

The Spine in the Disabled Athlete

Introduction

Sports participation in organized athletic activities individuals with disabilities has significantly increased in popularity over the past several decades. Increased involvement is demonstrated by greater numbers of participants in the United States alone, estimated at over 3 million participants.^{2,10} An increased incidence of injuries, particularly to the spine, has been observed. Yet, relatively little is known about the specific types of spine injuries sustained during disabled sporting events. This article attempts to inform the physicians and medical professionals dealing in spine-related illnesses about the history of sports for athletes with disabilities, common spine injuries in this population, and unique physical characteristics, which may predispose the physically challenged athlete to such injuries.

History of Sports for Athletes with Disabilities

The initiation of organized sports for physically challenged athletes has been attributed to Sir Ludwig Guttman. Dr. Guttman implemented athletic competition as part of a comprehensive rehabilitation program for his spinal cord patients at Stokes-Mandeville Hospital in 1944.¹ In 1948; the Stokes-Mandeville Games were established to encourage further competition. Subsequent international growth leads to the establishment of the Paralympic Games in 1960 and a continued interest in sports for athletes with disabilities.¹²

Since 1960, the Paralympics Games has expanded to involve over 3500 athletes representing over 100 nations in the Sydney 2000 Games. Athletes including the visually impaired, paraplegics, quadriplegics, amputees, and those with cerebral palsy and other conditions, compete in a variety of events common to the Olympics including track and field, basketball, swimming volleyball, etc... Other sporting events, such as goalball and quad rugby, are unique to those with specific disabilities. . In an attempt to standardize competition, athletes are classified using a complex system of impairment and function ratings..

Epidemiology of Cervical / Lumbar spine injuries

Studies have attempted to characterize common injury patterns in a variety of athletic events for athletes with disabilities. However, inherent to surveillance and sports epidemiological studies, the consistency and accuracy of data collection from injuries sequelae resulting from spine injuries have been difficult to obtain and interpret. Further study of this data is quite limited because of injury reporting systems. Analysis of available information has yielded several trends.

Ferrara et al⁶ completed a retrospective 1-year recall survey of injuries sustained by 19 elite wheelchair athletes participating in a training camp. Track and field events accounted for over 60% of all injuries following by swimming (20%). The majority of these injuries represented strains and muscular injuries (48%) with involvement of the neck in 18% of all injuries.

Ferrara MS et al⁵ completed a retrospective 6-month retrospective survey of athletes with different disabilities participating in the 1989 United States national competition. Athletes were associated with the National Wheelchair Athletic Association (NWAA), United States Association for Blind Athletes (USABA) or the United States Cerebral Palsy Athletic Association (USCPAA). An injury was defined as any trauma during practice, training or competition limiting participation for one day or more. The neck / spine accounted for 7% of all injuries, while trunk injuries presented 4% of all injuries. Comparison of injuries involving these organizations revealed neck / spine injuries accounting for 6% of injuries in wheelchair athletes (NWAA), 8% for visually impaired athletes (USABA) and 6% of cerebral palsy athletes (USCPAA). Similarly, trunk injuries accounted for 4% of injuries in wheelchair athletes (NWAA), 6% for visually impaired athletes (USABA) and 3% of cerebral palsy athletes (USCPAA).

More recently, Nyland et al¹³ reported on soft tissue injuries sustained during the 1996 Paralympic Games. Lumbar spine injuries occurred in 9% of wheelchair athletes (Wheelchair Sports USA), 14% cerebral palsy athletes (USCPAA), 8% visually impaired athletes (USABA) and 8% of amputees (Disabled Sports USA). Cervicothoracic spine injuries occurred in 8% of wheelchair athletes

(Wheelchair Sports USA), 7% cerebral palsy athletes (USCPAA), 19% visually impaired athletes (USABA) and 5% of amputees (Disabled Sports USA).

