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Traumatic Versus Non Traumatic Spinal Cord Injury: Characteristics and Functional Outcome in a Tunisian Rehabilitation Center

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Abstract

In our study, 177 patients with a diagnosis of Spinal Cord Injury (SCI) were admitted and divided into two groups. Recordings were made at the time of admission in rehabilitation department as well as after two years of follow up. ASIA scale scores and MIF scales were significantly higher in NT group (Non Traumatic SCI) at admission and after two years of follow up as compare with T group (Traumatic SCI), meaning thereby patients in latter group had more impairment both at admission and after two years.

Keywords: Epidemiology; Outcome; Rehabilitation; Spinal Cord Injury

Introduction

Spinal Cord Injury (SCI) is a devastating event. It not only causes permanent serious dysfunctions but also leads to several disorders of organ systems, including the respiratory, urinary and autonomic nervous system, as well as bone and join. SCI has a worldwide incidence of between 10.4 and 83 cases per million per year [1]. It may arise from traumatic and non-traumatic causes. In both types of injury, the damage suffered progresses unpredictably. The global incidence of Traumatic Spinal Cord Injury (TSCI) was reported as 9.2 to 246.0 per million residents [2]. Despite these tremendous health care and personal costs associated with SCI, there are still few studies regarding the incidence and prevalence in Africa.

SCI has a great impact on the health-care system. For example, the total lifetime cost per paraplegic living with traumatic spinal cord injury is estimated at $ 1.6 million in Canada and close to $ 3.0 million in cases of quadriplegia [3].

To implement appropriate prevention strategies, it is primordial to have a clear idea of the extent of the problem in terms of etiology, demographics, extent of disability and evolution. Unfortunately, there is a lack of information regarding epidemiologic data associated with SCI in Tunisia. The aims of this study were to describe the clinical and demographic data of SCI in a physical medicine and rehabilitation department in a university hospital Sahloul, Sousse, Tunisia and compare neurological and functional outcomes in both groups TSCI and NTSCI within two years of follow up.

Patients and Method

This is a retrospective study conducted from January 2008 to December 2014 in a physical medicine and rehabilitation department in a third care center Sahloul, Sousse, Tunisia. Hospital medical records of patients with SCI admitted to hospital were reviewed. Patients were divided into two groups: T group (for TSCI) and NT group (for NTSCI). Patients diagnosed with traumatic Cauda equina syndrome were excluded from group T. Cases of Myelopathy cervicarthrosis decompensed by a trauma were not included in group NT. The variables studied were associated with the social demographic profile of patients (age, gender, marital status, personal income, social care, occupation and comorbidities). In addition, the cause, type and level of spine injury were determined by physical examination. Neurological levels of SCI were classified using the American Spinal Injury Association Impairment Scale (AIS)(Appendix1). Functional status at admission and after two years of follow up was assessed by Functional Independence Measure (FIM) (Appendix 2). Concomitant injuries, Length of Stay (LOS) and different treatment choices were recorded.

Recordings were made at the time of admission in rehabilitation department as well as after two years of follow up. Scores were compared and analyzed in both the groups. Statistical analyses were performed using SPSS software (version 17.0, SPSS). Descriptive statistics were used to represent data as average, range, median and percentages. Ordinal data were expressed as medians, inter-quartile ranges, and percentages. For this normal distribution, Chi-square ($\chi 2$) tests of independence were applied. Independent sample t-tests were used to compare parametric variables between two groups of TSCI and NTSCI. A P value of 0.05 was considered significant.

Results

During the study period, a total of 177 patients with a diagnosis of SCI was admitted, distributed as follows: 108 TSCI (T group) and 69 had NTSC (NT group). Sociodemographic Data were represented in Table1. Patients of NT group were significantly older ($p<0.001$). While comparing between the two groups, sociodemographic profiles of two groups were similar ($p>0.05$).

