Prevalence of Hypertension, Dyslipidemia, and Diabetes Mellitus After Spinal Cord Injury

Sandee Bristow, MD; Kevin Dalal, MD; Jose O. Santos, MD;
Alberto Martinez-Arizala, MD; and Kresimir Banovac, MD

To assess whether the prevalence of hypertension, dyslipidemia, and diabetes mellitus is higher in U.S. veterans with spinal cord injury than that in the general U.S. population, researchers conducted a retrospective analysis of the medical records at the Bruce W. Carter VAMC.

Spinal cord injury (SCI) leads to many metabolic and neurologic changes, including control of blood pressure and lipid and carbohydrate metabolisms. This study evaluated the prevalence of hypertension (HTN) and dyslipidemia (DL) in patients with SCI, the known risk factors of heart disease—the leading cause of death in the U.S. The study also evaluated the prevalence of diabetes mellitus (DM), another medical condition associated with severe complications such as kidney failure, amputations, and blindness. Several studies have addressed the issues of HTN, DL, and DM after SCI.[1-20] These studies have typically been conducted on a heterogenous patient population, and when compared with control groups, the researchers did not adjust for age or for the time interval since the injury.

Recent national surveys described the prevalence of HTN, DL, and DM in the general population. The objective of this study was to compare these survey results with the results obtained among the male SCI population, when adjusted for age, at a VAMC.

METHODS

Research was a retrospective analysis of medical records involving data of 96 male patients with SCI (64 tetraplegics and 32 paraplegics) from the computerized patient record system at the Bruce W. Carter VAMC in Miami, Florida. The protocol for the study was approved by a local Institutional Review Board. There were 68 patients with the American Spinal Injury Association (ASIA) scale A, 18 patients with ASIA B, and 10 patients with ASIA C. Mean age of the patients was 58.6 ± 15.1 (standard deviation [SD]) years; the length of the injury was 22.3 ± 14 (SD) years. The following diagnostic criteria were used to determine inclusion in the study: Patients with DL were identified as being on antihyperlipidemic agents; patients with DM had to be on oral diabetes medication, insulin, or both; finally, patients with HTN had to be on 1 or more antihypertensive medications. All patients who had an annual examination within the 2-year data collection window were used for the analysis. This group of patients represented about 80% of patients with SCI who were followed in the Bruce W. Carter VAMC geographic district.

The results for DL, DM, and HTN were adjusted for age of the patients to be similar with those reported by the national surveys. The statistical analysis of prevalence of disease occurrence was used for the comparison with prevalence data obtained in the different national surveys. The prevalence of

Dr. Bristow and **Dr. Santos** are physical medicine and rehabilitation residents, and **Dr. Martinez-Arizala** is chief of the Spinal Cord Service, all at the Bruce W. Carter VAMC in Miami, Florida. **Dr. Dalal** is an assistant professor, **Dr. Banovac** is a professor, and Dr. Martinez-Arizala is also an associate professor, all in the Department of Rehabilitation Medicine at the University of Miami School of Medicine in Florida.

DL in patients with SCI was compared with the results obtained from the National Health and Nutrition Examination Survey 2003-2004.[21] The prevalence of diabetes was compared with recent data obtained from National Estimates of DM reported for 2010 by the Centers for Disease Control and Prevention (CDC) after adjustment for age of the patients.[22] The prevalence of HTN in patients with SCI was compared with the results obtained from national estimates of HTN reported by the CDC in 2008.[23]

RESULTS

Hypertension

When adjusted for age, patients with SCI aged < 55 years had a lower prevalence of HTN than that of men in the general population. Patients with SCI in the group aged > 55 years with tetraplegia had 2 times lower prevalence of HTN, and the patients with paraplegia had a similar prevalence as did men in the general population (68% vs 60%) (Table 1).

Dyslipidemia

In both groups of patients with SCI, the prevalence of dyslipidemia was lower than that in the general male population (Table 2).

Diabetes Mellitus

Prevalence of DM in patients with SCI aged > 60 years was 28%, similar to 26.9% in the same age group of the general population. In the group of patients with SCI aged < 60 years, the prevalence of DM was 18% compared with 11.2% reported by the CDC for the general population of men in the U.S. (Table 3).

Table 1. Prevalence of hypertension (%)

Age (y)	< 55	> 55
Tetraplegia	7.0	24.0
Paraplegia	3.0	68.0
General population	22.0	60.0

Table 2. Prevalence of dyslipidemia (%)

Age (y)	< 50	> 50
SCI	13.0	43.0
General population	45.0	65.3

SCI = spinal cord injury.

