Traumatic and Non-Traumatic Spinal Cord-Injured Patients in Quebec, Canada: 1. Epidemiological, Clinical and Functional Characteristics

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Abstract: ***Objective*:** Differences between traumatic (TSCI) and non-traumatic (NTSCI) spinal cord-injured patients with comparable geographical and socio-economical background have rarely been studied. The objective was to examine and compare a set of epidemiological, clinical, and functional characteristics in TSCI and NTSCI patients.

***Methods*:** This is a community-based, cross-sectional study of medical records from a cohort of one hundred and seventy-five (175) chronic spinal cord-injured patients (94 TSCI and 81 NTSCI individuals) who were treated at the *Interval* Rehabilitation Center located in Trois-Rivieres, Province of Quebec, Canada.

***Results*:** Clear differences in age, gender, extent and level of injury or associated conditions (also called secondary complications) were found between TSCI and NTSCI patients. Only one (1/81) completely injured patients was identified among the NTSCI group whereas completely injured patients constituted 37.8% of all TSCI patients. The percentage of patients with associated conditions including neurogenic bladder, neurogenic bowel, urinary tract infection, and pressure ulcer problems was significantly greater in TSCI than NTSCI patients. In contrast, a comparable proportion of TSCI and NTSCI patients was experiencing neuropathic pain.

***Conclusions*:** Given these differences between groups as well as regional-specific differences reported in studies from some other countries, it may be suggested that therapeutic approaches developed to treat these health problems and so-called associated conditions could be targeted for specific groups and subgroups of spinal cord-injured patients.

Keywords: Spinal cord injury, spinal disease, incidence, prevalence, functional, clinical.

INTRODUCTION

Spinal cord injury (SCI) typically induces devastating damages leading to a permanent loss of sensory and voluntary motor functions. In recent years, associated conditions or so-called secondary complications have received increasing attention from clinicians and scientists. It is now generally recognized that many SCI patients will develop important and often life-threatening complications several months to several years post-trauma. For instance, muscle wasting, osteoporosis, cardiovascular problems, immune deficiencies, hormonal imbalance, skin ulcers, anemia and urinary tract infections are among the problems typically encountered by chronic TSCI individuals (see also related papers)[1-4]. However, the extent to which these complications and related characteristics are similarly found in TSCI and NTSCI patients remains incompletely understood. This said, some studies have reported evidence suggesting that clinical, functional and epidemiological differences may exist between TSCI and NTSCI patients. For instance, higher risks of TSCI were found during adolescence and early adulthood males and females with a male to female ratio of 4:1. In contrast, higher risks of NTSCI were reported in older adults with a more or less even male to female ratio [5, 6]. Given that several SCI-related characteristics are increasingly believed to depend upon social-related factors [7-9], it may be critical for proper comparisons between TSCI and NTSCI people to study these characteristics in a rather homogenous and thus comparable (e.g., geographically, socio-politically, and culturally) cohort of patients. Consequently, the main aim of this study was to assess and compare in the relatively homogenous community of Trois-Rivieres City, clinical, functional, and epidemiological characteristics of TSCI and NTSCI patients. This article is the first of a series of three papers aimed to describe also biochemical and pharmacological characteristics associated with TSCI and NTSCI patients [10, 11].

METHODS

Study Population

An access to all medical records of SCI patients was provided by the *Interval* Rehabilitation Center (n=185). However, this investigation excluded the medical records that did not contain basic information on the patient such as the cause of injury, the time since injury or the extent and

