

Functional Outcomes of Patients with Acute Spinal Cord Injury

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Abstract

The purpose of this study was to identify relationships between age, length of stay, the American Spinal Injury Association classification (ASIA) with total functional gain during inpatient rehabilitation for patients with Spinal Cord Injury (SCI) with functional independence and rehabilitation outcomes of traumatic spinal cord patients. The data were obtained for 49 patients with traumatic spinal cord lesions admitted to the neuro physical therapy unit from 2006 to 2008. The mean age was 33 ± 10.63 years.

Study design: Retrospective observational study. The patient's characteristics and outcomes were analysed and compared according to the severity of traumatic spinal cord injuries (SCI) and its appearance according to vertebral level correlations of SCI with co-morbidities was analysed. The Functional Independent measure scores of patient at admission (FIMa) on were compared to Functional Independent Measure scores recorded at discharge (FIMd) to get the total gain for each patient. Patients were grouped according to age, level of neurological injury, length of stay to compare with the total gain. The Length of stay was also compared with the American Spinal Injury Association classification (ASIA) at discharge. The author had been observed that there is negative correlation of LOSa with FIMd and Gain ($r=-0.507$, $p=0.00$ and $r=-0.402$, $p=0.004$), respectively. FIMa is positively correlated with FIMd but negatively correlated to Gain. FIMd is positively related with Gain. The Mean LOSa and LOSr are 44.80 days and 174.37 days, respectively. The Mean FIMa and FIMd are 53.22% and 75.73%, respectively. It revealed that, a significant improvement in FIM at the time of discharge in SCI patients. The differences were found in the extent of functional improvement between subgroups of patients with different levels and extents of lesions. Regarding the outcome of Functional Independent measure better observed in incomplete cervical spinal cord injuries and complete thoracic spinal cord level injuries. Interestingly, independence in bowel management, independent mobility and locomotion were only attained by patients with incomplete lesions. This study provides insight into the functional outcomes of a group of inpatients with traumatic spinal cord injury. More research is needed to determine the specialized rehabilitation program for these patients.

Keywords: Spinal cord injury; Age; Functional independence; Length of stay; Rehabilitation unit

Introduction

Patients with spinal cord injuries (SCI) are confronted with motor and sensory deficits and dysfunction of the bladder and bowel, leading to disabilities in daily activities [1]. In several studies, motor and sensory recovery following traumatic SCI has been quantified, based on the initial level of injury [2]. Functional outcomes are based on knowledge of the sequential organization of spinal segments and the capacity of spared muscle groups to perform specific activities of daily living (ADL) [3]. Therefore, the level of functional independence ultimately achieved by an individual will also be influenced by a variety of medical and non-medical factors, such as age, associated injuries, level of injury, Mechanism of injury, severity of spasticity and financial status [4]. As there was no previous study conducted in Qatar and keeping view of all above studies, the author decided to conduct study of factors influencing Functional Independence and the length of stay of SCI patients in neuro trauma rehabilitation unit of Physical Medicine and Rehabilitation department, Qatar.

The American Spinal Injury Association (ASIA) has recommended the Functional Independent Measure scores of patient at admission (FIMa) be adopted as a universal functional measure for spinal cord injury (SCI) because of its well-defined guidelines, interdisciplinary assessment possible and it covers communication, social and cognitive measures relevant to functional aspects [1]. ASIA [5,6], however, has acknowledged some limitations of the FIMa, noting that its validity in subpopulations with SCI with head injury has not yet been demonstrated. Most authors agree that patients with paraplegia can be more independent in self-care skills. The outcome of bladder and bowel management in patients with spinal cord injuries is comparatively undocumented [7-13].

Patients and Methods

Study setting

This study was conducted between January 2006 and December 2008 and involved retrospectively collected data for SCI patients (≥ 65 years). All patients seen in neuro-rehabilitation unit with spinal cord injury were included provided their functional independence levels were measured. Patient who were not able to participate the study were excluded. Data were collected from patient file, e MR viewer (electronic), and from medical record. The study is complying with the "Records-based study" profile that was described by corresponding section of the Collaborative Institutional Training Initiative. Patients' name and HC-numbers will be used temporarily and only upon data collection and cleaning, so as to prevent duplication and allows proper re-access to the corresponding data to refine them. Both name and HC-number will be deleted immediately after data entry and coding.

Measures

Patient characteristics and outcomes were analysed and compared according to the severity of traumatic spinal cord injuries (SCI) and

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its appearance according to vertebral level correlation of SCI with comorbidities was analysed.

