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Review Article

Cardiovascular Risk in a Patient with Spinal Cord Injury

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Abstract

Spinal cord injury is a complex pathology that involves altering the mobility of patients leading to overweight and/or obesity, increased insulin resistance, proinflammatory cytokines, serious high levels of lipids and blood pressure, all these classic factors of risk for cardiovascular disease, being today the main cause of morbidity and mortality of patients with spinal cord injury. In the daily consultation we focus on seeing the needs of the spinal cord injury such as spasticity, bladder or bowel neurogenic, a mobility device among others, but we must encourage a systemic approach to prevent cardiovascular pathology. The purpose of this was derived from the needs in the area of spinal trauma of Physical Medicine and Rehabilitation of the Hospital Universitario del Valle, Cali-Colombia during the fellowship, for which a review of the literature was made presenting it as an academic topic at the convention Annual of Physical Medicine and Rehabilitation residents 2019 in Colombia, to promote comprehensive and preventive care in order to improve cardiovascular risk and reduce morbidity and mortality. It is expected in addition to encouraging long-term studies

Keywords: Cardiovascular Risk; Spinal Cord Injury; Physical Activity

Abbreviations

SCI: Spinal Cord Injury; CVD: Cardiovascular Disease

Introduction

The world health organization defines spinal cord injury [1] as damage to the spinal cord as a result of trauma (for example, a car accident), disease or degeneration (for example, cancer). On the other hand, it defines cardiovascular disease as a set of disorders of the heart and blood vessels.

Historically it is known that spinal cord injury has been described since the years 3000-2500 BC evidenced in the papyrus discovered by the Egyptologist Edwin Smith in the 80s; where several cases of involvement of the nervous system are mentioned, of which 6 of them referred to trauma to the spine.

War conflicts have been of great importance for the progress of medicine since they pose a great challenge to doctors to manage the multiple traumas in the body and to experiment initially in search of a timely and adequate treatment according to the knowledge and technologies according to the time, it is thus that one of the first to make a milestone for spinal cord injury was the English Admiral Sir Horatio Nelson in 1805 at the Battle of Trafalgar he suffered a wound from a bullet that pierced his chest and spinal cord where Doctor Beatty told him. "My Lord, unfortunately for our country, nothing can be done for you".

The Museum of the Institute of Pathology of the Armed Forces shows a broken vertebra with the title "an ailment that should not be treated", of the twentieth president of the United States of America James A. Garfield who in 1881 with a was wounded by firearm with spinal cord injury, 80 days after that he died.

In the First World War the neurosurgeon Harvey Cushing (1869- of American origin reported: "the conditions were such [that] 80% died in the first weeks... Only those cases in which the spinal injury

was partial survived. The rest had ailments that should not (could not) be treated".

A death due to a cardiovascular complication is narrated during hospitalization after a spinal cord injury due to a traffic accident. 1945 General George Patton (a reference to the Second World War), rejected all treatment since he knew that it was "a disease that was not due to treat, for not having a cure".

Thus, at the beginning of the 19th century, surgical management of the spinal cord and spinal column began to be performed as a desperate maneuver of those who deceived themselves into thinking that it was a disease to which "nothing should be done" like the surgeon Sir Astley Cooper. Many patients died from infections, kidney failure, lack of surgical planning.

Being of vital importance the discoveries in fields of infectology such as Luois Pasteur in the field of sterilization; Ignaz Semmelweis stating that hand washing and cleaning technique could dramatically reduce disease transmission; Joseph Lister applied the concept of antisepsis to surgery; Robert Koch demonstrated the causal relationship of microbes in infections and Alexander Fleming with the discovery of penicillin improving the survival of infections in these patients. Important advances in the field of diagnostic imaging such as William Conrad Roentgen discovered X-rays, Ja Sicard with X-ray myelography, with modernity the development of computed tomography and magnetic resonance imaging made diagnosis and planning of surgical management easier.

The morbidity and mortality of patients with spinal cord injury has been changing, prior to the year 2000 the first causes were kidney failure and septicemia in the acute phase of the disease [2,3], but with advances in care, the discoveries to prevent and manage infections, the management of kidney failure and a better comprehensive clinical approach to these complications, the survival of the patient with spinal cord injury is more durable.

Currently, people with spinal cord injury are older, morbidity and mortality change, adding several risk factors such as sedentary lifestyle due to lack of mobility makes cardiovascular disease the leading cause of mortality in these patients today. Rates of cardiovascular disease in patients with spinal cord injury are increasing. Therefore, the prevention of CVD through the identification, management and improvement of risk factors is a priority concern for the health of patients with SCI [4-9].

Materials and Methods

A summary of a review of the literature with keywords of spinal cord injury and cardiovascular risk in the virtual library server of the Universidad del Valle (Discovery Service), which includes databases of books, journals, magazines in electronic format, subscribed (PubMed, ScienceDirect, Ebooks, Ovid, among others).

Results and Discussion

Epidemiology

Until now there are no exact data on the estimation of the prevalence of CVD in patients with SCI due to the fact that there is not an adequate systematization of the results where pathologies with mixed origins are wrongly classified, data are overestimated or without an adequate database for the subject, however compared to people who do not have impaired mobility, a person with limited mobility with spinal cord injury and depending on the level will have a higher risk of suffering a CVD [2,5,10]. Given that today the person with SCI has an expectation greater than life, being more long - lived than in the past century and carries with it the implications of aging, longer sedentary lifestyle and therefore the greater exposure time to others risk factors, which will be addressed later, consequently the risk of presenting a CVD increased in these people.

