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Link between cardiovascular disease and spinal cord injury:

New evidence and update

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According to the most recent report by the National Spinal Cord Injury Statistical Center, hypertensive disorders and the resulting ischemic heart disease constitute the third leading cause of mortality in patients with spinal cord injuries (SCI).¹ Increased vascular and inflammatory markers are indicators of increased cardiovascular risk.² Abnormal cardiovascular control is related to the level and severity of injury to descending autonomic (sympathetic) pathways.³ The results of a systematic review covering studies published in English from 1990 to 2007 indicated that the quality of evidence regarding SCI status as an independent predictor of cardiovascular morbidity and mortality was suboptimal.⁴ The limited number of studies that investigated a link between CVD and SCI had small sample size, lacked appropriate control groups or adjustment for key confounders, and varied widely in reported outcomes.

In this issue of *Neurology*[®], Cragg et al.⁵ test the hypothesis that compared to able-bodied individuals, patients with SCI are more likely to develop CVD. More than 60,000 participants in this cross-sectional study were identified from the 2010 Cycle of the National Canadian Community Health Survey. The primary outcome measures in this analysis were self-reported heart disease and stroke. Participants with SCI were identified using the following question: “Do you have a neurological condition caused by a spinal cord injury?” All self-reported information was collected using the following statement: “Remember, we’re interested in conditions diagnosed by a health professional.” The authors carefully reviewed a list of possible confounding variables and factors for exclusion from the analysis: those that are associated only with CVD, but not SCI; or associated only with SCI, but not CVD; or factors that are the result of SCI that might lead to CVD. Although it is debatable whether smoking, obesity, hypertension, physical activity, fruit and vegetable intake, alcohol intake, and diabetes meet the definition of confounders, including them in the models did

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not change the magnitude or significance of the reported associations. After adjusting for age and sex in a logistic regression analysis, SCI was associated with increased odds of heart disease (adjusted odds ratio [OR] 2.72, 95% confidence interval [CI] 1.94, 3.82) and stroke (adjusted OR 3.72, 95% CI 2.22, 6.23).

This study had limitations that should be considered when interpreting the results. Causality cannot be established using cross-sectional study designs. Further, no information on neurologic level, completeness of injury, etiology of SCI, or heart disease and stroke were available. For instance, heart disease and stroke included both atherosclerotic and nonatherosclerotic heart disease (such as rheumatic or congenital heart disease). Finally, the heart disease and stroke as well as SCI were self-reported. However, as the authors noted, although low sensitivity may occur for self-reported data, the specificity of self-reports is usually high and the strength of the reported associations is most likely to be underreported in the analysis based on low specificity data. Compared to patients without SCI, traditional CVD risk factors including a lack of physical activity, overweight and obesity, dyslipidemia, abnormalities in glycemic control, and chronic inflammation likely play a similar or even a more pronounced role in patients with SCI.⁶ In addition to these traditional CVD risk factors, disturbances in the cardiovascular autonomic function after SCI play a distinctive role in the development of cardiovascular complications in individuals with SCI.⁷ Given that timely and careful evaluation of autonomic function in individuals with SCI is essential for successful clinical management of these patients, the American Spinal Injury Association (ASIA) and the International Spinal Cord Society (IS-CoS) developed the International Standards for the assessment of remaining autonomic functions following SCI.⁸ Specifically, documenting abnormalities of arterial blood pressure and cardiac rhythm (supine hypertension, supine hypotension, orthostatic hypertension, tachycardia, bradycardia, and autonomic dysreflexia) is recommended. Additional and more detailed information is available at the ASIA Learning Center (<http://lms3.learnshare.com/home.aspx>) and the eLearning project of ISCoS (<http://www.elearnsoci.org/>). The degree of these autonomic dysfunctions is determined by level of injury and severity of SCI, with the most severe cardiovascular consequences observed in complete cervical or high thoracic spinal cord injury.⁹ In most patients with SCI, there is concordance between the impairment of sympathetic function and somatic impairment.¹⁰

Despite the accumulating evidence on the associations between CVD and SCI, there is a lack of evidence-based research to guide clinicians in managing CVD risk factors in patients with SCI. Indeed, in the most recent and comprehensive review of evidence-based studies, only 2 small clinical trials investigating the effects of pharmacologic treatment of dyslipidemia and orthostatic hypertension (n = 52 and n = 4 participants, respectively) were identified.⁶ Moreover, the sample size in 20 other nonrandomized trials and observational studies ranged from 6 to 80 participants with the exception of one case-control study that was carried out in 1992 among 327 participants with SCI, matched with 327 healthy subjects. It is not surprising that few currently available guidelines address the management of CVD risk factors in patients with SCI and practically all of them are based on expert opinion or results from studies carried out in able-bodied individuals.⁶ Although the results of the study by Cragg et al. take us one step closer to understanding the unique profile of

CVD risk in patients with SCI, they are also a timely call for more research to address CVD in this population.

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