Another study attempted to characterize spine injuries in physically disabled snow skiers. Laskowski et al⁹ completed a retrospective review of injury rates of selected disabled skiing participants compared to able-bodied skiers. They discovered that there was no significant difference in overall injury rate between physically disabled and able-bodied skiers. Head and neck injuries accounted for 14.3% of disabled and 12.5 % of able-bodied skiers. Trunk and back injuries accounted for 5.7% of disabled and 4.8% of able-bodied skiers. Ferrara et al⁷ noted the neck and spine accounted for 11% of all injuries in disabled snow skiers, while the trunk accounted for only 1% of all injuries.

In summary, most studies have been retrospective in nature and limited to the analysis of data from surveillance recording systems and sample populations. Spine injuries in disabled athletes are relatively common depending upon the sporting event and unique disability of the athlete. Neck injuries appear to account for 7 - 19% of injuries, the thoracic / trunk accounts for 3-6% of injuries, and the lumbar spine 8-14% of injuries. Future studies are needed to discern the specific diagnoses for the various regions of the spine.

Unique Biomechanics Considerations

Physically challenged athletes present with unique biomechanical changes, which may predispose them to subsequent injury. This includes limitations in range of motion, muscle strength, sensation and postural balance-- all depend upon the underlying impairment and disability. In addition, increased muscle tone and hyperreflexia may contribute to altered biomechanics and impaired sport technique.

Use of the entire kinetic chain for sports specific tasks and movements may be hindered secondary to athletic impairment, and athletes may be at more risk for tissue overload/overuse injuries. Finally, each sporting event may require unique adaptive equipment to allow the athlete to participate.

Spinal-cord injured wheelchair athletes present with varying levels of impaired truncal and pelvic instability depending upon the severity and level of injury. Aerodynamic body positioning of wheelchair racers places the athlete in an extremely confined position with hyperflexion of the lumbar spine, and such positioning may provide an increased risk for lumbar disc herniations, paraspinous muscular strain

and decubitus ulcers. Field athletes may be confined to trunk stabilizing apparatus to assist with participation in events such as the javelin or discuss throw. Limitation of lumbar spine range of motion may increase biomechanical forces on the thoracic and cervical spine. Hardcastle et al noted that paraplegics with spinal fusion, particularly over multiple segments, have approximately a 25% reduction of truncal extensor strength.⁸

Athletes with amputations may develop spine pain due to altered gait kinematics dependent upon the level (trans-tibial or trans-femoral), number of limbs involved (unilateral vs. bilateral) and the cause of amputation (traumatic vs. vascular). Interestingly, Ehde et al completed a retrospective, cross-sectional survey of amputees greater than six months post lower limb amputation, noting that over 52% reported experiencing persistent lumbar spine pain.⁴ Czernicki et al³ analyzed the gait of five unilateral transtibial runners compared to non-impaired individuals. The amputees were observed to have greater total energy transfer during swing phase (69% increased total work), which was felt to be adaptive to enable the non-impaired lower extremity and trunk to compensate for the reduced power output of the stance phase prosthetic lower extremity.³

Athletes with varying degrees of cerebral palsy will have to compensate for increased muscle tone and spasticity. Such athletes learn to be cognizant of a variety of abnormal movements, which may trigger unusual muscle tone changes and alter the mechanics of running, swimming, throwing, and other athletic movements. Abnormal tone and spasticity may also interfere with proper strength training technique.¹¹ Similar to amputees, such altered movement can lead to spine injury. Finally, visually impaired athletes are at increased risk due to the underlying impairment and potential for acute injury secondary to an unforeseen fall and inability to react quickly due to absence of visual feedback.

Conclusion

The physically challenged athlete presents the spine and sports physician and health professional with unique considerations for injury and subsequent treatment and management. Overall, the spine has potential for injuries in many ways depending upon the athlete's disability and sport event. Future studies are needed to better define the true injury rate. Fortunately, the majority of spine-related injuries are minor in nature and can be managed conservatively. However, one must understand those impairment

issues unique to the impaired athletes and their sports to optimally manage these injuries and expedite a return to prior level of participation.

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