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level of injury (n=10). Consequently, data from 175 medical records of male and female patients that have been SCI traumatically (94 patients) or non-traumatically (81 patients) for at least 1 year and typically less than 10 years were used in this study. Most TSCI patients but only 1 NTSCI patient were functionally classified using the standard *American Spinal Cord Association* (ASIA) classification (http://www.asia-spinalinjury.org/publications/2006_Classif_worksheet.pdf). Trois-Rivieres is a community constituted of 129,000 people (2010 statistics – *www.stat.gouv.qc.ca*) that is generally considered as having a relatively old population composed of a large proportion of welfare blue-collar workers (i.e., in 1998, it was identified as one of the poorest cities in the Province of Quebec). The education level is also among the lowest of the Province with less than 13% of the population with a university diploma. The city is known for its lack of socio-cultural diversity and immigration (it is composed essentially of white people - less than 4% of the city's population belongs to visible minorities)(*www.theglobeand mail.com*). This protocol was approved by the institution (*Interval Rehabilitation Center,* Trois-Rivieres, Quebec, Canada) as well as by an independent ethics committee (*International Review Board Services*, Aurora, ON, Canada).

Study Outcomes and Data Extraction Form

The medical records were thoroughly examined in order to find data corresponding with the following categories which composed our Data Extraction Form. The outcome measures of the Data Extraction Form included the type of injury (traumatic or non-traumatic), cause, gender, level of injury, extent of injury (either complete or incomplete), time since injury, age at injury, and all reported 'associated conditions' that were found in the medical records.

Statistical Analysis

Clinical, functional and epidemiological data presented in this study were expressed as arithmetic sums (incidences), percentages, medians or means ± standard deviations. Statistical analysis consisted in comparing means by Student's *T* tests and percentages by Pearson's chi-square tests (Prism V5, Graph Pad Software, LaJolla, CA, USA). The threshold of probability was p=0.05.

Results

The results showed that the most frequent type of trauma was induced by motor vehicle accidents (52.5%). Specifically, 36.7%, 8.4%, and 7.4% of all TSCI accidents were attributed to cars, motorcycles or recreational vehicles (e.g., ATVs, snowmobiles), respectively Fig. (**1**). The other main types of trauma included falls (15.8%) and injuries at work (11.6% professional- or industrial-related). Among other causes, it is worth noticing that accidents associated with fire arms constituted only 3.1% of all TSCI patients . It goes without saying that the etiology of NTSCI vs. TSCI is profoundly different. In this study, the results showed that the main cause of NTSCI was myelopathy associated with stenosis (34.5%) or with viral infection/inflammation whereas syringomelia (9.9%), myeloma (9.9%) and hernia (9.9%) constituted the other main cases of NTSCI found in Trois-Rivieres Fig. (**2**).

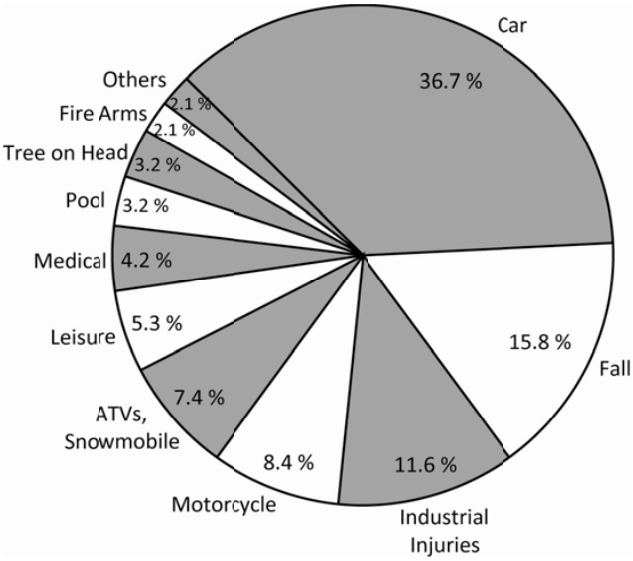

Fig. (1). Causes of traumatic spinal cord injury.

