Return to Play Considerations for Cervical Spine Injuries in Athletes

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KEYWORDS

• Return to play • Cervical fractures • Stingers • Cervical stenosis
• Cervical cord neuropraxia • Disc herniation

KEY POINTS

- Describe typical mechanisms of injury for common cervical vertebral fractures.
- Understand the contribution of electrodiagnostic medicine to return to play considerations in stingers.
- Describe controversies in both screening for cervical stenosis in the athletic population and management of athletes with cervical injuries and identified stenosis.
- Know relative and absolute contraindications for return to play following cervical disc herniation.

INTRODUCTION

Cervical spine injuries are significant concerns in the athletic population, and they can occur with a variety of mechanisms and severities. Although catastrophic sports-related cervical spine injuries are relatively rare, they have been reported in multiple contact and noncontact sports, including American football,[1] rugby,[2] wrestling,[3] hockey,[4] recreational diving,[5] horseback riding,[6] skiing, and snowboarding.[7] Sports injuries were the fourth most common cause of spinal cord injury (SCI) in the United States between 2005 and 2010, after motor vehicle accidents, violence, and falls, and are the second most common cause of SCI in the first 30 years of life.[8]

Noncatastrophic injuries of the cervical spine occur with even greater frequency. These less grave injuries are typically amendable to functional rehabilitation and return-to-play (RTP) for the affected athlete. Although some cervical spine injuries have clearer guidelines, RTP decisions for many cervical injuries remain controversial. Authors have proposed criteria to guide RTP decision-making in cervical spine

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fractures,[9–12] stingers,[13–15] cervical stenosis and cervical cord neuropraxia (CCN),[12,14,16] and herniated nucleus pulposis.[17–19] However, the relative infrequency of these injuries has limited the ability to perform randomized clinical trials, elucidate their epidemiology and risk factors, or produce validated outcomes measurements. Much of the current RTP guidelines are based on retrospective case series and expert opinion pieces.

The general principles that guide RTP decision-making, namely being free of pain with full range of motion (ROM) and normal or near-normal strength, are not unique to injuries in the cervical spine. However, because of the presence of adjacent neurovascular systems, team physicians, trainers, and parents must proceed with care in deciding when an athlete may return to the field. This article attempts to aggregate both the current published literature and the clinical experience of field leaders in the recommendations that follow.

CERVICAL FRACTURES

Cervical spine fractures may occur by a variety of mechanisms in the athletic population. They vary greatly in severity depending on the location of fracture, extent of involvement of adjacent neurovascular structures, and time required for bone healing. In the 2012 assessment of spine injuries in National Football League (NFL) players from 2000 to 2010, the spectrum of cervical fractures occurred with the lowest frequency, 1.8% of all cervical injuries, but carried the longest mean number of days lost at 119.7 days.[20] Tator and colleagues[21] described 188 cervical fractures and/or dislocations in competitive ice hockey players between 1966 and 1993, 130 of which occurred without neurologic involvement.

Spinous process fractures are not uncommon forms of isolated cervical vertebral fracture and typically have a benign clinical course. They most commonly occur in the lower levels of the cervical spine and were described with 4 postulated injury mechanisms by Meyer and colleagues.[22] The first mechanism involves avulsion of the spinous process by forceful co-contraction of trapezius, rhomboid minor, and/or serratus posterior muscles, the pattern of which is often referred to as "clay shoveler's fracture (**Fig. 1**)."[23] Other injury mechanisms include hyperflexion-hyperextension whiplash injuries that have been observed in football, hockey, and gymnastics,[11] as well as sharp direct blows to the spinous process, and avulsion injury associated with fracture/dislocation of the rest of the cervical spine.

Jefferson[24] described fractures of the C1 vertebrae following traumatic falls and direct cranial impact, with force transmission to the lateral masses from axial loading of head impact and continued torso momentum, with resultant fractures of the anterior and/or posterior vertebral arches (**Fig. 2**). In the athletic population, inappropriate tackling technique with cervical flexion has been implicated in Jefferson C1 burst fractures in football and rugby players,[25] as well as heads-first form checking into the boards in hockey players.[26]

Compression fractures in the cervical spine are significantly less common than those in the thoracolumbar spine. Such injuries may happen sporadically in the athletic population, postulated as a result of hyperflexion forces in contact sports. The severity of the compression fracture may vary from mild deformation of superior or inferior endplate to significant anterior wedging of the vertebral body. Simple cervical compression fractures are typically benign in clinical course when properly identified, because they retain structural integrity of the anterior and posterior longitudinal ligaments as well as the posterior vertebral body. However, the mechanism of contact hyperflexion with higher magnitude forces may also result in more severe cervical