Methods

A sum of 49 patients with traumatic spinal cord injury (SCI) enrolled from the inpatient rehabilitation unit in Rumailah Hospital, Hamad Medical Corporation, Doha-Qatar for the period of two years from Jan 2005 to Dec 2006, were integrated in this study retrospectively. All medical data were obtained from data files sustained by the office of the Physical Medicine and rehabilitation department of the Hamad Medical Corporation. We developed a data-extraction tool that included the medical data on age, nationality, sex, marital status, current occupation, years of education, medical diagnosis, neurological level, comorbidity, time of accident, cause of accident had been included in the study. Data were analyzed using commercially available SPSS version 20. Descriptive statistics were done.

Variables

The dependent variable was gain or Functional Independent Measure scores recorded at discharge (FIMd). The independent variables were age, The Functional Independent Measure scores of patient at admission (FIMa), ASIA at admission, ASIA at discharge and Length of stay in rehabilitation (LOSr).

Furthermore, the Medical Research Center at Hamad Medical Corporation, Qatar, approved the study (IRB# 9091).

Statistical Analysis

Data are presented as proportions, medians, or mean SD as appropriate. The continuous variables were analyzed using Student's t tests or one-way ANOVA wherever applicable. For skewed continuous data, a non-parametric Mann-Whitney test was used. Categorical variables between groups were compared using the chi-square test. We evaluated the associations between SCI and socio-demographic and clinical indicators. We also studied correlation between the Functional Independent Measure scores of patient at admission (FIMa) on were compared to Functional Independent Measure scores recorded at discharge (FIMd) to get the total Gain for each patient. Patients were grouped according to age, level of neurological injury, length of stay to compare with the total gain. Length of stay was also compared with the American Spinal Injury Association classification (ASIA) at discharge. A two- tailed P less than 0.05 was considered significant. All data analyses were carried out using the Statistical Package for Social Sciences version 20 (SPSS Inc., USA).

Results

On an estimated study group included 44 male and 5 female patients in this study. The mean age was 33.94 ± 10.63 years and the range between 14-63 years (Tables 1 and 2). The author have been observed that there is negative correlation of LOSa with FIMd and Gain ($r=-0.507$, $p=0.00$ and $r=-0.402$, $p=0.004$), respectively. Similarly, Muakkassa et al. [14] published that an increased risk of low FIM (OR, 2.21; 95% CI, 1.41-3.45; $P=0.001$) was observed with an increased ratio of Hospital length of Stay (HLOS/RLOS) after adjusting for injury severity score. FIMa is positively correlated with FIMd but negatively correlated to gain. FIMd is positively related with gain. The mean LOSa and LOSr are 44.80 days and 174.37 days, respectively. The Mean FIMa and FIMd are 53.22% and 75.73%, respectively (Table 3).

#	Variables	Category	Number
		Brain	6
		Spinal Cord And Peripheral Nerves	0
		Cardiovascular System	0
		Respiratory System	2
		Structures Related To The Digestive, Metabolism And Endocrine Systems	0
		Urinary System	1
10	Comorbidity (ICF)*	Shoulder Region	5
		Upper Extremity (Arm, Hand)	2
		Pelvis	1
		Lower Extremity (Foot)	3
		Trunk	4
		Skin And Related Structures	0
		Any Other Body Structures	0
		More Than One Comorbidity	7
		No Comorbidity	18
		Driver (RTA)	7
		Passenger In Car(RTA)	7
		Fall From Height	25
11	Mechanism of Accident	Heavy Object Fall On Him	5
		Diving	1
		Violence	1
		Other	3
		A	22
12	ASIA on Admission (ICF)*	B	6
		C	20
		D	1
#	Variables	Category	Number
		A	20
13	Asia on Discharge (ICF)*	B	4
		C	7
		D	18

*ICF check list of the World Health Organization, September 2003

Table 1: Distribution of qualitative characteristics.

	Mean ± SD	Min	Max
Age	33.94 ± 10.63	14.00	63.00
LOSa (Days)	44.80 ± 34.40	10.00	125.00
LOSr (Days)	174.37 ± 117.72	16.00	597.00
FIMa (%)	53.22 ± 15.01	21.00	88.00
FIMd (%)	75.73 ± 16.02	31.00	95.00
Gain (%)	22.51 ± 14.41	0.00	49.00

*Gain is the difference between FIMd and FIMa

Table 2: Descriptive statistics of included variables in the study.

	LOSr	FIMa	FIMd	Gain
LOSa	$r=-0.112$	$r=-0.155$	$R=-0.507$	$R=-0.402$
	$p=0.442$	$p=0.288$	$p=0.000$	$p=0.004$
LOSr		$R=-0.061$	$R=0.068$	$R=0.139$
		$P=679$	$P=0.643$	$R=342$
Gain		$R=-0.407$	$R=0.0518$	-
		$P=0.004$	$P=0.000$	

$P>0.01$

Table 3: Correlations.