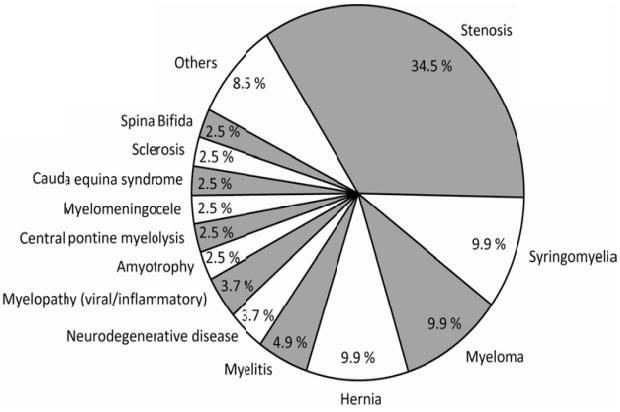

Fig. (2). Causes of non-traumatic spinal cord injury.

As reported also elsewhere [5,6], clear differences in age and sex between TSCI and NTSCI patients was also found in this study. For instance, on average, TSCI patients (males and females) were 36.8 ± 17.8 year-old (the median was 40.5 year-old) at the time of injury (Table **1**). Significantly (P = 0.001) older people at the time of injury (i.e., when diagnosed clinically) constituted the NTSCI group (48.8 ± 22.2 year-old) (the median was 41.5 year-old). A clearly greater proportion of males versus females were TSCI (74.5% vs. 25.5%) which, again, is in clear contrast with the results from NTSCI patients (53.1% were men and 46.9% were women, Table **1**). However, within each group, the age at injury was comparable (P > 0.05) between men and women (Table **2**, TSCI men 38.6 ± 17.3 vs. TSCI women 31.7 ± 18.6 and NTSCI men 49.6 ± 22.1 vs. NTSCI women 49.3 ± 23.3). In the group of TSCI patients, most males were young adults between 10 and 29 years of age which constituted 47.9% of all cases (Table **3**). In turn, the age at injury of NTSCI patients was more evenly distributed (from birth to 89 year-old) with a small peak (21.0% of all cases) between 50-59 year-old (Table **3**).

Table 1. Age, Gender, Type and Completeness of Spinal Cord Injury

	TSCI (n=94)	NTSCI (n=81)	X^2 and significance
Age at injury	36.8 ± 17.8	48.8 ± 22.2	P = 0.001
Age at injury excluding diseases at birth	---	50.8 ± 20.2	P < 0.001
Age at 31 dec. 2008	45.0 ± 16.9	59.4 ± 17.9	P < 0.001
Time since injury	8.2 ± 8.3	9.7 ± 11.3	P >0.05
Sex	% (n=94)	% (n=81)	
Male	74.5 (70)	53.1 (43)	X^2 = 8.695
Female	25.5 (24)	46.9 (38)	P = 0.003
Types of injury	% (n=90)	% (n=80)	
Paraplegic incomplete	35.6 (32)	52.5 (42)	X^2 = 34.84
Paraplegic complete	22.2 (20)	1.3 (1)	P < 0.001
Tetraplegic incomplete	26.7 (24)	46.2 (37)	
Tetraplegic complete	15.5 (14)	0 (0)	
Level of injury	% (n=93)	% (n=80)	
Cervical	40.8 (38)	36.4 (29)	X^2 = 20.58
Cervical and thoracic	2.2 (2)	3.8 (3)	P = 0.005
Thoracic	33.3 (31)	23.7 (19)	
Thoracic and lumbar	5.4 (5)	2.5 (2)	
Lumbar	18.3 (17)	15.0 (12)	
Lumbar and sacral	0 (0)	6.3 (5)	
Degenerative diseases	0 (0)	10.0 (8)	
Spina Bifida	0 (0)	2.5 (2)	

Table 2. Age at Injury and Other Differences Between TSCI and NTSCI

	Male	Female	*P*-value
TSCI	(n=70)	(n=24)	
Age at injury	38.6 ± 17.3	31.7 ± 18.6	*P* > 0.05
Age at 31 dec. 2008	45.4 ± 16.9	44.0 ± 17.3	*P* > 0.05
Time since injury	6.8 ± 6.8	12.3 ± 10.9	*P* = 0.002
NTSCI	(n=43)	(n=38)	
Age at injury	49.6 ± 22.1	49.3 ± 23.3	*P* > 0.05
Age at injury excluding diseases at birth	52.2 ± 19.3	51.3 ± 21.5	*P* > 0.05
Age at 31 dec. 2008	59.9 ± 16.4	58.8 ± 19.8	*P* > 0.05
Time since injury	9.6 ± 12.1	9.8 ± 10.5	*P* > 0.05

