Spinal Cord Abnormalities in Sports

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KEYWORDS

• Chiari malformation • Syringomyelia • Spinal cysts • Tethered spinal cord • Spinal cord injury • Spinal cord tumors

KEY POINTS

- There are many anomalies of the spinal cord that may be detected in the evaluation of an athlete, several of which are incidental and not likely to affect his or her ability to participate in sports.
- Minor Chiari malformation (<5 mm cerebellar tonsillar descent) and small dilatations of the central canal of the spinal cord are often normal variants that require no further evaluation.
- Patients with significant Chiari malformations, spinal syringomyelia, and spinal cord tumors, cysts, or tethering should be evaluated by a neurosurgeon.
- Data to support return-to-play criteria for spinal cord anomalies are relatively sparse, and many of the recommendations in this article are based on consensus and experience.

Congenital and acquired brain stem and spinal cord anomalies, such as Chiari malformation, cysts within and around the spinal cord, tethered spinal cord, prior spinal cord injury, and spinal cord tumors may be present in competitive athletes. There is a paucity of information on the management of these conditions in athletes, however, and whether they represent a contraindication to play. This article attempts to clarify this confusing area by reviewing the literature and the consensus of experts in the field in hopes of providing readers with a practical common sense approach to the management of these issues.

CHIARI MALFORMATION

Background

Chiari malformation is generally defined as descent of the cerebellar tonsils 5 mm or more below the foramen magnum, the opening at the skull base where the spinal cord joins the brain. It is one of the more common incidental findings seen in neurosurgical

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practice, being detected in roughly 1% of individuals undergoing magnetic resonance imaging (MRI).[1] Additional patients may have what is called "tonsillar ectopia," another normal variant in which the cerebellar tonsils are between 1 and 5 mm beyond the foramen magnum. The Chiari malformation is so common that some authors have recently suggested it should be called the Chiari anomaly.[2]

Evaluation

The symptoms of a Chiari malformation may relate to either the brain or the spinal cord. When the cerebellar tonsils are descended beyond the level of the foramen magnum, they can crowd the structures located there, causing symptoms due to compression of the cerebellum, brain stem, and spinal cord.[2,3] The most common symptom of this crowding is headache, which is typically exacerbated by transient increases in intracranial pressure (called "tussive" headache, occurring when the patient coughs, laughs, or has some other transient spike in intracranial pressure related to physical exertion). These headaches are usually located in the occiput at the craniocervical junction, and the patient may describe them as either occipital headaches or neck pain. When the compression at the level of the foramen magnum makes it difficult for cerebrospinal fluid (CSF) to circulate normally out of the fourth ventricle, the Chiari malformation can lead to the development of syringomyelia, dilated cystic spaces within the spinal cord[4] (see "Syringomyelia"). Patients may rarely have cranial nerve findings from brain stem compression, including snoring, difficulty swallowing, double vision, or sleep apnea. Findings on MRI that might indicate a more severe Chiari malformation include altered CSF flow studies and pointed cerebellar tonsils,[5] as well as signal changes on MRI within the spinal cord (**Fig. 1A**, **B**).

Treatment

One difficulty with Chiari malformation is that many of its associated symptoms can be multifactorial, and the presence of the Chiari does not always imply that it is the cause of the symptoms. For instance, many patients suffering a concussion undergo imaging of the brain, and a coincidental Chiari malformation may be discovered because of its high prevalence in the population. Genuinely symptomatic patients can benefit from surgery, and most neurosurgeons would agree that asymptomatic Chiari malformation does not require surgery.[2,3,6,7] What are the reasons to consider operating on an athlete with asymptomatic Chiari malformation? One concern is that the Chiari malformation can become symptomatic over time, and therefore the surgery should be performed prophylactically.[8,9] The more concerning issue is that a patients with a significant Chiari malformation could present with a catastrophic central nervous system (CNS) injury after trauma owing to preexisting spinal cord or brain stem compression from the malformation; there are several anecdotal reports of this phenomenon occurring.[10,11] However, the true incidence of this event is probably quite low, as several studies that have looked prospectively at patients with Chiari malformation have failed to show any significant incidence of brain stem or spinal cord injury and suggest that the natural history is benign.[2,3,7] The surgery to decompress a Chiari does carry some risks, and the very low risk of spinal cord injury in the asymptomatic patient who suffers neck trauma needs to be weighed against the risks and potential complications of surgery. Although the literature has yet to define the exact degree of concern that a sport medicine clinician should have in this situation, most neurosurgeons do not advocate prophylactic surgery for asymptomatic Chiari malformations in competitive athletes.[6,12]