Parameters	T group, n (%)	NT group, n(%)	p
Mean age(years)	34	48.5	<0.001
Gender:			
Male	77(71.3%)	37(53.6%)	0.17
female	31(28.7%)	32(46.4%)	
Social insurance	54(50%)	59(85%)	0.085
Education:			
Elementary	56(52%)	47(69%)	0.19
Secondary	39(37%)	20(29.6%)	
university	13(12%)	2(1.9%)	
Employment :			
Manual	70	52	0.06
Office	22	2	
Unemployment	6	2	
student	10	11	

Table 1: Sociodemographic characteristics of SCI.

Road Traffic Accidents (RTA) were the main cause of TSCI. Main concomitant injuries observed were brain injuries in 19 patients (17.6%), rib fracture in 13 cases (12.0%) and pelvis fracture in 9.3 % of cases. In respect of NT group, degenerative disease was the main cause of NTSCI including discal hernia and myelopathy in 30.4 % and 20.1% respectively. Etiologies of SCI in both the groups are shown in Table 2.

Group	Characteristic	Patients, n (%)
T group	RTA	52(48.1)
	Falls	27(25.0)
	Work accident	15(13.9)
	Diving	6(5.5)
	Violence	4(3.7)
	Suicide attempt	4(3.7)
NT group	Degenerative disease	35(50.7)
	Neoplasic disease	14(20.3)
	Infection	13(18.8)
	Vascular disease	4(5.8)
	Inflammatory disease	3(4.3)

Table 2: Etiology of patients with spinal cord injury.

Regarding baseline evaluation, the cervical level was the most frequently affected region in both groups. AIS scores were significantly higher in NT group at admission ($p<0.001$) as compare with T group (in T group, most of patients was AIS A and in NT group, most of lesions were classified as AIS D). Thirteen patients of T group were diagnosed with conus medullaris versus 5 cases in NT group. Patients with TSCI showed a significant lower functional status at admission than NT group (96.0% vs 76% of T and NT group respectively had FIM scores lower than 100/126). Details of baseline evaluation are represented in Table3.

At admission	T Group(n)	NT Group(n)	p
Cervical level	46	32	<0001
Thoracic level	34	30	
Lumbar Level	12	22	
Multifocal lesions	16	49	
ASIA « A or B »	64	13	
ASIA « C »	21	24	
ASIA « D or E »	10	27	
Urinary incontinence	78	16	< 0.001
Anal incontinence	58	15	<0.001
FIM score (mean)	52.7	78.8	<0.001
DOS(days)	40	24	< 0.001
Timing of surgery	7	180	< 0.001
Surgical procedure :	Total (92 patients)	Total (48patients)	<0.001
Only laminectomy	8	19	
Laminectomy+fixation	70	8	
Reduction	4	0	
Dissectomy	0	8	
Surgical exeresis	0	14	

Table 3: Baseline evaluation of both groups.

Operative management was analyzed and compared between the two groups. With regard to timing of decompression, it was found that patients of T group had significantly earlier surgical intervention. Medical management of SCI was appropriate for etiology, including antibiotics (for infectious spondylodiscitis), anti-tubercular treatment, corticosteroids), embolization, chemotherapy, treatment with radiation. Regarding Vesico-ureteral dysfunctions, treatment strategies were adapted to bladder disorder type. Treatment of overactive bladder was based on anticholinergic drugs and Self-intermittent catheterization (76.9% and 44.9% of T and NT group, respectively). Five patients in T group had suprapubic catheter because of urinary retention in patients with indwelling urinary catheters urethral trauma and penile sores.

Analysis for requirement of orthosis and assistive devices was also realized between the groups. A significant difference was found between the two groups (Patients of T group needed significantly more equipment (92.6% and 62.3% of T and NT group, respectively, P <0.001), especially wheelchairs for tetraplegia and paraplegia and anti-bedsore mattresses. Readmissions in rehabilitation department were analyzed and compared between the two groups. The rate of readmission was significantly higher in T group (33.6% of T group, 12.8 % of NT group, P=0.01). Details about readmissions of SCI were showed in Table 4.

Readmissions	T Group	NT Group
Percentage	33.60%	12.90%
Delay(mean)	14 months (432days)	13 months (404days)
DOS(mean)	19 days	7 days
FIM score (mean)	73/126	95/126
Cause:		
Reevaluation	55.60%	70%
Complication	44.40%	30%

Table 4: Characteristics of readmissions in SCI.

