The Disabled Athletes and Related Medical Conditions

Pisit Lertwanich, M.D.

Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Siriraj Med J 2009;61:100-103

E-journal: http://www.sirirajmedj.com

Sports participation is not only beneficial to able-bodied individuals, but also the disabled persons. Sports activities improve both physical condition and psychosocial skill. Success in sports competition of the disabled athletes reflects the good quality of the medical care and rehabilitation process. Understanding their demands and specific medical conditions is important for the physician in taking care of the disabled athletes.

Sports for the disabled individuals

Sports competition of disabled persons was started with the World War II veterans who had spinal cord injury. In 1948, Sir Ludwig Guttmann set up Stoke Mandeville games in England.[1] This olympic style event for disabled athletes was firstly organized in Rome in 1960, the same venue as the olympic Games, with 400 athletes from 23 countries. The number of athletes has increased to 3,951 persons, from 146 countries, participating in 20 sports, in the Beijing Paralympic Games 2008. Most of the sports are modified in rules and equipment from able-bodied sports competitions except boccia and goalball which have specific characteristics for cerebral palsy and visual impaired individuals respectively. Some sports are open to multiple disability categories (e.g. athletics, swimming), while others are restricted to only one disability (e.g. goalball, judo) (Table 1).

A classification system is used to ensure an even ground for athletes to compete against others with comparable disability. There are 6 categories of disability including wheelchair athletes, amputees, athletes with cerebral palsy, visual impairment, intellectual impairment, and les autres ("all other" in French). The les

TABLE 1. Sports in summer Paralympic Games and eligible disabilities.

Sports	Disabilities					
	Wheelchair athletes	Amputees	Cerebral palsy	Visual impairment	Intellectual impairment	Les autres
Archery	x	x	x			x
Athletics	x	x	x	x	x	x
Boccia			x			
Cycling	x	x	x	x		x
Equestrian	x	x	x	x		x
Football 5-a-side				x		
Football 7-a-side			x			
Goalball				x		
Judo				x		
Powerlifting	x	x	x			x
Rowing	x	x	x			x
Sailing	x	x	x	x		x
Shooting	x	x				x
Swimming	x	x	x	x	x	x
Table tennis	x	x	x		x	x
Volleyball	x	x				x
Wheelchair basketball	x					
Wheelchair fencing	x					
Wheelchair rugby	x					
Wheelchair tennis	x					

autres group is the athletes with a mobility impairment or other loss of physical function that do not fit into another group such as dwarfism, muscular dystrophy, arthrogryposis.[1,2] In addition, the athletes are further sub-classified into classes in reference to their activity limitation resulting from impairment. The details of classes are different which depends on the types of sports and disabilities.

Trained medical professionals may participate in the classification process of particular sports as classifiers. For the most appropriate class of each athlete, the evaluation process includes physical, technical, and observation assessment. The classifiers should be aware of misclassification which is an intentional or subconscious attempt of the athlete to increase functional deficit for an unfair advantage over other competitors.[3]

Epidemiology of injury

In general, injury rates and patterns in disabled athletes are comparable to able-bodied athletes.[4,5] A cross-disability retrospective survey performed in 426 athletes found that 32% of the athletes experienced at least 1 injury during the 6 months prior to their national competition resulting in limitation in sport participation lasting for 1 day or more.[6] Fifty-seven percent of the injuries in wheelchair athletes were located in the shoulder, arm, or elbow. Fifty-three percent of the injuries in athletes with visual impairment were to the lower extremities. Most common site of injuries in athletes with cerebral palsy was the knee (21%), followed by the shoulder, forearm, wrist and ankle.[6]

Thermoregulatory problems

Spinal cord injury (SCI) impairs thermoregulation. The degree of thermoregulatory impairment will be increased in the persons who have higher and more complete spinal cord lesions.[7] The athletes with SCI have higher core temperatures in the hot environment and lower core temperatures in the cold ambient when compared with able-bodied individuals.[7] For paraplegic athletes, esophageal temperature is a better index of core temperature than rectal temperature.[8]

Athletes with SCI have impartment of sweating and vasomotor control below the level of the lesion. Hyperthermia can occur when the athletes have training or competition in a hot environment. Heat related illness involves heat cramp, heat exhaustion, and heat stroke. Common manifestations are fatigue, weakness, lightheadness, headache, vomiting, and myalgia.[2,9] Heat stroke is the most severe form of heat related illness which can cause convulsion, permanent neurological damage or death.