The extent of injury was also statistically (P < 0.05) different between TSCI and NTSCI patients. The proportion of patients with incomplete paraplegia, complete paraplegia, incomplete tetraplegia, and complete tetraplegia was rather evenly distributed in the TSCI group (35.6%, 22.2%, 26.7% and 15.5%, respectively) whereas essentially no (1% or 1/81 patient) completely injured (with paraplegia or tetraplegia) patients were found in the NTSCI group (Table **1**). Data presented for male vs. female TSCI and NTSCI patients unexpectedly revealed a different gender-related trend. Indeed, for men, there was almost a 2:1 ratio (62% vs. 38%) of paraplegia vs. tetraplegia whereas, for women, an inverse ratio (42% vs. 58%) of paraplegia vs. tetraplegia was found (Table **4**). However, there was a comparable trend when comparing complete vs. incomplete patients within each group of men or women with 39% vs. 61% of complete and

Table 3. Distribution of Age at Injury Between Male and Female TSCI and NTSCI

TSCI; age at injury	Male	Female	Total	Complete	Incomplete
	% (n=70)	% (n=24)	% (n=94)	% (n=34)	% (n=54)
0 – 9	1.4 (1)	0 (0)	1.1 (1)	0 (0)	1.9 (1)
10 – 19	14.3 (10)	29.2 (7)	18.1 (17)	17.6 (6)	14.8 (8)
20 – 29	28.6 (20)	33.3 (8)	29.8 (28)	38.2 (13)	27.8 (15)
30 – 39	10.0 (7)	12.5 (3)	10.6 (10)	11.8 (4)	9.3 (5)
40 – 49	11.4 (8)	12.5 (3)	11.7 (11)	5.9 (2)	14.8(8)
50 – 59	21.4 (15)	0 (0)	15.9 (15)	23.5 (8)	12.9 (7)
60 – 69	10.0 (7)	4.2 (1)	8.5 (8)	3.0 (1)	12.9 (7)
70 – 79	2.9 (2)	8.3 (2)	4.3 (4)	0 (0)	5.6(3)
NTSCI; age at injury	**Male**	**Female**	**Total**	**X^2 and significance**	
	% (n=40)	**% (n=36)**	**% (n=76)**		
0 – 9	7.5 (3)	5.6 (2)	6.6 (5)	TSCI male / female	
10 – 19	7.5 (3)	5.6 (2)	6.6 (5)	$X^2 = 9.907$	
20 – 29	5.0 (2)	11.1 (4)	7.9 (6)	$P = 0.194$	
30 – 39	5.0 (2)	8.3 (3)	6.6 (5)	NTSCI male / female	
40 – 49	15.0 (6)	19.4 (7)	17.1 (13)	$X^2 = 2.724$	
50 – 59	22.5 (9)	19.4 (7)	21.0 (16)	$P = 0.951$	
60 – 69	20.0 (8)	11.1 (4)	15.8 (12)	TSCI complete / incomplete	
70 – 79	15.0 (6)	16.7 (6)	15.8 (12)	$X^2 = 8.605$	
80 – 89	2.5 (1)	2.8 (1)	2.6 (2)	$P = 0.282$	

incomplete TSCI male patients and 32% vs. 68% of complete and incomplete TSCI female patients (Table **4**). Corresponding numbers were found when examining more closely the specific level of injury (i.e., cervical, thoracic, lumbar, sacral). Most patients in both groups were either cervically (TSCI 43% and NTSCI 40.2%) or thoracically (TSCI 38.7% and NTSCI 26.2%) injured. Only a few TSCI patients were injured at the lumbar or sacral level (18.3%) whereas 21.3% of NTSCI patients were injured at the lower levels (i.e., excluding typically widespread neurodegenerative diseases, Table **1**).