Recordings were made at admission in rehabilitation department, as well as after two years of follow up. ASIA scale scores and MIF scales were significantly higher in NT group at admission and after two years of follow up as compare with T group, meaning thereby patients in latter group had more impairment both at admission and after two years. Details of final evaluation are represented in Table 5.

Final evaluation (n)	T Group	NT Group	p
ASIA SCORE A or B	53	6	< 0.001
C or D or E	42	57	
Non walkers	66	7	< 0.001
Walkers	42	62	
Spontaneous urination	25	42	0.05
Urinary symptoms	27	7	< 0.001
FIM score (mean)	87.5	98.6	0.05
Gain MIF	27.02	18.27	0.04

Table 5: Final evaluation of patients with SCI.

On the basis of the present findings neurological and functional impairment was higher in T group as compare with NT group, not only at admission in rehabilitation department, but also after two years of follow.

Discussion

Spinal cord injuries are a devastating condition. It is generally known that SCI exerts a substantial financial burden on patients and society on account of the tremendous cost of health-care treatments, decreased quality of life and social participation, as well as lost productivity [4]. A precise knowledge of the course and of the factors associated with SCI has become a scientific need as it is essential for the evaluation of rehabilitative strategies. Within the entire population of patients with SCI, TSCI accounts for the largest proportion, and there are many publications describing the demographic data, etiology, neurological deficit, functional outcomes and disability of TSCI [5]. In our study, patients in T group were more often men (71.3%). This is in line with earlier studies [2,6]. Authors Explained this on the basis that major cause of TSCI was RTA and the most of persons who drive on road are generally men. This predominance is less important among patients of NT group. Citterio A [7] also reported a male predominance in NTSCI, with 58% of men. However, most authors found a female predominance regardless of the etiology of TSCI [6-8]. In our study, mean age of patients in T group was 34 +/- 13 years and the age group most frequently affected was 21–30 years. By reviewing literature, authors announced a change in the profile of TSCI population. Previously, mean age was around 27 years and currently the patients are older with an average of 41 years [9,10]. This can be explained by demographic aging, an increase in the incidence of accidents beyond age 65, and a decrease in accidents among children [11]. In our study, patients of NT group were significantly older (49 years vs 34 years). Such a finding is widely described in the literature [4,7,11]. Most of patient in both the groups had no history of medical disease (88.9% in the T group and 64.9% in the NT group). According to Moutquin et al. [12] a greater number of comorbidities is observed in the NT group, particularly diabetes (6%), cancer (57%) and chronic obstructive bronchopneumopathy (2%). This can be explained by the fact that patients in the NT group are older, often retired and have more concomitant health problems. The most two common causes of TSCI are RTA and falls(48.1% and 25.0%,respectively). These findings were consistent with previous reports [11-13]

In respect of NT group, degenerative disease was the most common cause (50.7%). A predominance of degenerative causes was also noted in the series of Kay and al. [13]. Most of injuries in both the groups belonged to cervical level. Contrary to the earlier study by Gupta and al [14] recording that most patients had thoracic or lumber injuries. Gupta announced that this fact is understandable as common spinal site for lesions is dorso-lumbar level, such as Pott's spine and spinal tumors.

Regarding AIS scale at admission, we found a significant difference between the two groups. The majority of the T group (61.1%) presented with an AIS "A", whereas in the NT group most of patients belonged to AIS "C" or "D". Our results are similar to those described in the literature. Table 6 summarizes recent works dealing with this subject.

Articles :		T Group					NT Group				
	Year of publication	total	ASIA A(%)	ASIA B(%)	ASIA C(%)	ASIA D(%)	total	ASIA A(%)	ASIA B(%)	ASIA C(%)	ASIA D(%)
Current study	2017	108	61.10%	6.30%	22.10%	10.50%	69	14.10%	6.30%	38%	40.60%
Anghelescu et al. [22]	2016	346	62.70%	13.90%	13.90%	9.50%	87	24.13%	19.54%	14.94%	41.33%
Y Zhou et al. [2]	2016	354	20.90%	11.30%	20.90%	46.9	___	___	___	___	___
Derakhshanrad et al. [23]	2016	1137	53.50%	18.70%	17.60%	9.60%	___	___	____	____	____
Rinkaewkan et al. [24]	2015	85	57.60%	12.40%	16.40%	7.50%	115	22.40%	16.90%	21.40%	36.30%

