Junior Medical Research

Full Text Article Open Access

Original Article

Traumatic versus non traumatic spinal cord injury: Characteristics and functional outcome in a Tunisian rehabilitation centre

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Publication data:

Submitted: February 5, 2018

Accepted: April 24, 2018

Available Online: June 22,2018

This article was subject to full peer-review.

Abstract

Background:

Understanding of the underlying mechanisms of Spinal cord injury (SCI) would help in the development of treatment strategies and enhance neurological recovery.

Aim:

The aim of this study was to describe clinical and demographic data of SCI in a physical medicine department and to compare neurological and functional outcome in Traumatic Spinal Cord Injury group (TSCI) and Non Traumatic Spinal Cord Injury group (NTSCI) during two years of follow up.

Materials and methods:

This study was conducted in a physical medicine and rehabilitation department of a tertiary hospital (January 2008-December 2014). Medical records of 177 patients with spinal cord injury (SCI) were reviewed. Two groups were defined: traumatic (TSCI) and non-traumatic (NTSCI) spinal cord injury. Characteristics and functional outcome were analyzed and compared.

Results:

Patients of NT group were significantly older. Most of injuries in both groups had a cervical level. ASIA scale scores and MIF scales were significantly higher in NT group at admission and after two years of follow up. The impairment was more remarkable in this group.

Conclusions:

Our study suggests that non traumatic SCI represent a considerable proportion of SCI rehabilitation admissions. Although different characteristics and injury patterns, functional outcomes maybe comparable to traumatic SCI.

Key words:

spinal cord injury, epidemiology, etiology, rehabilitation

Citation: Gaddour M, Ouannes W, Frioui S, Salah S, Khachnaoui F, Jemni S. Traumatic versus non traumatic spinal cord injury: Characteristics and functional outcome in a Tunisian rehabilitation center. Junior Medical Research. 2018; 1(2):12-21. Gaddour et al
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Introduction:

Spinal cord injury (SCI) is an event that results in a disturbance to normal sensory, motor, or autonomic nervous function. It may also lead to several disorders of organ systems, such as respiratory, joint, and urinary system. SCI usually affects also the patient's psychological, and social well-being. The annual global incidence of SCI is 10.4 to 83 cases per million [1]. It may arise from traumatic and non-traumatic causes. In both types of injury, the damage suffered can progress unpredictably. The management of severe cases is difficult due to the lack of guidelines and the high cost of the consensual procedures. Implementing an appropriate prevention strategy require an established knowledge on injury mechanisms, disease pathophysiology, and disability characteristics [2].

Patients and methods:

This is a retrospective study (2088-2014) conducted in the physical medicine and rehabilitation department of Sahloul university hospital, Sousse, Tunisia.

Medical records of patients with SCI admitted 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 majored 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 specified in the 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 options were recorded.

Recordings were made at the time of admission in rehabilitation department as well as after two years

Statistical analysis was performed using SPSS software (version 17.0). 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 comparison was applied. Independent t-tests were used to compare parametric variables. A p value < 0.05 was considered as significant.

Results:

During the study, 177 patients with SCI were included. Defined groups were: TSCI (T group; n =108) and NTSC (NT group; n=69). Sociodemographic data is represented in Table1. Patients of NT group were significantly older ($p<0.001$). however sociodemographic profiles of the two groups were comparable ($p>0.05$).

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. Regarding NT group, degenerative disease was the main cause of NTSCI including discal hernia and myelopathy in 30.4 % and 20.1% respectively. Mechanisms of SCI in both groups are summarized in table 2.

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 ($p<0.001$). In T group, most of patients were AIS A. However, 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 table 3.

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Table1: SCI Sociodemographic characteristics

	T	NT	P
Mean age	34	48.5	<0.001
Gender:			
M	77(71.3%)	37(53.6%)	0.17
F	31(28.7%)	32(46.4%)	
Insurance	54(50%)	59(85%)	0.085
Education:			
Primary	56(52%)	47(69%)	0.19
High	39(37%)	20(29.6%)	
University	13(12%)	2(1.9%)	
Occupation			
Manual	70	52	
Office	22	2	0.06
None	6	2	
Student	10	11	

Table2: Spinal cord injury mechanisms

	Mechanism	n (%)
T	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	Degenerative disease	35(50.7)
	Neoplastic disease	14(20.3)
	Infection	13(18.8)
	Vascular disease	4(5.8)
	Inflammatory disease	3(4.3)

Regarding the operative management; surgical decompression was earlier in T group. Medical management of SCI depended on the etiology. It included antibiotics (infectious spondylodiscitis), anti-tubercular agents and corticosteroids (tuberculosis), embolization, chemotherapy, radiation (neoplastic diseases). Regarding urinary dysfunctions, treatment strategies were adapted to bladder disorder types.