Management of heat related illness includes discontinuing exercise, moving the patient to a cold environment, removing cloths, external cooling (e.g. ice bag, ice water-wetted towels), and rehydration with oral and/or intravenous fluid. Hyperthermia can be prevented by acclimatization to the environment, wearing appropriate light, loose clothes, and optimizing hydration before and during exercise.

In a cold environment, SCI athletes also have thermoregulatory problem because of impairment in body heat production due to loss of skeletal muscle mass and activity.[10] This problem should be more concerned in swimmers, endurance racers, and winter sports athletes.

Signs and symptoms of hypothermia include slurred speech, amnesia, cold extremities, confusion, and apathy.[9] Treatment comprises moving the athletes to a warm environment, removal of wet clothes, and rewarming.

Autonomic dysreflexia

Autonomic dysreflexia (AD) is an acute syndrome of uncontrolled sympathetic hyperactivity in response to certain stimuli in spinal cord-injured individuals especially those who have the lesions at or above the sixth thoracic level (T6). This condition is relatively common with estimated lifetime frequency range between 19 to 70 percent.[11] Various pain or discomfort conditions were described as stimuli to AD including bladder distension, urinary tract infection, urinary catheterization, fecal impaction, hemorrhoids, anal fissure, pressure sore, ingrown toenail, fracture, dislocation, and thrombophlebitis.[9,11]

A noxious stimulus below the level of a spinal lesion creates a sympathetic response below the neurological lesion. In the persons with lesions at or above T6, this response includes splanchnic and peripheral vasoconstriction resulting in hypertension. The descending inhibitory signals are blocked at the spinal cord injury level causing excessive parasympathetic response above the level of spinal injury. Therefore, the patients experience headache, sweating above the spinal-injured level, nasal congestion, and blurred vision.[2,11] Serious complications which may occur following AD consist of seizures, cerebral hemorrhage, cardiac arrhythmia, and death.[12]

Treatment of AD comprises sitting the athlete upright to enhance an orthostatic decrease in blood pressure, loosening any tight clothes or constructive devices, and also removing the potential stimuli.[11] Since bladder distension is the most common stimulus, intermittent catheterization is advocated if no indwelling catheter is present. If the patient has an indwelling catheter, it should be checked for obstruction and irrigated. An antihypertensive agent is indicated if the symptoms are still present and systolic blood pressure is 150 mmHg or greater. Nifedipine and nitrates are commonly used to treat this condition. For nifedipine, the bite and swallow method in a dose of 10 mg is preferred.[2,11]

Boosting

Boosting is a self-induced autonomic dysreflexia for performance enhancement. Similar to the stimuli that causes AD, the methods that athletes use for boosting include clamping the urinary catheter to produce bladder distension, excessive tightening of the leg straps, twisting and/or sitting on the scrotum.[12] A study of eight elite quadriplegic athletes demonstrated a mean improvement of 9.7 percent in a simulated 7.5 km wheelchair race performance.[13]

Since boosting can be dangerous to health and it is also considered to be an unethical and illegal practice, the International Paralympic Committee (IPC) forbids athletes to compete in a dysreflexic state.[14] The assessment may be undertaken anytime during a warm-up period and at any other time deemed appropriate. An athlete with a systolic blood pressure of 180 mmHg or greater will be re-assessed approximately 10 minutes after the first examination. If the systolic blood pressure remains above 180 mmHg, the athlete shall be withdrawn by the IPC from the particular event in question.[14]

Pressure sores

Pressure sores can be problems in disabled athletes due to prolonged pressure over the particular area of skin causing disruption in skin integrity. The amputees with an improperly fitted prosthesis or the wheelchair athletes may have more risk of this condition. Sports wheelchairs are designed to keep the knees higher than the buttocks which increases the pressure over ischial and sacral area.