Noreau et al. [6]	2014	1137	42.80%	9.10%	18.30%	15.00%	412	19.90%	3.20%	22.80%	35.90%
Shin et al. [10]	2013	481	51.40%	15.20%	18.10%	15.40%	148	12.20%	6.80%	30.40%	50.70%
G Scivoletto et al. [25]	2011	144	51.30%	8.30%	27.80%	12.50%	236	20.30%	7.20%	43.60%	28.80%
A Gupta et al. [14]	2008	38	50%	13.10%	13.10%	5.20%	38	28.90%	15.70%	23.60%	31.5

Table 6: Review of articles.

Recent epidemiological studies reported that patients diagnosed with TSCI have often more complete lesions compared with non-traumatic group. In our study, similar trend can be seen (61.1% of the T group had complete lesions compared to 11.5% in the NT group, P <0.001). These results are relatively close to those found by Moutquin et al. [12] (64% and 24% in T and NT group, respectively had complete lesions).

Length of stay in rehabilitation department, as outcome measure of rehabilitation was compared between the groups and analyzed. A significant difference was found between the groups in our study. Patients in NT group had a shorter rehabilitation LOS than those in T group (24 days vs 40 days). Similar trend can be seen in the study of Mckinley et al. [15]. According to authors, factors potentially influencing longer LOS in traumatic group include treatment of concomitant injuries associated with TSCI (such as Brain trauma, chest trauma…) as well as medical complications which are more frequently observed among T group.

The WHO designated three prevention steps: primary (consisting on preventing the occurrence of diseases or accidents, such as road preventive campaigns) secondary (full neurological examination, quick screening and early decompressive surgery) and tertiary. Tertiary prevention aims to minimize the after-effects of disease or accident and favor patient reintegration. It includes Functional repair (tendon, muscle and even nervous implantation, electrical stimulation of locomotion), medical treatments (pain, spasticity, trophic dysfunction, etc.), rehabilitation program and social and professional reintegration [16,17]. An interdisciplinary approach is essential in rehabilitation in SCI. The team is led by a physiatrist and consists of the patients' family, physiotherapist, occupational therapist, dietician, psychologist, speech therapist, social worker and other consultant specialists as necessary [18]. The Early Inpatient Rehabilitation Program includes learning transfers, wheelchair skills and other skills to do daily tasks, skin care, bowel and bladder management then Discharge planning. Then, a regular follow up is set on Neurogenic bladder and bowel, urinary tract infections, pressure ulcers, orthostatic hypotension, deep vein thrombosis, spasticity, autonomic dysreflexia, and depressive disorders are frequent complications after SCI. During follow up, physiatrist look for these complications and treat them [19].