Table 3. Prevalence of diabetes mellitus (%)

Age (y)	< 60	> 60
SCI	18.0	28.0
General population	11.2	26.9

SCI = spinal cord injury.

DISCUSSION

Several groups of investigators have evaluated HTN in patients with SCI.[1-4] Yekutiel and colleagues evaluated 77 patients with SCI aged 27 to 62 years and found a prevalence of HTN of 24.7%, which was significantly higher than that in the control group of healthy volunteers ($P < .05$).[1] This analysis included both paraplegic and tetraplegic patients of all ages as 1 group. In 2007, Bauman and colleagues and Weaver and colleagues reported prevalence of HTN in U.S. veterans.[2,3] Bauman and colleagues studied veterans with SCI; Weaver and colleagues also included patients with other spinal cord disorders, such as multiple sclerosis, tumors, and infections. Both groups of authors reported a higher prevalence of HTN in patients with paraplegia than that in patients with tetraplegia. The differences in the results were not known for certain, but they were most likely due to more pronounced orthostatic hypotension in the patients with tetraplegia than in the patients with paraplegia. In both studies, the prevalence of HTN was not analyzed after age adjustment. Age-adjusted relative risk (RR) of HTN in patients with SCI was evaluated in a collaborative study among 3 spinal cord centers.[4] In 545 patients, researchers found that the RR of HTN increased with age for patients with paraplegia but not for patients with tetraplegia.

When the data were analyzed by age groups as performed by the CDC for the U.S. population, there were differences from previously reported results in the literature. It was found that younger patients with SCI (aged < 55 years) had a lower prevalence than did men in the general U.S. population regardless of level of paralysis; whereas in the older group of patients with

paraplegia (aged > 55 years), prevalence of HTN was similar to that of men in the general population.

Serum lipids and their fractions have been studied in patients with SCI by several investigators.[5-15] The most frequent finding was a decreased level of high-density lipoprotein cholesterol (HDL-C).[10,12,14,15] Total serum cholesterol concentration and low-density lipoprotein choloesterol (LDL-C), including triglycerides (TGs), were less affected.[10,12] This study focused on the general abnormalities of lipids, namely, serum cholesterol and TGs. The study observation supported previous findings by others and indicated that in patients with SCI, regardless of patient's age for more accurate determination of lipid abnormalities and associated risk factors, the diagnosis of DL should include determination of cholesterol fractions HDL-C and LDL-C.[10,12]

In 1980, when insulin measurements in serum became available, Duckworth and co-investigators used the oral glucose tolerance test in patients with SCI to study carbohydrate metabolism after SCI.[16] These authors found an insulin resistance in patients with SCI that correlated with the duration of SCI. These findings were later confirmed by Bauman and colleagues in 1994 and 1999.[17,18] In addition to insulin resistance, Bauman and colleagues documented a higher prevalence of DM after SCI.[19] In the first study, they found prevalence of DM of 22%; in the second study, a prevalence of 13%.[17,18] In addition, 29% of veterans were found to have impaired glucose tolerance by World Health Organization criteria.[18] The authors compared their results with the results of prevalence of DM in the general population (aged 20 to 70 years, reported by Harris and colleagues) and found a marked difference of 2- to 3-fold higher prevalence of DM in patients with SCI than that in the general population with the prevalence of 6.6%.[19] The age stratification was not addressed in these studies, and an older SCI population was evaluated with a younger general population. Prevalence of DM in patients with SCI was also studied by a group of investigators from different SCI centers in the U.S., using data obtained in a cross-sectional survey in 2003 of 18,372 individuals.[20] These results were compared with data published by the CDC in 2003 for the general population in the U.S. An overall prevalence of DM in patients not stratified by age was 20%, 3 times higher than that in the general population.

In the present study, no significant differences were found when comparing the prevalence of DM in the Bruce W. Carter VAMC population with surveyed results of the general population aged > 60 years. When age-adjusted, as done by the CDC, the prevalence of DM after SCI was similar to that in the U.S. general male population and not higher as previously reported. In a younger cohort of patients (aged < 60 years), there was a somewhat higher prevalence of DM in patients with SCI (18% vs 11.2%). This finding may be attributable to increased insulin resistance after SCI.[16,17]

If these results can be confirmed over a larger SCI patient population, ideally involving multiple SCI centers, they might have important clinical implications in determining the frequency of monitoring the occurrence of HTN, DL, and DM after SCI. It seems, at least on the basis of this study's limited evaluation of a relatively small patient population, these chronic medical conditions are as prevalent after SCI as they are in the general population, and similar recommendations for their monitoring could be generally applied. ●

Author disclosures

The authors report no actual or potential conflicts of interest with regard to this article.

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