Skin condition in the area at risk should be frequently checked for early signs of pressure sore. Adaptive equipment and prosthesis should be correctly fitted to users. Wheelchair athletes must shift the weight and change position frequently to enhance circulation in the area at risk. An appropriate cushion should be provided. Skin moisture can be minimized by wearing absorbent fabric.[10]

Impingement syndrome of the shoulder

Wheelchair athletes are at risk for overuse injuries of the shoulder because of repetitive use of their upper extremities for propulsion and weight bearing in both sports and daily activities. Muscle imbalance can be a risk factor of shoulder impingement syndrome which is the most common diagnosis for shoulder pain in wheelchair athletes.[15] Paraplegic athletes have a higher ratio of shoulder abduction to adduction strength when compared with able-bodied athletes.[15] The shoulder of the paraplegic athletes with impingement syndrome have weaker adduction, internal rotation, and external rotation strength compared with those without impingement syndrome.[15] This imbalance pattern contributes to superior displacement of the humeral head and narrowing of the subacromial space.

Although treatment of shoulder impingement syndrome uses the same principle as able-bodied individuals, resting the shoulder in wheelchair users is usually impracticable because they have to use their upper extremities to perform activities of daily living. Pain control, anti-inflammatory medication and also physical modalities are treatment options for this condition. Moreover, stretching exercises of anterior shoulder muscles and strengthening exercises for muscles of adduction, internal/ external rotation, and scapular stabilization are essential for both preventive and therapeutic purposes.[10,15,16]

Premature osteoporosis

Osteoporosis is a common complication after SCI which can lead to subsequent fractures. While lack of mechanical stimulus is an important factor in developing osteoporosis, neural and hormonal changes after SCI also play roles in this process.[17] This condition should be more concerned in the athletes with SCI who participate in contact sports such as wheelchair basketball, wheelchair rugby.

Treatment consists of applying various stimuli to bone (e.g. standing, orthotically aided walking, functional electrical stimulation)[18] and using antiresorptive drugs such as calcitonin and bisphosphanate.[17,18]

Minor injury can cause fracture in the osteoporotic bone in this group of the athletes. Making a diagnosis of fracture in the patients with SCI may be difficult due to sensory impairment. If injury is suspected, the physician should be aware of fracture and examine for any suspected evidences such as localized swelling, ecchymosis, and deformity. The diagnosis is confirmed with radiographic study. Appropriate treatment of each fracture depends on its location and pattern.

Peripheral nerve entrapment

Paraplegic individuals have repetitive and forceful wrist and hand movement for their daily activity. Prevalence of peripheral nerve entrapment of the upper extremity in paraplegic persons determined by electrodiagnosis is higher than able-bodies control subjects.[19] Median nerve entrapment has highest prevalence, following by ulnar nerve and radial nerve respectively.[20,21]

Bilateral nerve conduction studies of 12 elite wheelchair racers indicate that 50 percent of the athletes had evidence of median mononeuropathy (80 percent of these athletes had bilateral lesions).[20] In the same study, ulnar and radial nerve dysfunction were found in 25 and 17 percent of the subjects respectively.[20] The type of sports participation may affect the prevalence of peripheral nerve dysfunction. In one study of 6 paralympic weight lifters, all athletes had electrodiagnostic evidences of bilateral median nerve dysfunction.[20]

Nerve conduction abnormalities were related to the duration of disability, but were not related to the amount of training and years of competition.[20,21] A possible explanation is the force occurring at the wrist during transfers may have more contribution to this problem than the force during propelling the wheelchair.

Conclusion

The number of the disable persons who participate in sports activities and competition continues to increase. This challenges physicians to provide a high quality of medical care to the athletes. Further studies are needed for both preventive and therapeutic objectives in various types of sports and disabilities.