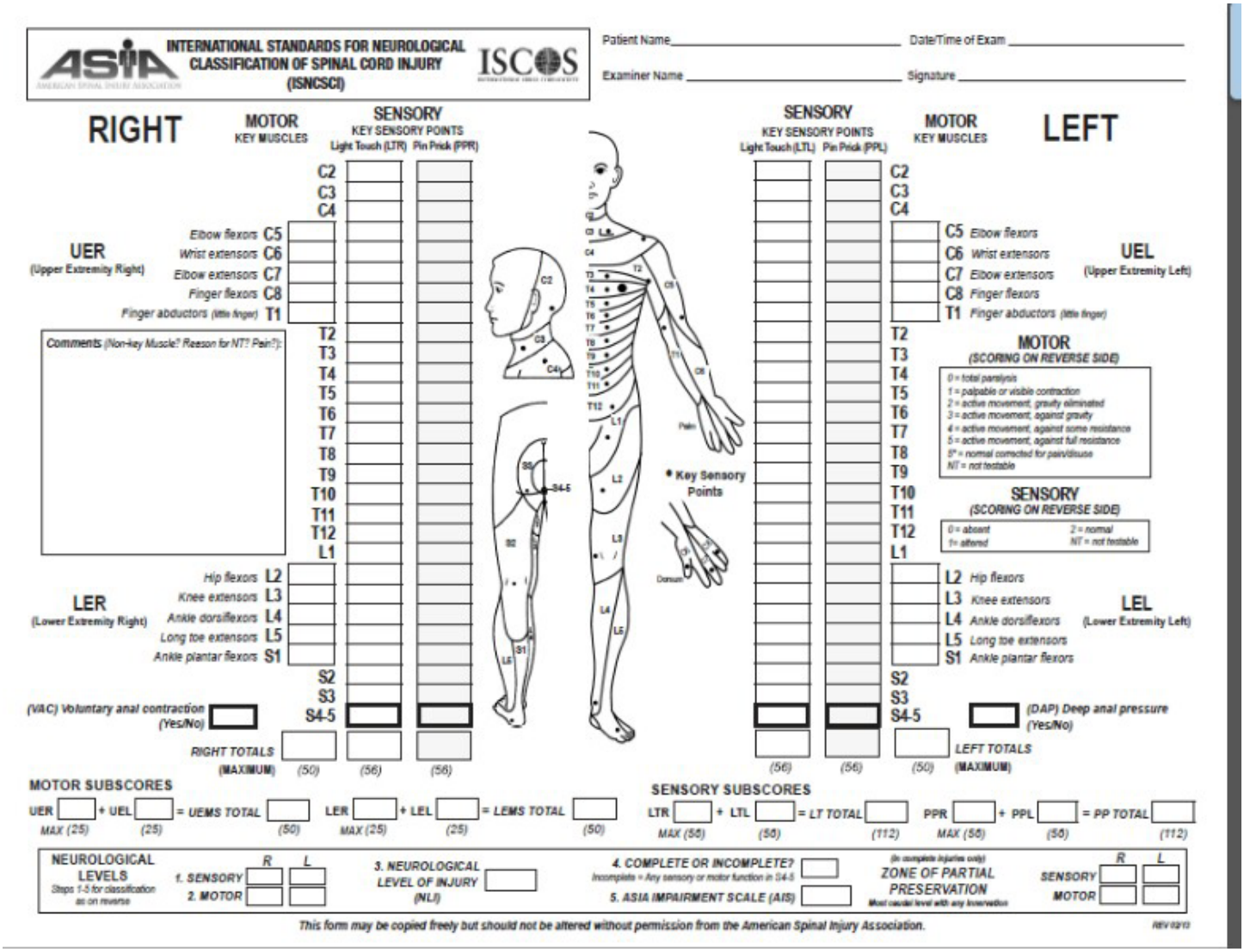
FIM scores at the time of admission and after two years were recorded and used as functional outcome measure comparison between the groups. The mean MIF was 52.7/126 in T group versus 78 in NT group. While comparing between the groups, it was found a significant difference (P<0.001). These findings are in line with results of articles published. For example, Noreau et al. [6] reported that median FIM score is significantly higher in NT group compared with T group (53 vs. 38; p <0.001).

According to Ditunno [20], major questions asked by patients and their families, relate to function, such as: What will I be able to do?" "Will I be able to walk?". Doctors must reassure patients and their families of realistic goals. In fact, walking recovery is one of the main goals of patients after SCI, rated at first place together with bladder and bowel function [21]. In our study, 38.9% of T group and 89.9% of NT group were walkers, the majority of which were initially classified "AIS C" and "D". Ditunno realized a review of literature demonstrating that the chance of walking recovery after a SCI can be accurately predicted on the base of demographic data and baseline clinical examination. Patients with complete lesions have very limited possibility of achieving walking function at follow up. The chances of walking recovery improve in less severe lesions, as demonstrated by AIS B and C subjects.