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 for urinary retention in case of urethral trauma or penile sores.

Table3: Baseline evaluation

Admission	T	NT	P
Cervical level	46	32	
Thoracic level	34	30	
Lumbar Level	12	22	
Multifocal lesions	16	49	<0.001
ASIA « A / B »	64	13	
ASIA « C »	21	24	
ASIA « D /E »	10	27	
Urinary incontinence	78	16	<0.001
Anal incontinence	58	15	<0.001
Mean FIM score	52.7	78.8	<0.001
DOS(days)	40	24	<0.001
Time to surgery	7	180	<0.001
Surgical procedure	n=92	n=48	<0.001
Laminectomy	8	19	
Laminectomy fixation	70	8	
Reduction	4	0	
Discectomy	0	8	
Excision	0	14	

Requirement of assistance devices was significantly higher in T group (92.6% versus 62.3% in NT group: P <0.001).

Readmissions in rehabilitation department characteristics 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).

Characteristics of SCI readmissions are summarized in table 4.

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Table4: Characteristics of readmissions in SCI

Readmission	T	NT
%	33.6	12.9
Average time to readmission	432	404
Mean inpatient days	19	7
FIM score	73/126	95/126
% Scheduled /complications	55.6/44.4	70 /30

A variety of complications was diagnosed during the follow up of patients with clear difference between the two groups. In fact, all types of complications were significantly more frequent in T group. However, the comparative study could not be independent from postoperative courses factors. Managed complications are detailed in table 5.

Table 5: Major complications

Complications	T (n)	NT(n)	P
Spasticity	44	22	0.008
Neuropathy	41	13	0.05
Urinary tract infection	63	6	< 0.001
Sepsis	35	2	< 0.001
Thrombosis	14	2	0.03
Pressure ulcer	55	8	< 0.001
Osteoma	23	0	< 0.001
Constipation	40	4	< 0.001

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. Details of final evaluation are represented in table 6.

Table 6: final assessment

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

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 injury is a devastating condition. In addition to organic and psychological disorders; SCI management represents substantial financial challenge on patients and society [3,4]. A comprehensive study of the leading factors and the pathological behaviour of SCI has simplified the management and improved the prognosis. Trauma contributes to the largest proportion of SCI. The demographic data, etiology, and functional outcome have been well codified for traumatic SCI in the previous published literature [5]. Male predominance is usually noticed for traumatic SCI. In our study, patients in T group were male in 71.3% of cases. This was concordant with earlier studies results [5,6]. Regarding non-traumatic SCI; Citterio and al have also reported a male predominance (58%) [7]. However, most of the other authors found a female predominance independent from the etiology [6-8]. Traumatic SCI affect more young adults. In our study, mean age of patients in T group was 34 years (21-30). However a remarkable increase of traumatic SCI incidence is noticed in older population [9,10]. This can be explained by the progress of demographic assessment and a higher accident rate beyond the age of 65 [11].

In our study, patients of NT group were significantly older (49 years vs 34 years). This finding is widely described in the literature [4,7,11].

Moutquin and al found a significant higher rate of associated comorbidities in non-traumatic SCI [12]. That was the case of diabetes (6%), cancer (57%) and chronic obstructive pulmonary disease (2%).

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As previously reported; the most two common causes of traumatic SCI are Road traffic accidents and falls (respective incidence are 48.1% and 25.0%) [11,12,13]. However, in non-traumatic SCI; degenerative diseases remain the most common cause (50.7%) [13].

Most of injuries in both the groups are located in a cervical level. Gupta and al reported most frequent thoracic and lumber injuries especially in non-traumatic SCI [14].

Regarding AIS scale at admission, we found a significant difference between the two groups. The majority of the T group patients (61.1%) presented with an AIS "A", however in the NT group most of patient's AIS were "C" or "D". Our results are similar to those described in the literature. Table 6 summarizes recent works dealing with this subject.

Recent epidemiological studies reported that patients diagnosed with traumatic SCI have more complete lesions. In our study, comparable findings could be seen (61.1% of the T group had complete lesions compared to 11.5% in the NT group, P <0.001). This can be explained by the high velocity and sudden mechanisms in traumatic injuries [12,14].

Length of stay in rehabilitation department is considered as indicator in the outcome assessment. A significant difference was found between the groups in our study.

