Sports Neurology in Clinical Practice: Case Studies

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KEYWORDS

• Sports • Concussion • Headache • Traumatic brain injury
• Chronic traumatic encephalopathy • Exercise

KEY POINTS

- With regard to persistent posttraumatic headache, there is legitimate concern that duration of symptoms may have an impact on the efficacy of future treatment attempts.
- Without neuropathologic confirmation, a clinical diagnosis of chronic traumatic encephalopathy (CTE) cannot be made with a high degree of confidence.
- Sport-related headaches are challenging in a return-to-play context, because it is often unclear whether an athlete has an exacerbation of a primary headache disorder, has new-onset headache unrelated to trauma, or is in the recovery phase after concussion.
- Regular physical exercise may prove beneficial to multiple neurologic disease states.

It is only recently that neurologists have become more active participants in the realm of sports medicine. The field of sports neurology specifically addresses the neurologic aspects of sports and sports-related injuries. Many major professional and amateur sports programs have found neurologists to be crucial in determining when an athlete can return to play after an injury. Whether a general neurologist, designated subspecialist, or dedicated sports neurologist, however, each clinical neurologist ultimately encounters patients whose neurologic disorders either are a consequence of or have an impact on participation in an athletic activity. The 4 cases discussed provide a framework for a general neurologist's participation with such patients.

CASE 1: SPORT-RELATED CONCUSSION AND ASSOCIATED HEADACHE

A 22-year-old Division I male football player presented 3 months after his second lifetime concussion. The injury occurred via head-to-head collision with no associated loss of consciousness; however, the subject experienced approximately 4 hours of anterograde amnesia immediately postinjury. His initial recovery course was fairly typical, with expected headache, light and sound sensitivity, positional dizziness, and cognitive slowing. All symptoms resolved over the ensuing 2 weeks with the exception of

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continued persistent headache. For this reason, he was held out of all physical activity and was unable to return to practice and/or game participation the remainder of the season. The headache was unresponsive to various over-the-counter medical regimens; however, no prescription medication was attempted. His neurologic examination as well as MRI of the brain were all noted to be within normal limits despite his prolonged recovery. Due to this ongoing singular complaint of persistent posttraumatic headache, his primary care sports medicine physician ultimately referred him to a regional sports neurologist for further input.

Discussion

After concussion occurs, a complex neurophysiologic cascade is initiated resulting in the disruption of axonal and membrane function, including ionic flux with widespread neurotransmitter release, cerebral blood flow alterations, and synaptic dysfunction.[1,2] These physiological changes results in an injury of transient neurologic dysfunction, as evidenced by the clinical syndrome of concussion. The metabolic mismatch of decreased cerebral blood flow and increased glucose requirement is thought to be a potential cause of central nervous system (CNS) vulnerability and the presence of associated symptoms.[3] Headache is consistently the most common symptom after concussion and occurs in approximately 86% of athletes with sports-related concussion.[4] Approximately 90% of adults experience clinical recovery from concussion within 7 to 21 days, whereas up to 10% progress to postconcussion syndrome, which often includes persistent headache.[5] Prolonged recovery courses are more common in the pediatric population, with 15% still reporting postconcussion symptoms 90 days after injury.[6]

Multiple studies suggest that posttraumatic headache (PTH) characteristics after concussion are associated with cognitive impairments and prolonged symptoms, highlighting the considerable overlap of typical postconcussive symptoms and those commonly described in migraine.[7,8] Most recently, Kontos and colleagues[8] reported that patients with posttraumatic migraine had 7.3-times and 2.6-times increased risks of a protracted recovery compared with those with no headache or headache without migrainous symptoms, respectively. Previous research raises the possibility of a common molecular pathophysiologic cause of migraines and posttraumatic headache.[9–11] Mild head trauma can activate trigeminal nociception, similar to that seen in migraine. This, in turn, results in the sequential activation of second-order and third-order neurons within the brain stem, hypothalamus, and thalamus, leading to cortical spreading depression. The upper cervical sensory nerve roots that converge on the trigeminal nucleus caudalis may also contribute to the activation process, because inciting trauma results in forced flexion and extension of the cervical spine.[12]

Diagnosis

The patient in the case presented is experiencing persistent posttraumatic headache. Although a majority of patients with PTH have complete resolution of symptoms within 3 months from the time of injury, a small percentage of patients develop chronic headache (ie, persistent posttraumatic headache).[13] Multiple studies have documented recovery rates; however, the methodology of those studies varied greatly, providing for inconsistent results. The percentage of patients with headaches at 1 month varies from 31.3% to 90%, at 3 months from 47% to 78%, and at 1 year from 8.4% to 35%. Approximately 25% of patients report refractory headaches at 4 years.[14] The International Classification of Headache Disorders, 3rd edition (beta version) (ICHD-3), requires headache duration of greater than 3 months after traumatic injury to the head to fulfill the formal diagnosis of persistent headache attributed to traumatic brain injury to the head[15] (**Box 1**). When a new-onset headache occurs in close temporal