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Autonomic response in subjects with spinal cord injury: brief comments

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Brief comments

A spinal cord injury (SCI) usually occurs with damage to any part of the spinal cord and/or nerves where displaced bone fragments, disc material, or ligaments bruise, which compromises spinal cord tissue.[1,2] SCI is a traumatic event that compromises physical, psychological and social well-being of patients, and shake substantial financial burden on health care systems.[2] Thus, this traumatic event can exacerbate the physical and physiologic debilities in the musculoskeletal, cardiovascular, gastrointestinal, pulmonary and integumentary systems leading to shake substantial financial burden on health care systems.[2] These complications are related to forces that are required to fracture the spine, consequently, suffer significant peripheral and neurological damages that can be or not fatal.

Two types of SCI could be described: complete, which contributes to loss of function below the level of the injury, and incomplete, that result in some feeling below the point of injury.[3] Data from 2010 showed that higher frequency of SCI are related to incomplete tetraplegia(45%), followed by incomplete paraplegia (21%), complete paraplegia (20%), and complete tetraplegia(14%).[4] The average age at the time of injury is comprehended between 20 to 40 years, and the male/female ratio is 4:1, respectively.[5,6] The major incidence of SCI are related to cervical trauma (55%), which shows higher prevalence from traffic accidents (40%–50%), assault (10%–25%), falls (20%), work-related injuries (10%–25%), and sports/recreation-related injuries (10%–25%).[5,7,8] A document published by the World Health Organization[5] shows that global SCI incidence is about 40-80 new cases per million, which corresponds to 250,000 to 500,000 new cases per year around the world.

Subjects with cervical SCI are a high-risk group, with the highest reported mortality rate in spinal trauma when compared to thoracic or lumbar spine injuries.[8] Cervical SCI promote a loss, either temporary or permanent, in the response sensory/motor, bladder/bowel function, and cardiac autonomic function.[9,10] Cardiac autonomic dysfunction is a frequent complication after a cervical SCI and result in increased morbidity and mortality from cardiovascular instability, such as heart rate and arterial blood pressure.[11,12] This type of traumatic lesion maintains vagal afferent and efferent pathways intact while the spinal sympathetic system loses supraspinal autonomic control, when injuries occurred above of the thoracic spinal cord segments (T1–T4).[12,13] The interruption of cardiac sympathetic innervation and parasympathetic control intact promotes bradycardia, reduces myocardial contractility and cardiac arrest occur due to a vago–vagal reflex, that contribute for autonomic dysfunction leading to ventricular arrhythmias and cardiac arrest.[14,15]

Impairment of the autonomic cardiac regulation has been associated to increased incidence of cardiac arrhythmias and the analysis of heart rate variability (HRV) has been used as a tool for noninvasive assessment of cardiac autonomic balance in physiological and pathological conditions.[16,17,18] HRV analysis may provide a noninvasive method for estimating the sympatho-vagal balance.[18,19] and independent prognostic information about ventricular arrhythmia.[16] In relation spinal cord injury, subjects with chronic complete cervical SCI showed significant decrease of SDNN when compared to incomplete cervical SCI.[20,21] However, during acute phase of the incomplete cervical SCI was observed rise of SDNN possibly to recovery of autonomic function and remodeling of damaged axons after trauma.[22,23] Possibly an autonomic adjustment occurs chronic phase of the injury with the practice of physical activity can a remodeling occur? West et al.[24] suggest that partial preservation of sympathetic autonomic control and response of the cardiovascular system to exercise may be a determinant for adjustment of the cardiac autonomic profile in practitioners of physical exercise with cervical SCI.

Electrocardiographic ventricular repolarization (QT interval) parameters have been used as predictors of increased risk of ventricular arrhythmias and sudden death in patients with SCI.[15,25,26] Acute phase of the cervical SCI and consequently increases in QT interval can be due to sympathetic nerves damage after separation from supraspinal control associated to parasympathetic nerves intact that negatively change cardiac autonomic control.[26] On the other hand, La Fountaine and colleagues[26] found longer QTc intervals in paraplegia when compared to tetraplegia and Chung et al.[14] observed significant decreases of QT interval after 12 months of the cervical SCI. These results could be related to injury in the sympathetic innervation of the heart more that the unopposed parasympathetic activity thus helping to increase risk of atrioventricular blocks, ventricular arrhythmias and cardiac sudden death.[27] However, most studies measured the QT interval mainly during in the acute phase of the SCI, mainly after first month.[14,26,27] On the other hand, subjects with cervical SCI and practitioners of physical exercise showed reduction of the myocardial atrophy due changes in the pressure and volume imposed to the heart exercise-induced.[28] However, the relationship between the cervical SCI, physical exercise, and cardiac repolarization changes were not investigated. Regarding to physical exercise, the sympathetic nerves decentralization on the exercise response is severe in tetraplegic subjects by impairs the HR increasing at the onset of exercise and the rapid deceleration after exercise.[29] However, further investigation could give information about how the heart adapts to physical exercises in a situation of damage to sympathetic innervation and which patients are especially vulnerable to the cardiac instability resulting of the cervical SCI.

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Conflict of interest

The author declares no conflict of interest.

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