Neurological Level	ASIA	Mean Gain	Min	Max
C5	Complete	18.00	2	35
	Incomplete	21.67	0	42
C6	Complete	18.33	9	25
	Incomplete	25.67	18	39
C7-C8	Complete	10.00	10	10
	Incomplete	30.67	24	42
D ₁ -D ₉	Complete	20.86	10	40
	Incomplete	0.00	0	0
D ₁₀ -L ₁	Complete	28.83	9	49
	Incomplete	25.22	0	47
L ₂ -S ₅	Complete	10.00	10	10
	Incomplete	22.00	0	43

Table 4: The relationship between neurological level, extent of impairment (ASIA) and functional gain during inpatient rehabilitation after spinal cord injury.

Age Group (Years)	No.	Mean ± SD of Gain
11-30	23	22.74 ± 16.09
31-40	13	22.85 ± 11.49
41-65	13	23.38 ± 13.44

*Gain is the difference between FIMd and FIMa

Table 5: The relation between age and gain.

Discussion

The complexity of the lived experience of SCI and the variations in that experience around the world mean that, despite being a comparatively low-prevalence condition, SCI has wider implications for monitoring health care. In principle, an individual with SCI will experience nearly every clinical setting that his or her country provides emergency services, intensive care, stabilizing medical care, and particularly rehabilitation, including return to the community and on-going primary care. Beyond the health sector, the individual with SCI will require services, resources and access to the social, educational and economic sectors to lead a full and rich life. Functional Independence Measure (FIM) is often considered the gold standard tool for assessing basic activities of daily living and it consists of two subscales, motor and socio-cognitive in SCI patients [7]. Traumatic spinal cord injury (SCI) is a catastrophic event of every individual life [15] who involved in the accident, which affects his physical, social and psychological spheres. Sekhon et al. [8] reported that the annual incidence of SCI occurs throughout the world varies from 11.5 to 53.4 per million population. Sekhon et al. [8] also indicated in their text that the most common causes of SCI include the following as Motor vehicle accidents (44.5%), fall (18.1%), Violence (16.6%) and Sports injuries (12.7%). Pedro et al. [9] cited the incidence of 1.25 SCI per 100, 000 inhabitants per year in Qatar and the cause were road traffic accidents [9] for 72%, fall from height (FFH) with 13% and falling heavy object on the spine in 9.3%. We observed that FFH is the most common cause than Motor Vehicle Accident (51 versus 28 percent). Heavy object fall accounted for 10 percent. Bracken et al. [10] reported that there was a strong relationship between motor function and functional independence measure (FIM) and depend upon the initial level of injury and its severity. Pollard [11] cited that the younger age group has significant improvement in neurological outcomes. In present study shown that the Spinal Cord Injury occurred most frequently in young adult of age from 20-30. The better improvement occurs between these groups of age as the average gain is 26.21. A recent study from Saudi Arabia [10] reported that the SCI frequency was higher in the 21-30 (40%) and 31-40 (19.7%) age

groups and lower in the 71-80 (2.2%) age group.

It revealed that, a significant improvement in FIM at the time of discharge in SCI patients. The differences were found in the extent of functional improvement between subgroups of patients with different levels and extents of lesions. In our study (Table 4), regarding the outcome of Functional Independent measure better observed in incomplete cervical spinal cord injuries (C7-C8 level) and complete thoracic spinal cord (D1-D9 level) injuries. Although the level of the lesion does not seem to be very important in most studies [11], it is generally accepted that patients with complete lesions above T10 cannot achieve successful independent locomotion [16].

Physical Medicine and Rehabilitation facilities with infrastructure, as an intrinsic part of modern health care delivery services, have received due attention by Ministry of public health authorities, with full born services being made available to all the nationalities and expatriates. Recently, many such modern medical rehabilitation centers were started in Qatar with good facilities. In addition, most sophisticated rehabilitation institute has been operational, including the Sheikh Bin Khalifa Medical City.

Conclusion

SCI is a relatively low incidence but very high-cost health condition. Although it was realized that the sample size was small, this study provides information about patients with spinal cord injuries in Qatar. The Functional independence measurements on discharge (FIMd) have been significant negative correlation with Length of stay on admission (LOSa), but it showed positive correlation with FIMa and Gain. LOSa was shown negative correlated with Gain. This study also revealed that the factors influencing the functional outcome in SCI groups include LOSa, FIMa and Gain. The better improvement in Gain was noted younger age groups (Table 5).

Limitations of the Study

There was lack of information on the training and qualifications of the individuals collecting the SCI data. One important limitation of this review is that we relied on only a few published articles from each country that was available in the literature. Moreover, it is not clear whether hospitals participating in the published studies treat all traumatic SCIs within that country or if there were not any other hospitals in the region that also treat traumatic SCIs. Future Study is till challenging due to the lack of SCI registries in countries, an accurate estimation of the incidence and epidemiological patterns of SCI is not feasible. There is a need for large national epidemiological surveys to assess the incidence, prevalence and etiology of SCI.

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