Prevalence of Carpal Tunnel syndrome in wheelchair users due to medullary lesion

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ORIGINAL ARTICLE

ABSTRACT

Medullary lesions create numerous functional limitations directly related to the loss of nervous functions. However, the mechanics associated with the use of a wheelchair impose a load on the upper limbs that seems to be linked to secondary lesions in the tendinous and nervous structures. **Objective:** This study seeks to evaluate the appearance of signs of electromyographic impairments of the median nerve around the carpal tunnel in individuals who use wheelchairs due to medullary lesion. **Method:** Following a transversal design, all the individuals with medullary lesion in the rehabilitation program at the HC-FMUSP Institute of Physical Medicine and Rehabilitation in the year 2010 were submitted to a study of nervous conduction and electromyography. Those findings were correlated with biodemographic and clinical variables, as well as to characteristics of the use of wheelchairs. **Results:** Twenty-eight (28) individuals were evaluated, with an average age of 41.4 years (60.7% males). Most patients moved the wheelchair for less than four hours and would move it less than 500 meters a day. An absence of painful symptoms was found in 67.9%, while only 7.1% presenting positive Phalen and/or Tinel test. Half of the sample presented the neurophysiological diagnostic of carpal tunnel syndrome (CTS), which had a statistically significant association with age ($p = 0.024$), but not with the time and distance moving the wheelchair daily, the use of protection or adaptation of the wheelchair, of pain in upper limbs, or the presence of positive signs of CTS in the physical exam. **Conclusion:** We concluded that the electromyographic signs of CTS are very prevalent in these individuals, which suggests more situations of risk for the integrity of their upper limbs and demands the development of a more efficient biomechanical strategy for prevention.

Keywords: carpal tunnel syndrome, neurophysiology, spinal cord injuries, wheelchairs

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Received on December 27, 2011.
Accepted on February 7, 2012.

DOI: 10.5935/0104-7795.20110005

INTRODUCTION

Approximately 40 people/million per year become paraplegic or quadriplegic due to spinal cord injuries.[1] Considering these statistics in relation to the Brazilian population, column trauma corresponds to 12,962 cases admitted by the Unified Health System in 2000, with progressive values of up to 21,684 cases in 2005, spinal cord injuries correspond to 16.1%, that is, 3,492 cases in that year.[2]

Spinal cord injuries are an expensive infirmity for the health system. Many resources need to be mobilized from initial hospitalization and rehabilitation in the acute phase until the chronic phase, involving a late rehabilitation process, necessary adaptations, medications, and frequent complications stemming from the state of disability.[3]

Notwithstanding the complications and cost derived from disability, spinal cord injury mostly afflicts young and economically active individuals.[1,2,4] The removal of these individuals from the labor market adds to the total cost that surrounds this infirmity. The re-inclusion of these individuals into the labor market, also affording them quality of life, must be the focus of the rehabilitation centers that deal with these citizens.[3] Thus, the importance and the need for public health policies is evident, as are medical studies that address this population.

The individual with a spinal cord injury deals with many new situations in his/her daily life and needs to modify habits and routines to adapt to this new reality. Besides, these individuals acquire secondary handicaps, due to this new condition. Among those afflictions that interfere with the quality of life of this demographic, we can mention peripheral neurological lesions in individuals in wheelchairs.

The Carpal Tunnel Syndrome (CTS) is a peripheral nerve lesion more commonly diagnosed in the general population,[5] and it is caused by compression on the median nerve in the carpal channel.[6] Its incidence and prevalence varies from 1% to 16% depending on the method and diagnosis criteria used.[6] The etiology of this affliction seems to involve occupational factors such as repetitive movements, continuous extension position, and wrist ulnar deviation, vibrations and mechanical compressions on the base of the palm.[6,7] Individuals in wheelchairs are dependent on their hands to move around and in this way they are exposed to all the factors that lead to CTS, making them a population at risk for this infirmity.[5] Clinically, CTS is manifested by pain, paresthesia, and in more severe cases by muscular atrophy.[6] Electroneuromyographically, CTS can be studied by the study of motor and sensory latencies of the median nerve.[8,9]

The prevalence of CTS in individuals in wheelchairs has been defined as between 10 and 67%.[8] As this population has great need of their hands to move around, and consequently for daily life activities, any disability that affects the hand of these individuals leads to an increase in disability and compromises their quality of life.

OBJECTIVE

In view of the reality presented, the present study seeks to investigate the prevalence of CTS in a sample of individuals with spinal cord injury and its relationship to the use of wheelchairs.

METHOD

For this study individuals were selected with spinal cord injuries receiving rehabilitation with multiprofessional intervention at the *Instituto de Medicina de Reabilitação do Hospital das Clínicas da Universidade de São Paulo* (Physical Medicine and Rehabilitation Institute HC-FMUSP), provided they were using wheelchairs, with no restriction of age, gender, or other clinical characteristics. All the patients being treated at the institution with spinal cord injury diagnoses were invited by telephone to an examination. The patients who signed the Free and Informed Consent form accepting to participate in the study, after the objectives and procedures of the research were explained, were examined in the neurophysiology laboratory, answering a questionnaire on factors related to their pathology and were submitted to a specific physical exam with tests to evaluate for CTS. Afterwards, they were submitted to electroneuromyography by two physicians experienced in neurophysiology from the same team. The same routine was used to perform the exam and the temperature conditions of the limb were controlled at 32°C.