One of the most interesting findings in this study was the clear difference found in incidence of associated conditions or so-called secondary complications. A rather large proportion of TSCI patients suffered of problems such as neurogenic bladder (52.2%), neurogenic bowel (51.1%), spasticity (48.9%), pressure ulcers (41.3) and urinary tract infections (26.1%) whereas a much lower proportion of NTSCI patients in Trois-Rivieres City suffered of these conditions (11.1%, 8.3%, 29.2%, 18.1%, 2.8%, respectively). This said, there was one condition, chronic pain, for which TSCI and NTSCI patients were both largely affected (65.2% and 66.7%, respectively, Table **5**). It is important to specify that some of these associated conditions were possibly affected or even due to circumstances related directly with the accident in the case of TSCI. For instance, acute pain from nerve damage during a car accident may possibly lead to chronic pain that is not entirely associated with chronic SCI *per se* but, instead, with the circumstances of the car accident (e.g., the security belt crushing a peripheral nerve at the shoulder level occurring simultaneously with a SCI at the cervical level caused by airbag deployment).

DISCUSSION

This study reveals the existence of clear differences between TSCI and NTSCI patients in term of age, gender, extent and level of injury or associated conditions. Among key findings, the data showed that 1) TSCI patients are younger (age of injury) compared with NTSCI individuals; 2) virtually no completely injured patients were found among the group of NTSCI; 3) among men, there were more patients with paraplegia than tetraplegia whereas, among women, the opposite was found (more cases with tetraplegia than paraplegia); 4) most TSCI were cervically or thoracically injured (82%) whereas NTSCI patients were more evenly distributed at all levels; 5) chronic pain was equally experienced by a majority of patients in both groups (NTSCI and TSCI); and 6) most secondary complications found in TSCI patients were not generally experienced by corresponding numbers of NTSCI individuals.

Table 4. Type and Completeness Between Male and Female TSCI and NTSCI

TSCI; Type of Injury	Male	Female	Total	X^2 and significance
	% (n=71)	% (n=19)	% (n=90)	
Paraplegic incomplete	36.6 (26)	31.6 (6)	35.6 (32)	$X^2 = 2.993$
Paraplegic complete	25.4 (18)	10.5 (2)	22.2 (20)	$P = 0.393$
Tetraplegic incomplete	23.9 (17)	36.8 (7)	26.7 (24)	
Tetraplegic complete	14.1 (10)	21.1 (4)	15.5 (14)	
Paraplegic	62.0 (44)	42.1 (8)	57.8 (52)	$X^2 = 2.425$
Tetraplegic	38.0 (27)	57.9 (11)	42.2 (38)	$P = 0.119$
Complete	39.4 (28)	31.6 (6)	37.8 (34)	$X^2 = 0.394$
Incomplete	60.6 (43)	68.4 (13)	62.8 (56)	$P = 0.530$
NTSCI; Type of Injury	**Male**	**Female**	**Total**	**X^2 and significance**
	% (n=43)	**% (n=37)**	**% (n=80)**	
Paraplegic incomplete	46.5 (20)	59.5 (22)	52.5 (42)	$X^2 = 1.981$
Paraplegic complete	2.3 (1)	0 (0)	1.3 (1)	$P = 0.371$
Tetraplegic incomplete	51.2 (22)	40.5 (15)	46.2 (37)	
Tetraplegic complete	0 (0)	0 (0)	0 (0)	
Paraplegic	48.8 (21)	59.5 (22)	53.8 (43)	$X^2 = 0.903$
Tetraplegic	51.2 (22)	40.5 (15)	46.2 (37)	$P = 0.342$
Complete	2.3 (1)	0 (0)	1.3 (1)	$X^2 = 0.871$
Incomplete	97.7 (42)	100 (37)	98.7 (79)	$P = 0.351$