Conclusion

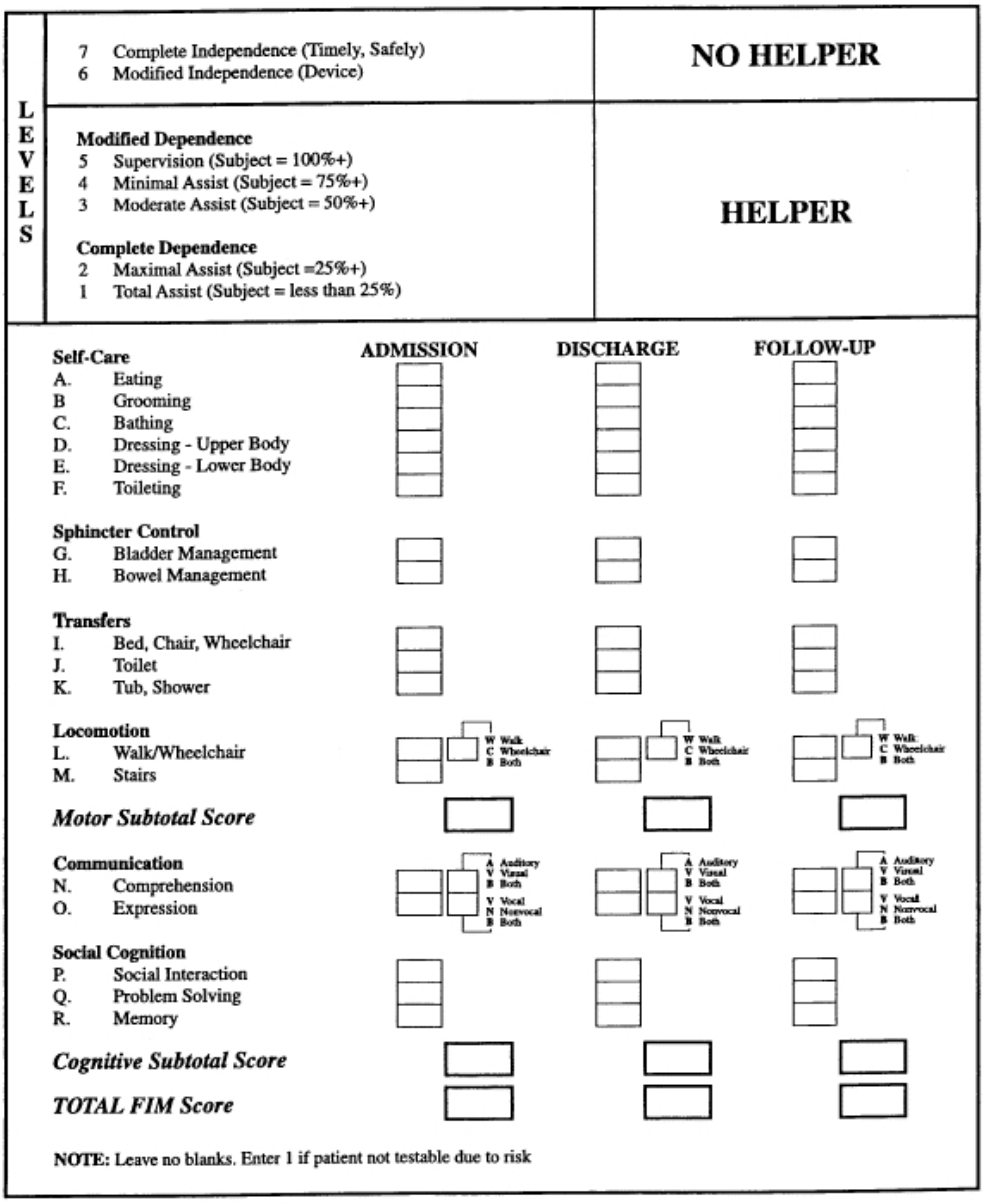
This study presents some shortcomings that deserve further analysis. The number of subjects did not allow a more detailed analysis. Another bias could be that the non-traumatic group includes different etiologies with different prognoses (worse outcome may be related to progression of disease). A follow-up study would help to determine prognosis factors associated with better outcome.

A major conclusion may be driven from our study. Patients with clinically stable non-traumatic lesions have better outcome comparable to patients with traumatic lesions. This finding is of particular interest as concerns discharge destination and resources utilization. Understanding of the underlying mechanisms would help in the development of strategies and treatments enhance neurological recovery.



Appendix 1: AIS scale.

FIM™ instrument



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Appendix 2

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