disclosure Statement

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Weakness to the Animal Faculty

Sometimes a great wound or concussion of the head,
especially which happens by falling headlong from a high place,
brings a prejudice and weakness to the animal faculty, dulling the understanding.

— Thomas Willis, 1621-1675, English physician and founding member of the Royal Society