Table 5. Associated Conditions (Secondary Complications) Between TSCI and NTSCI

Associated conditions		TSCI		NTSCI	X^2 and Significance
	Complete (n=34)	Incomplete (n=56)	Total (n=90)	Total (n=80)	
Neurologic Bladder	79.4	41.2	52.2	11.1	TSCI / NTSCI
Neurologic bowel	73.5	43.1	51.1	8.3	$X^2 = 34.87$
Urinary tract infection	32.4	11.8	26.1	2.8	$P < 0.001$
Touch sensitive	2.9	15.7	9.8	9.7	TSCI Comp / Incomp
Pain	67.6	72.5	65.2	66.7	$X^2 = 24.25$
Temperature	5.9	19.6	13.0	8.3	$P = 0.004$
Spasticity	58.8	47.1	48.9	29.2	TSCI Incomp / NTSCI
Pressure ulcers	76.5	23.5	41.3	18.1	$X^2 = 16.93$
Thrombophlebitis	8.8	5.9	6.5	1.4	$P = 0.05$
Orthostatic hypotension	23.5	5.9	13.0	2.8	

This study was not designed to assess the incidence and prevalence of TSCI and NTSCI patients among the entire population of Trois-Rivieres City, Province of Quebec, or Canada since it is unlikely that this sample (175 patients) allows to reliably assess such values. In fact, there is evidence suggesting that incidence and prevalence numbers are rather difficult to assess appropriately. As an example, for many years, numbers and statistics from the University of Alabama (The National Spinal Cord Injury Statistical Center in the U.S.) were considered as reliable estimates of the incidence and prevalence of TSCI in the U.S. Forty cases per million population was reported as a fair estimate of incidence and 259,0000 Americans currently living with SCI was considered as a fair estimate of prevalence

(www.spinalcord.uab.edu). Interestingly, an extensive study sponsored by the Christopher and Dana Reeve Foundation has recently reported very different estimates. According to that recent report, the incidence is similar to previous estimates although the prevalence would be significantly higher (e.g., than estimates from the University of Alabama) with 1,275,000 SCI patients (0.4% of the U.S. population). It is unclear if comparable estimates may apply to Trois-Rivieres or the Province of Quebec. If they do apply, this would correspond to 28,000 patients who could currently be living with TSCI in Quebec. This said, an Ontario (another Canadian province)-based epidemiological study reported 37 to 46 TSCI cases per million population [13]. However, different incidences were reported in other countries such as in Germany (66 cases per million population per year)[14] or France (only 12.7 cases per million population per year)[15], strongly suggesting that incidence and prevalence values (and probably causes) may largely differ from one geographical area to another. On the other hand, studies that have estimated NTSCI incidences are rather rare although numbers as high as 80 cases per million population per year have been reported [16].

Regarding the causes of SCI, data from this study revealed that the etiology of TSCI in the Province of Quebec (Trois-Rivieres City) versus in the U.S. is partially different. The study showed that TSCI patients in Quebec were injured by vehicle accidents (36.7% for cars, 8.4% for motorcycles and 7.4% for recreational vehicles), falls (15.8%), and accidents at work (11.6%). Comparable percentages (e.g., vehicle accidents) were found in larger Quebec-based (2200 TSCI patients) and Ontario-based studies conducted a few years ago [13,17]. In contrast, data from the Christopher and Dana Reeve Foundation-sponsored report indicate that TSCI in the U.S. are caused mainly by accidents at work (28%), vehicle accidents (24%), and falls (9%)[18]. Among other causes, it is worth noticing that accidents associated with fire arms constitute only 3.1% of all TSCI patients in this study which is in clear contrast with data from across the boarder where they constitute a leading cause of TSCI in the U.S. [12]. For NTSCI, the main causes in the U.S. are stroke (29%) and multiple sclerosis (17%)(although discrepancies were reported in specific geographical areas, e.g., Virginia with 53% of all NTSCI cases caused by stenosis)[19] whereas in Quebec, the present study reports that the mains cause of NTSCI are stenosis-associated myelopathies (34.5%).