The prevalence rate of symptomatic CVD in SCI is 30% to 50% compared to 5% to 10% in the general population of able-bodied individuals. The prevalence of asymptomatic CVD has been estimated to be between 60% and 70% in people with SCI [4]. Finding a broad correlation between CVD and SCI, the greater the complexity of the spinal cord injury, the greater the cardiovascular risk [11-13].

Pathophysiology

Sympathetic preganglionic neurons are located in the column of lateral intermediate cells in the gray matter of the spinal cord at the T1-L2 level [9,14]. Neurons of the parasympathetic system are at the level of the nuclei of the cranial nerves and spinal cord in S1 and S2. The parasympathetic control of the heart is given by the X pair, so depending on the level of the spinal cord injury, there may or may not be sympathetic control of the heart and the parasympathetic innervation of the heart will always be intact in a spinal cord injury [14].

The sympathetic control of the cardiovascular system originates mainly in the spinal segments T1 to T4, therefore, a lesion at the T1 level will not have any supraspinal sympathetic control, a T1-T5 lesion will present partial preservation and a lesion below T5 will have total supraspinal sympathetic control of the heart and blood vessels [14,15].

Adrenergic dysfunction (autonomic dysreflexia), poor diet, and physical inactivity play a key role in the elevated risk of CVD in SCI [10,16].

In the acute phase of spinal cord injury there is an acute loss of sympathetic stimulation which causes vasodilation, bradycardia and arterial hypotension which leads to a high risk of cardiovascular disease if it is not treated adequately [14,16].

Spinal cord injury

Spinal cord injury is a serious medical condition with considerable functional (sedentary), psychological and socioeconomic sequelae; it is also a chronic inflammatory state where an elevation of inflammatory markers at a systemic level has been evidenced in both acute and chronic patients [17,18].

Spinal cord injury patients have a predisposition to cardiovascular disorders due to poor sympathetic and sympathetic control of the heart with a tendency to alter heart rhythm and blood pressure [8,10,19].

Risk factors

The classic risk factors for CVD are obesity, lipid disorders, impaired glucose metabolism, and high blood pressure [20-22].

On the other hand, the alteration of the functionality (movement) leads to a sedentary lifestyle and a high-calorie and unhealthy diet, generating an imbalance between calorie intake and calorie expenditure [23], ending in overweight and obesity, which per se insulin resistance increases, with elevated serum glucose levels, in addition to increased lipid levels, and inflammatory cytokines [18]. In the same way, if we add to this the genetic predisposition to this type of pathology, it will enhance the metabolic and therefore cardiovascular injury [24].

Key points for prevention of cardiovascular disease

All associated cardiovascular risks can be prevented and managed in patients with spinal cord injury [24,25].

In February 2019, the American College of Cardiology and the American Heart Association [26] released a guide on the primary prevention of cardiovascular disease, of which the following should be highlighted for patients with SCI with grade IA classification:

- A team care approach is recommended to control risk factors associated with CVD
- For adults 40 to 75 years of age, physicians should routinely assess traditional cardiovascular risk factors and calculate the 10-year risk of CVD using pooled cohort equations (In Colombia use the Framinghan scale multiplied by 0,75 already previously validated [27].
- A diet that emphasizes the intake of vegetables, fruits, legumes, nuts, whole grains, and fish is recommended to decrease CVD risk factors.
- Adults should be routinely counseled at health care visits to optimize a physically active lifestyle
- Adults should get at least 150 minutes per week of cumulative moderate intensity aerobic physical activity or 75 minutes per week (or an equivalent combination of moderate and vigorous activity) to reduce the risk of CVD
- Stop using tobacco.

The patient with spinal cord injury and cardiovascular risk can perform physical activity, but as it is known, a patient who is ambulatory and will enter a cardiac rehabilitation program, the 6-minute walk test is performed. For patients with spinal cord injury, the 6-minute cycle ergometer test is supported, finding similarities between oxygen consumption, heart rate, and other measures evaluated in a patient without spinal cord injury in terms of the walk test [28].

Scientific Evidence-Based Exercise Guidelines for Adults with Spinal Cord Injury: An Update and New Guide [29]

- Physical exercise is the best measure to prevent and control modifiable risk factors for cardiovascular disease in any type of patient [30,31], and patients with spinal cord injury are not exempt from this measure.
- These guidelines are appropriate for adults (aged 18-64 years) with chronic spinal cord injury (at least one year after it, neurological level of injury C3 or below), caused by traumatic or non-traumatic causes, including tetraplegia and paraplegia, and regardless of sex, race, ethnicity, or socioeconomic status.

- To obtain benefit in cardiorespiratory and muscular capacity, adults with SCI should perform at least 20 minutes of moderate-vigorous intensity aerobic exercise twice a week plus three series of strength exercises for each muscle group with moderate intensity functionality -vigorous twice a week
- For cardiometabolic health benefits, it is suggested that adults with SCI get at least 30 minutes of moderate-vigorous intensity aerobic exercise three times per week.

Conclusion

Cardiovascular complications are common after spinal cord injury and result in increased morbidity and mortality, so it is important to: assess CVD in patients aged 40-75 years, the individual and social determinants of the patient, to promote healthy lifestyles, it is not contraindicated to carry out physical activity, to achieve a reduction of morbidity and mortality due to CVD in patients with SCI.

Conflict of Interest

I declare no conflict of interest.

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