Patients in NT group had a shorter rehabilitation than those in T group (24 days vs 40 days). Several factors may contribute to a longer rehabilitation for traumatic SCI patients. These factors include the treatment of concomitant injuries and the management of non-specific complications which are more frequently observed [15].

Even consensual and well codified; the management of SCI is still difficult. A multidisciplinary team management approach is mandatory in the rehabilitation of SCI. In addition to the managing physicians; the team should include by a physiotherapist, a dietician, and a psychologist. Training and education of the patient's family improve always the treatment outcome [16].

Table 6: Literature review

		T Group					NT Group				
		total	ASIAA	ASIAB	ASIAC	ASIAD	total	ASIAA	ASIAB	ASIAC	ASIA D
Current study	2018	108	61.1%	6.3%	22.1%	10.5%	69	14.1%	6.3%	38%	40.6%
Anghelescu [22]	2016	346	62.7%	13.9%	13.9%	9.5%	87	24.13%	19.54%	14.94%	41.33%
Derakhshanrad [23]	2016	1137	53.5%	18.7%	17.6%	9.6%					
Rinkaewkan [24]	2015	85	57.6%	12.4%	16.4%	7.5%	115	22.4%	16.9%	21.4%	36.3%
Noreau [6]	2014	1137	42.8%	9.1%	18.3%	15.0%	412	19.9%	3.2%	22.8%	35.9%
Shin[10]	2013	481	51.4%	15.2%	18.1%	15.4%	148	12.2%	6.8%	30.4%	50.7%
Scivoletto [25]	2011	144	51.3%	8.3%	27.8%	12.5%	236	20.3%	7.2%	43.6%	28.8%
Gupta [14]	2008	38	50%	13.1%	13.1%	5.2%	38	28.9%	15.7%	23.6%	31.5

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Early inpatient rehabilitation program aims to teach the patient the daily tasks achievement. This may include the wheelchair use skills, bowel and bladder management, and skin care. The prevention and the management of late complications is considerable part of the treatment.
Urinary tract disorders, pressure ulcers, deep venous thrombosis, spasticity, and depression are frequent and delay patient autonomy recuperation [17].

The use of specific scores simplify the assessment and make from physical examination findings a measurable entity that could be followed up. In our study; FIM scores at the time of admission and after two years were recorded and used as functional outcome measurement tool. The mean MIF was 52.7/126 in T group versus 78 in NT group ($P<0.001$). The significant difference in traumatic SCI patients is attested by all the authors and highlights the severity of pathological lesions as well as the delayed healing in these cases. [18-20]. According to Ditunno; most asked questions asked by patients and their relatives are related to motility function "Will i be able to walk?" [20]. Social and psychological assistance is capital during the walking recovery period [21].
In our study, 38.9% of T group and 89.9% of NT group were walkers. These patients were initially classified AIS "C" or "D". Actually the chance of walking recovery after a SCI can be predicted from the admission time. Patients with complete lesions have very limited chance for full recovery. The prognosis is better for partial lesions in young patients and in the absence of severe associated comorbidity or late complications. The prevention and early diagnosis improve the treatment results is both types of SCI [22].

The WHO recommended three levels prevention strategy to improve functional prognosis of SCI. Primary consist in the control of the leading factors such as road traffic accident for trauma SCI. Secondary prevention aims to ensure an early diagnosis of the injury and an efficient management (complete initial neurological examination, quick screening and early decompressive surgery).

Tertiary prevention aims to minimize durable side effects and to improve patient's re-integration [23-25].

Conclusions:

Understanding of the underlying mechanisms and the control of the leadings factors would help in the development of SCI treatment strategies and enhance neurological recovery.
This report corroborates many previously evident facts; especially the difficulty of the management of traumatic cases. However it showed a comparable treatment results in both types of lesions in an area of very high accidents rate. The rehabilitation is as important as the first given care. It should be driven in a well codified scientific way to ensure a maximum of recuperation. A larger study may allow to avoid statistical bias and give more objective results.

