Spondylolisthesis and Spondylolysis in Athletes

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Participation in competitive sports carries inherent risk. Most athletic activities require an athlete to perform rapid complex movements, many of which produce compressive, torsional, and shear stresses on the lumbar spine.

Athletes who participate in contact and collision sports may have even greater loads applied to the lumbar region due to potential impact with other athletes and the playing surface. The high forces from a single traumatic event can produce serious lower back pathology, but it is believed that cumulative repetitive stresses from sports participation are responsible for most lower back complaints (Berry et al., 1994).

In gymnastics, 12 to 19% of all injuries are to the trunk and spine, whereas the incidence of spinal injuries across all sports has been reported at 20% (Cypress, 1983; McAuley et al., 1997). Low back dysfunction can be a challenging dilemma for the athlete as well as for the individual providing rehabilitative care.

Key Points

- Spondylogenic disorders of the lumbar spine are a common cause of lower back pain in the adolescent athlete.
- Athletes with these disorders often complain of lower back pain that presented insidiously and increases with lumbar spine extension.
- Treatment involves rest, avoidance of lumbar extension/trunk strengthening exercises, and an emphasis on maintaining a neutral pelvic position.

This article is intended to give athletic trainers and therapists a better understanding of spondylogenic disorders in athletes. It reviews the pertinent anatomy, provides an overview of the etiology and suggested mechanisms of injury, and presents preventive strategies. Hopefully, readers will learn to recognize the clinical presentation of spondylolysis and spondylolisthesis in order to design appropriate treatment intervention.

Anatomy

The vertebral column is a segmented structure comprising 33 vertebrae. Collectively, the articulated vertebrae provide increased mobility to the trunk and protection to the spinal cord and exiting neural structures.

The anterior vertebral body is primarily cancellous bone surrounded by a thin layer of cortical bone (Williams & Warwick, 1986). The large lumbar vertebral bodies allow weight-bearing forces to be transmitted along the vertebral column. Each vertebral body articulates with the neighboring vertebral bodies superiorly and inferiorly through intervertebral discs (Moore, 1992; Williams & Warwick, 1986).

The posterior portion of each vertebra is called the vertebral arch. It is primarily composed of cortical bone and serves an attachment site for multiple muscles and ligaments (Williams & Warwick, 1986).
The pedicles are a dense and strong dorsal projection off the vertebral body. The two pedicles project posteriorly and join the lamina medially, the superior articulating process superiorly and the pars interarticularis inferiorly.

The lamina project dorsally and medially and join to form the spinous process. The joining of the lamina closes an osseous ring that will protect the spinal cord and spinal nerves.

The posterior vertebral arches of adjacent vertebrae articulate through bilateral facet joints which are created by respective superior and inferior articulating surfaces (Moore, 1992; Williams & Warwick, 1986). The pars interarticularis is continuous with the inferior articulating surface, and is thin and vulnerable to injury in the adolescent athlete who has not reached skeletal maturity (Stinson, 1996).

**Etiology**

Spondylolysis is defined as a disruption in the pars interarticularis of the posterior vertebral arch. It is often described as a fatigue or stress fracture. Spondylolysis can occur at any vertebral level, but is most common in the lower lumbar region (Dubousset, 1997). Some 90% of patients with spondylolysis have involvement at the 5th lumbar level (Saraste, 1993).

The pars interarticularis acts as a fulcrum point for hyperextension of the lumbar spine. It also has a small area of focused stress, less than 1 cm², making the pars interarticularis susceptible to this type of stress fracture (Stinson, 1996).

Spondylolysis with an anterior slippage of the involved vertebral body, in relation to the vertebrae below, is called spondylolisthesis. In approximately 80% of patients with spondylolisthesis, some anterior translation of the vertebral body, spondylolysis, some anterior translation of the vertebral body, spondylolisthesis, was found with radiographic imaging (Saraste, 1993).

It is believed that disruption of the pars interarticularis increases the shear load on the intervertebral disc at the involved level, resulting in spondylolisthesis (Payne & Ogilvie, 1996). The exact mechanism for anterior displacement of the vertebral body is not fully understood, but long-term follow-up studies have shown that progression of the displacement is rare (Saraste, 1993; Stinson, 1996).

It appears that the athlete’s symptoms are related to the degree of anterior displacement of the vertebral body (Saraste, 1993). Early detection and intervention are important in assuring a favorable prognosis for return to sports.

Spondylolysis and spondylolisthesis have three major characteristic differences when compared to stress fractures that occur in other parts of the body. Unlike other stress fractures, the defect of the pars interarticularis is an acquired condition that develops in young people. There is a high incidence of spondylolysis in athletes 5 to 15 years of age (Stinson, 1996).

In a study by Micheli and Wood (1995), 47% of athletes under the age of 19 with complaints of lower back pain had spondylolysis. Only 5% of athletes over the age of 21 with lower back pain had spondylolysis. The diagnosis of spondylolysis was confirmed through imaging studies.

Second, in some cases the pars defect may be asymptomatic despite the fact that it often does not heal completely. Immobilization in a cast or brace is often effective at reducing symptoms and improving function, but radiographic union is often unattainable (Stinson, 1996). Failure of radiographic union alone should not keep an athlete from returning to sports (Hoshina, 1980; Stinson, 1996).

Finally, there is a strong genetic component related to spondylogenic disorders. Adolescents of Alaskan Eskimo descent have the highest incidence of pars defects, whereas adolescents of African American descent have the lowest (Hoshina, 1980). With this pathology, family history is an important variable when interviewing an athlete about his or her lower back pain.

Young athletes whose sports involve repetitive hyperextension of the lumbar spine appear to be at greatest risk for developing spondylolysis and spondylolisthesis. The essential components of a competitive gymnastics routine place high loads on the