The gender factor is apparently also different on each side of the North American boarder. Data from this study show that men and women constitute respectively 74.5% and 25.5% of TSCI cases whereas, in the U.S., 61% and 39% of men and women constitutes the TSCI cases [18]. In contrast, comparable proportions of NTSCI men and women were found in the U.S. (54% and 46%) and Quebec (53.1% and 46.9%). One small community-based study conducted in Virginia (U.S.) also reported a 1:1 ratio (NTSCI male to female)[19] which is also supported by data from a large U.K.-based study [20]. Reasons underlying this gender-related difference among TSCI patients across the U.S.-Canada boarder is unclear but may be associated, as described above, with clearly different incidences of vehicle accidents and work-related accidents.

The age-distribution appears to be similar in Quebec (this study) and the U.S. Data from the University of Alabama report that 56% of the TSCI group are between 16 and 30 years of age (most of which are men) (www.spinalcord. uab.edu) whereas we found in Quebec (Trois-Rivieres) that most TSCI individuals are men between 10 and 30 years of age (42.9%).

To our knowledge, proportions of NTSCI versus TSCI within a relatively homogenous population (patients of Trois-Rivieres City and its surroundings who are essentially Caucasian, french-speaking, blue-collar Canadians) have rarely been reported in the literature. This study is among the firsts to report that comparable numbers of TSCI and NTSCI (respectively, 94 and 81 patients in this study) were found within a rather small and homogenous community. Relatively different numbers were reported in small community-based studies regarding NTSCI in India where 60% of all SCI patients were reported as NTSCI (64/106 patients) as well as in Turkey and the U.S. where only 32.5% and 39% of all SCI patients were NTSCI, respectively [19,21,22]. Comparable proportions (30%) as those found in the U.S. were found by Guttman in his large U.K.-based study [18]. Interestingly, the Indian study also showed that significantly more NTSCI patients were associated with paraplegia than tetraplegia (2:1 ratio) and 32% were completely injured which in clear contrast with results from our study reporting a 1:1 ratio (paraplegia : tetraplegia) and virtually no (1%) completely NTSCI patients (1/81 patients). All and all, it appears that the different numbers (proportions and prevalences) reported in the literature (including those from this study) may be influenced by geographical and thus socio-economical factors.

Very few studies have reported an exhaustive list of secondary complications associated with NTSCI. An India-based study with 297 NTSCI patients has reported significant cases of urinary tract infections (62%), spasticity (57%), chronic pain (50%), depression (38%), respiratory tract infections (34%), constipation (31%), pressure ulcers (30%), contractures (18%) and sleep disturbance (14%)[23]. In this study, we also found significant cases of spasticity (29.2%), chronic pain (66.7%) and pressure ulcers (18.1%) although percentages are different. Urinary tract infections were rarely found in this small community-based study (only 2.8%) which is in clear contrast with the results from the two Indian studies (> 50% of all NTSCI cases)[21,23]. However, the extent of secondary complications found here in TSCI patients is also supported by a much larger (2200 TSCI patients) Quebec (province)-based study that reported significantly large percentages of cases with spasticity, urinary tract infections, pressure sores and hypotension [16].

As mentioned earlier, although it is unclear what the prevalence of TSCI and NTSCI is in Quebec, 6,000 patients is often reported to constitute the prevalence of SCI across the entire Province. Thus, data reported here obtained from 175 patients may possibly be representative of the situation in this part of Canada (3% of all SCI Quebecers). Indeed, several studies published recently reporting comparable sets of data from India or the United States have drawn a number of conclusions based on results from less than 300 SCI medical records (approximately 310 million and 1.18 billion people in the U.S. and India, respectively)[19, 21-23].

CONCLUSION

This study provides evidence that may support the idea that therapeutic treatments either currently used or in development against secondary complications should probably be designed or specifically adapted for subgroups of SCI patients. Along the same line of evidence and based on comparisons with other studies (e.g., in India and U.S.), health professionals (medical doctors, physiotherapists and researchers) may keep in mind that geographical and social related factors probably affect statistics related with incidence, prevalence, and associated chronic conditions.

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