Conflict of interest: none

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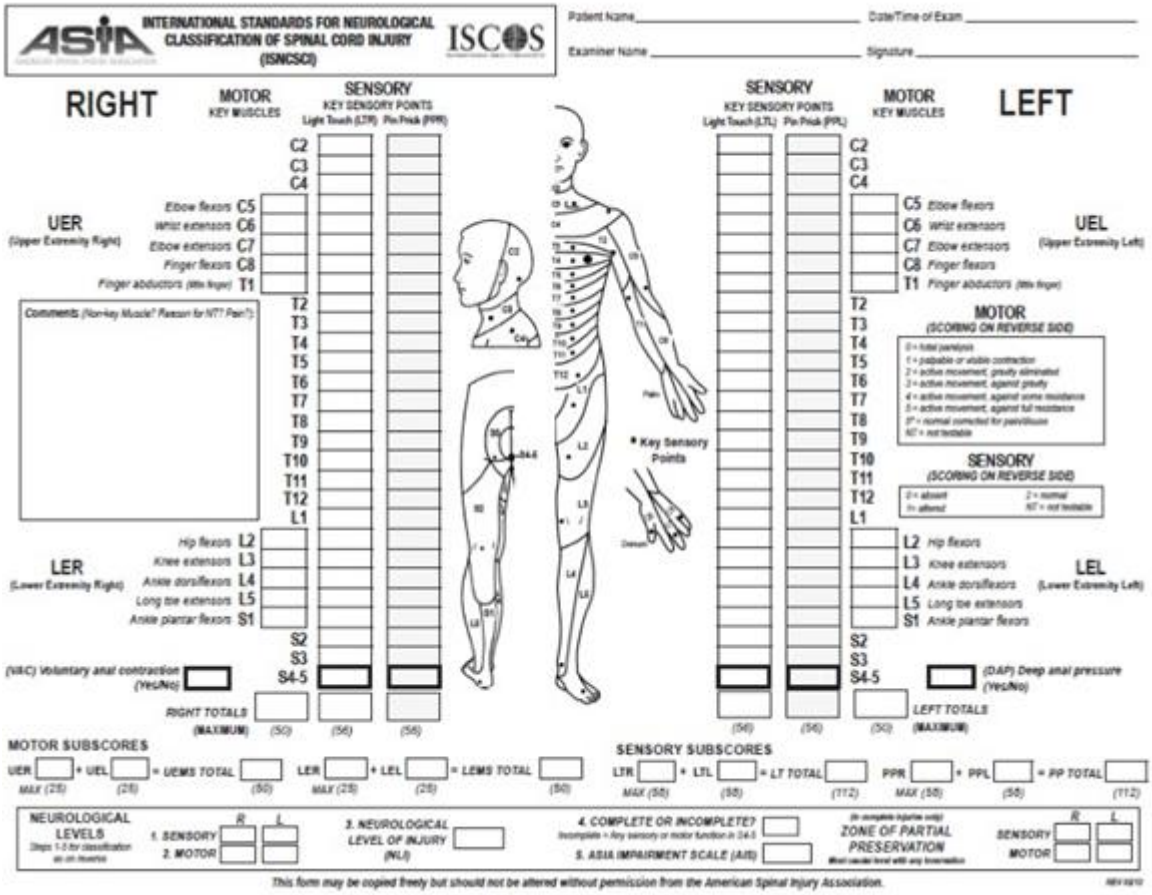
Appendix 1



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Appendix 2

FIM™ instrument

LEVELS		
	7 Complete Independence (Timely, Safely) 6 Modified Independence (Device)	NO HELPER
	Modified Dependence 5 Supervision (Subject = 100%+) 4 Minimal Assist (Subject = 75%+) 3 Moderate Assist (Subject = 50%+) **Complete Dependence** 2 Maximal Assist (Subject =25%+) 1 Total Assist (Subject = less than 25%)	HELPER

	ADMISSION	DISCHARGE	FOLLOW-UP
Self-Care			
A. Eating			
B Grooming			
C. Bathing			
D. Dressing - Upper Body			
E. Dressing - Lower Body			
F. Toileting			
Sphincter Control			
G. Bladder Management			
H. Bowel Management			
Transfers			
I. Bed, Chair, Wheelchair			
J. Toilet			
K. Tub, Shower			
Locomotion			
L. Walk/Wheelchair	W Walk C Wheelchair B Both	W Walk C Wheelchair B Both	W Walk C Wheelchair B Both
M. Stairs			
Motor Subtotal Score			
Communication			
N. Comprehension	A Auditory V Visual B Both	A Auditory V Visual B Both	A Auditory V Visual B Both
O. Expression	V Vocal N Nonvocal B Both	V Vocal N Nonvocal B Both	V Vocal N Nonvocal B Both
Social Cognition			
P. Social Interaction			
Q. Problem Solving			
R. Memory			
Cognitive Subtotal Score			
TOTAL FIM Score			

NOTE: Leave no blanks. Enter 1 if patient not testable due to risk

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