

# Cardiovascular Disease in Persons with Spinal Cord Dysfunction—An Update on Select Topics

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## KEYWORDS

- Spinal cord injuries • Cardiovascular diseases
- Dyslipidemias • Diabetes mellitus
- Peripheral vascular diseases • Amputation

As knowledge of spinal cord injury (SCI) and its consequences continue to increase, care delivered to individuals with SCI has improved significantly. This has translated to decreased mortality rates of persons with SCI over the preceding five decades.<sup>1–3</sup> However, the natural course of aging can bring an onset of new medical problems that differ from those that resulted at the time of immediate injury or illness. This includes the increased risk and complications resulting from cardiovascular disease (CVD), of which coronary heart disease (CHD) is a subset. The purposes of this article are to discuss the prevalence of CVD in persons with chronic SCI, to emphasize the scope of the problem, and to highlight particular areas of interest. A number of thorough reviews have been completed detailing each of the subject areas covered in this article. The reader is referred to these reviews to gain additional insight into the challenges of the issues discussed. The reader is further directed to a multitude of other sources addressing cardiovascular issues that predominantly occur in setting of acute and subacute SCI (eg, neurogenic shock, deep venous thrombosis).

## EPIDEMIOLOGY

Historically, dysfunction of the renal and urinary tract systems were the leading causes of mortality in persons with SCI.<sup>2,3</sup> Improvements in the management of neurogenic

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bladder had led to a decrease in mortality from renal and urinary tract complications.<sup>1-3</sup> Although the precise prevalence is not known, it is believed that CVD accounts for a significant proportion of morbidity and mortality in individuals with SCI. Ischemic and nonischemic heart disease is second only to pneumonia and respiratory system diseases as the underlying cause of mortality in individuals with SCI.<sup>1,3</sup> DeVivo and Stover<sup>1</sup> reported that ischemic and nonischemic heart disease accounts for 18.7% of all deaths of known cause in individuals with SCI. In fact, heart disease is the second most common underlying cause of death in persons with tetraplegia, and the leading underlying cause of death in persons with paraplegia or Frankel D level of injury.<sup>1</sup> Combined, ischemic and nonischemic heart disease are the leading underlying causes of death in persons more than 5 years post injury.<sup>1</sup> Whiteneck and colleagues<sup>2</sup> reported that cardiovascular diseases were the most frequent causes of death among persons with SCI more than 30 years of age (46%) and more than 60 years of age (35%). This data is supported by a recent prospective study which suggested that diseases of the circulatory system were the most common (40%) underlying and contributing cause of death in individuals at least 1 year post injury.<sup>4</sup>

Heart disease is the leading cause of death in the United States.<sup>5</sup> The standardized mortality ratio (SMR) can be used to compare mortality rates for persons with SCI to that of the general population. DeVivo and Stover<sup>1</sup> reported no increased risk of mortality due to ischemic heart disease in individuals with SCI (SMR = 1.2), but a significant increase in mortality due to nonischemic heart disease (SMR = 6.4). Garshick and colleagues<sup>4</sup> demonstrated nonsignificant increases in SMR in disease of the heart (SMR = 0.59) or other diseases of the circulatory system (SMR = 1.49). However, both studies may be limited by availability of follow-up data or small numbers of deaths. A recent review of existing literature determined that there is no indication that individuals with SCI are at markedly greater risk for cardiovascular morbidity and mortality than able-bodied adults.<sup>6</sup> Although the prevalence of CVD in individuals with SCI may not be increased, its place as the leading cause of death suggests that the prevention of CVD in persons with SCI is as critical to the maintenance of health as it is in the able-bodied population. However, diagnosis and treatment of CVD in individuals with SCI present challenges not encountered in the noninjured people.

These studies provide valuable insight into the causes of death in persons with SCI. Current focus lies on the identification and prevention of CHD. Unfortunately, both identification and prevention of CVD in individuals with SCI is challenging. The ability of a person with SCI, particularly a higher-level injury, to report an ischemic event may be limited because of interrupted sensory pathways. Noninvasive cardiac stress testing has revealed that 63% to 65% of subjects have evidence of silent myocardial ischemia after dipyridamole administration and thallium-201 myocardial perfusion single-photon emission computed tomography imaging.<sup>7-9</sup> A cardiac event can pass unnoticed in some individuals.

### **CARDIOVASCULAR RECOMMENDATIONS IN THE GENERAL POPULATION**

The Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (ATP III) summarizes the current recommendations for management of elevated serum cholesterol levels in the general population.<sup>10</sup> The recommendations are based on levels of serum low-density lipoprotein (LDL) cholesterol and are influenced by the coexistence of CHD and the number of cardiac risk factors. CHD risk factors include diabetes mellitus, symptomatic carotid artery disease, peripheral artery disease, abdominal aortic aneurysm, cigarette smoking,

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