REFERENCES

1. Paralympic Games. [cited January 22, 2009]. Available from: http://www.paralympic.org.
2. Klenck C, Gebke K. Practical management: common medical problems in disabled athletes. Clin J Sport Med. 2007 Jan;17(1):55-60.
3. Firth FY. Seeking misclassification: "doping" in disability sport. Br J Sports Med. 1999 Jun;33(3):152.
4. Ferrara MS, Palutsis GR, Snouse S, Davis RW. A longitudinal study of injuries to athletes with disabilities. Int J Sports Med. 2000 Apr;21(3): 221-4.
5. Reynolds J, Stirk A, Thomas A, Geary F. Paralympics--Barcelona 1992. Br J Sports Med. 1994 Mar;28(1):14-7.
6. Ferrara MS, Buckley WE, McCann BC, Limbird TJ, Powell JW, Robl R. The injury experience of the competitive athlete with a disability: prevention implications. Med Sci Sports Exerc. 1992 Feb;24(2):184-8.
7. Sawka MN, Latzka WA, Pandolf KB. Temperature regulation during upper body exercise: able-bodied and spinal cord injured. Med Sci Sports Exerc. 1989 Oct;21(5 Suppl):S132-40.
8. Gass GC, Camp EM, Nadel ER, Gwinn TH, Engel P. Rectal and rectal vs. esophageal temperatures in paraplegic men during prolonged exercise. J Appl Physiol. 1988 Jun;64(6):2265-71.
9. Gottschalk F. The orthopaedically disabled athlete. In: DeLee J, Drez D, Miller M, editors. DeLee and Drez's orthopaedic sports medicine: principles and practice. 2nd ed. Philadelphia: Elsevier Science; 2003. p. 521-31.
10. Dec KL, Sparrow KJ, McKeag DB. The physically-challenged athlete: medical issues and assessment. Sports Med. 2000 Apr;29(4):245-58.
11. Blackmer J. Rehabilitation medicine: 1. Autonomic dysreflexia. CMAJ. 2003 Oct 28;169(9):931-5.
12. Webborn AD. "Boosting" performance in disability sport. Br J Sports Med. 1999 Apr;33(2):74-5.
13. Burnham R, Wheeler G, Bhambhani Y, Eriksson P, Belanger M, Steadward R. Intentional induction of autonomic dysreflexia among quadriplegic roadracers for performance enhancement: Efficacy, safety and mechanism. Clin J Sport Med 1994;4:1-10.

14. International Paralympic Committee. International Paralympic Committee Handbook. Bonn; 2002.
15. Burnham RS, May L, Nelson E, Steadward R, Reid DC. Shoulder pain in wheelchair athletes. The role of muscle imbalance. Am J Sports Med. 1993 Mar-Apr;21(2):238-42.
16. Curtis KA, Tyner TM, Zachary L, Lentell G, Brink D, Didyk T, et al. Effect of a standard exercise protocol on shoulder pain in long-term wheelchair users. Spinal Cord. 1999 Jun;37(6):421-9.
17. Jiang SD, Jiang LS, Dai LY. Mechanisms of osteoporosis in spinal cord injury. Clin Endocrinol (Oxf). 2006 Nov;65(5):555-65.
18. Maïmoun L, Fattal C, Micallef JP, Peruchon E, Rabischong P. Bone loss in spinal cord-injured patients: from physiopathology to therapy. Spinal Cord. 2006 Apr;44(4):203-10.
19. Liang HW, Wang YH, Pan SL, Wang TG, Huang TS. Asymptomatic median mononeuropathy among men with chronic paraplegia. Arch Phys Med Rehabil. 2007 Sep;88(9):1193-7.
20. Boninger ML, Robertson RN, Wolff M, Cooper RA. Upper limb nerve entrapments in elite wheelchair racers. Am J Phys Med Rehabil. 1996 May-Jun;75(3):170-6
21. Burnham RS, Steadward RD. Upper extremity peripheral nerve entrapments among wheelchair athletes: prevalence, location, and risk factors. Arch Phys Med Rehabil. 1994 May;75(5):519-24.