

Opinion

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Spinal Cord Injury: An Under Recognized Cardiovascular Disease Risk Factor



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Opinion

Spinal cord injury (SCI) is a devastating, life-changing condition causing paralysis and sensory impairment as well as autonomic dysfunction. In addition, evidence documents a state of chronic inflammation in individuals with SCI [1-4]. Importantly, chronic inflammation is a significant cardiovascular disease risk factor. Furthermore, paralysis can lead to a relatively sedentary life style and a consequent reduction in physical work capacity [5-8]. Other consequences of inactivity are a higher body weight, a higher percentage of body fat [9,10], skeletal muscle dysfunction [11-14] and a lower forced vital capacity [15-17].

Autonomic dysfunction involves an abnormal and unstable regulation of the of the heart and vasculature [18]. Specifically, hypotension occurs immediately after the injury because of loss of tonic supra-spinal excitatory drive to spinal sympathetic neurons [19]. Subsequently, resting arterial pressure returns toward normal values; however, episodic bouts of hypertension often develop as part of the condition termed autonomic dysreflexia (AD) [20,21]. If not treated promptly, the hypertension may produce cerebral and subarachnoid hemorrhage, seizures, and renal failure and may lead to death [22]. Furthermore, autonomic dysregulation of the heart alters cardiac electrophysiology and increases the susceptibility to arrhythmias [23].

The overwhelming consequences of SCI-induced paralysis often overshadows the fact that inactivity, chronic inflammation and autonomic dysfunction increase the risk of stroke, coronary heart disease, diabetes and, possibly death [9,24-30]. Specifically, individuals living with SCI have an increased risk of heart disease and stroke [31]. Furthermore, individuals living with SCI have a three-fold greater risk of developing cardiovascular disease (CVD) than their able-bodied counterparts [31]. Importantly, the magnitude of CVD risk is heavily dependent on the level of SCI, whereby individuals with tetraplegia have a 16% greater risk of

all-cause CVD than individuals with paraplegia [32-35]. As noted, the risk for significant cardiovascular disease is mediated, in part, by reduced physical inactivity, dyslipidemia, blood pressure irregularities, chronic inflammation, and abnormal glycemic control [1-3,28,36-49].

Despite this increased risk of cardiovascular disease [31,50], many health care providers are unaware of the complications associated with SCI [51-56] as there is generally little undergraduate or postgraduate training on SCI [52,54,56,57]. Even knowledge of life threatening conditions, such as autonomic dysreflexia, are unknown among many physicians outside the rehabilitation or neurologic specialties [58]. Thus, additional information regarding the cardiovascular risks associated with SCI has the potential to improve the quality of life for individuals and families living with SCI. An understanding of the unique medical conditions related to SCI is an important first step because cardiovascular complications are important and potentially serious conditions.

In summary, individuals living with spinal cord injury have an increased risk for heart disease and stroke. Furthermore, cardiovascular disease is the leading cause of death and morbidity. The risk for cardiovascular disease is associated with an unstable autonomic control of the heart and vasculature, a relatively sedentary lifestyle, chronic inflammation and blood lipid profiles consisting of elevated total and low-density lipoprotein cholesterol and depressed high-density lipoprotein. Relative inactivity associated with SCI also results in a reduced muscle mass and increased adiposity. Accordingly, individuals living with SCI often experience insulin resistance, hyperinsulinemia and an atherogenic profile that contributes to early development of cardiovascular disease. Impairments in autonomic function markedly impacts blood pressure control [18] and promote

the development of cardiac arrhythmias [59-63]. Thus, autonomic dysfunction, relative inactivity and adverse changes in body composition lead to metabolic changes that promote

cardiovascular disease in individuals living with SCI. Increasing awareness of these facts has the potential to positively impact individuals and families living with SCI (Figure 1).

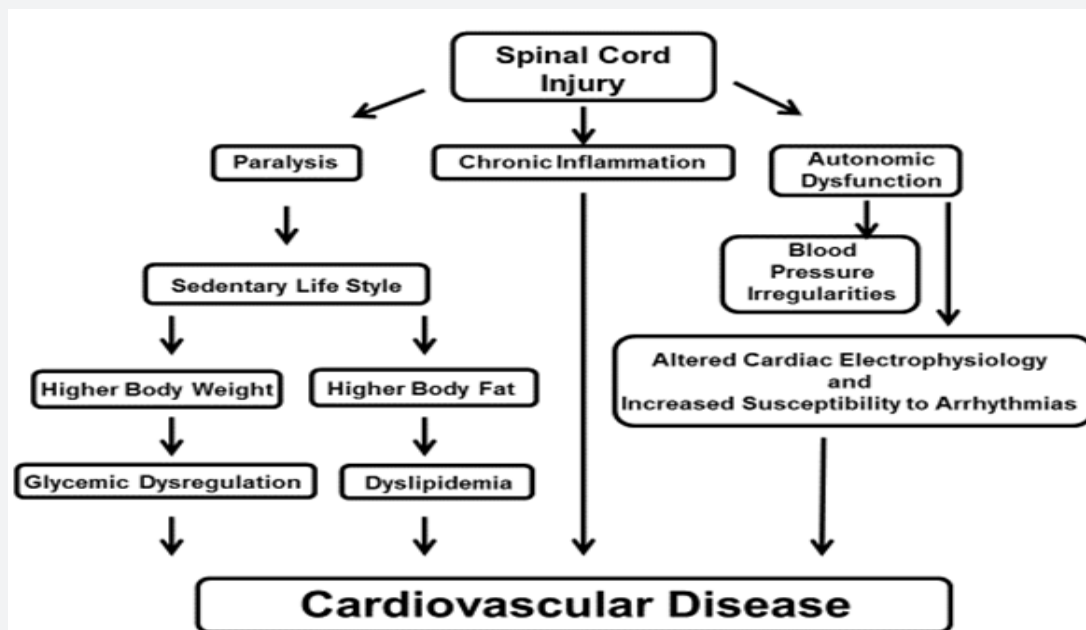


Figure 1: Spinal cord injury induced paralysis, chronic inflammation and autonomic dysfunction accelerate the development of cardiovascular disease in individuals living with spinal cord injury.

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