RESULTS

The sample consisted of 28 patients. Their ages varied from 16 to 73 years, with an average of 41.4 years of age. The sample had more presence of males with 17 (60.7%). Most patients moved the wheelchair for a period of less than four hours per day and covered a distance of less than 500 meters (Table 1). When questioned about the presence of painful symptoms in the upper limbs, most of them (67.9%) denied having any symptoms like that. Few patients reported using some protection for their hands during the use of the wheelchair (25%), and only two patients (7.1%) had any adaptation to the chair. At the physical exam, two patients (7,1%) registered positive Phalen and/or Tinel tests. From the total sample, 14 patients (50%) presented a CTS neurophysiological diagnosis. From those patients, two presented isolated ulnar neuropathy, and two others presented ulnar affliction associated with median neuropathy.

There was a statistically significant association between the increase in age and the CTS neurophysiological diagnosis ($p = 0.024$). However, no other significant relationship was observed in the association of the group with the CTS diagnosis and the distribution of genders, time, distance covered moving the wheelchair, the use of hand protection or adaptation to the wheelchair, painful symptomatology in the upper limbs, or the presence of positive CTS signs in the physical exam.

DISCUSSION

The results show the percentage of CTS in individuals in wheelchairs similar to what is described in the literature,[8,10] however much higher than the population in general (50% of the wheelchair users versus 5 to 16% of the general population).[11] Despite having a difference of diagnostic criteria between our study and this population evaluation, we believe this difference alone cannot explain so great a disparity of occurrence in such findings.

In the group with neurophysiological CTS diagnosis, there was an increased association of age with the existence of neuropathy, as demonstrated previously by other authors.[10,12,13] However, the physiopathological relationship between aging and CTS is still uncertain. Among the hypotheses explaining such a relationship are the degenerative phenomena typical of nerves, which worsen with age, but there are also connective tissue alterations that modify the structure of the carpal tunnel. Progressive age represents an accumulation of clinically undetectable or unnoticed lesions that can result in disarray of the local morphology.

Table 1. Comparison between the groups of individuals with spinal cord injuries according to the presence of CTS

		CTS		*p*
		Present	Absent	
Gender	Male	11	6	0.120
	Female	3	8	
Daily use of wheelchair	< 4h	7	6	1.000
	4-8h WC	4	5	
	> 8h	3	3	
Distance covered per day	< 500 m	10	6	0.3723
	500-1000 m	1	3	
	> 1000m	3	5	
Protection for hands	Uses it	3	4	1.000
Wheelchair adaptations	present	1	1	1.000
CTS symptoms	present	4	5	1.000
CTS tests	present	2	0	0.481

Other demographic characteristics analyzed such as gender, time of spinal cord injury, and the length of time using the wheelchair did not show any statistical relationship. These variables were investigated due to our suspicion that CTS was more common among females, which is usually observed in the general population, especially after 50 years of age.[13]

Protection measures and adaptations of the wheelchairs, despite being commonly preconized as preventive factors of neuropathies in upper limbs, did not show any statistically significant beneficial association. The repetitive effort of hands in the general population is considered a CTS risk factor.[11] Modifications in the furniture and work instruments did not show themselves to be definitely associated with any change of symptoms in individuals with CTS in the work environment after 12 weeks, despite having some short term effect.[14] However, the use of cobbled-together orthoses associated with stretching exercises for lumbrical muscles was associated with the improvement of symptoms and hand disability.[15] In the sample studied, 78.6% of the individuals, regardless of having CTS, reported remaining in the wheelchair for up to 8 hours a day, however, 71.4% would move up to 1,000 meters, which indicates that, despite remaining in this type of vehicle for long periods, the distances covered were still small, therefore, this could not have been a precise measurement of effort on the upper limbs. Also necessary would be the distances travelled, the degree of effort, and the joint positioning in each one of them. Another factor that may be associated with the appearance of lesions and which was not validated was the way the individuals performed the propulsion. The positioning of the wrists and the effort made was associated with the onset of CTS in a working context.[16] This association was not verified for users of wheelchairs, for there was a kinematic and biomechanical study that related the neurophysiological health of the ulnar and median nerves with broader movements of the wrist, however, still associated with less speed and force.[17]

Among wheelchair users, the use of the upper limbs for propulsion has been demonstrated by various authors as a risk factor for lesions and pain.[9,17,18] In addition, these patients seem less responsive to conventional treatments for pain relief.[19] Among the wheelchair users group of the present study, the repetitive effort to move the wheelchair did not show a statistically significant relationship with the CTS diagnosis. The reduced size of the sample may be considered as a limiting factor for statistical analysis. Despite the limitations of the study, this work may be the first Brazilian study evaluating the incidence of peripheral nerve lesion, especially CTS, among wheelchair users.

CONCLUSION

This study identified 50% of the sample of individuals with spinal cord injury in rehabilitation with electroneuromyographic signs of CTS. No relationship was shown between age, gender, time of injury, distance covered during the day, or time spent in the wheelchair. In comparison with general population studies, these results show high incidence of CTS among wheelchair users, raising the question about the need for other studies in the same direction to confirm the findings and clarify the physiopathology of this process, which may promote the creation of preventive measures of functionality.

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