
FUNCTIONAL ASSESSMENT OF PEOPLE WITH SPINAL CORD INJURY: USE OF THE FUNCTIONAL INDEPENDENCE MEASURE - FIM¹

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ABSTRACT: Spinal cord injury usually occurs from trauma, causing serious disturbances for the individual, the family, and society at large, and is considered a serious public health problem. The aim of this research was to investigate functional gain in people with traumatic paraplegia participating in a rehabilitation program, by applying the Functional Independence Measure Scale. This is a retrospective cross-sectional, quantitative and descriptive study, with analysis of 228 medical records. We used Statistical Package for Social Science software, version 13 for Windows, with specific statistical tests. There was average functional improvement in all categories of body care, sphincter control, transfers, locomotion and stairs. The smallest functional gain occurred in the items feeding and toileting. Rehabilitation promotes gains in functional independence, since there was an average increase in functional gain of people with spinal cord injury.

DESCRIPTORS: Rehabilitation. Paraplegia. Epidemiology. Nursing.

AVALIAÇÃO FUNCIONAL DE PESSOAS COM LESÃO MEDULAR: UTILIZAÇÃO DA ESCALA DE INDEPENDÊNCIA FUNCIONAL - MIF

RESUMO: A lesão medular geralmente ocorre por trauma, ocasionando sérios transtornos ao indivíduo, família e para a sociedade, sendo um problema grave de saúde pública. O objetivo desta pesquisa foi investigar o ganho funcional de pessoas com paraplegia traumática, participantes de um programa de reabilitação, através da aplicação da Escala de Medida de Independência Funcional. Trata-se de um estudo transversal retrospectivo, quantitativo e descritivo, com análise de 228 prontuários. Foi utilizado o software *Statistical Package for the Social Science* versão 13 para Windows, com testes estatísticos específicos. Os resultados apontam que ocorreram ganho funcional médio em todas as categorias de cuidados com o corpo; controle dos esfíncteres; transferir-se; locomoção e escadas. O menor ganho funcional ocorreu no item alimentar-se e toalete. A partir deste estudo conclui-se que a reabilitação promove ganhos na independência funcional, sendo fundamental para a recuperação e autonomia das pessoas com lesão medular.

DESCRIPTORIOS: Reabilitação. Paraplegia. Epidemiologia. Enfermagem.

EVALUACIÓN FUNCIONAL DE PERSONAS CON LESIÓN DE LA MÉDULA ESPINAL: EL USO DE LA ESCALA DE INDEPENDENCIA FUNCIONAL - MIF

RESUMEN: La lesión de la médula espinal generalmente tiene el traumatismo como causa, originando serias molestias en el individuo, su familia, y sociedad. Es grave problema de salud pública. El objetivo de este trabajo fue investigar la ganancia funcional para personas con paraplejía traumática, participantes de un programa de rehabilitación, a través de la aplicación de la Escala de Medida de Independencia Funcional. Se trata de un estudio transversal retrospectivo, cuantitativo y descriptivo, con análisis de 228 registros. Se utilizó el programa *Statistical Package for Social Science*, versión 13 para Windows, con determinadas pruebas estadísticas. Los resultados muestran que la ganancia funcional promedio se produjo en todas las categorías de cuidado del cuerpo, control de esfínteres, traslado, caminar y escaleras. De este estudio se concluye que la rehabilitación promueve mejoras en la independencia funcional es fundamental para la recuperación y la independencia para las personas con lesión de la médula espinal.

DESCRIPTORIOS: Rehabilitación. Paraplejía. Epidemiología. Enfermería.

INTRODUCTION

Spinal cord injury results in dramatic alterations in the life of the person, due to changes in body dynamics and the abrupt transformations through which the patient, their family and their closest social group pass. This leads them to adopt a different lifestyle to adapt themselves to the new situation. There are several resulting changes, impacting on bladder and bowel elimination, skin and soft tissues, articular structures, expression of sexuality, nutritional requests, as well as those impacting on the professional and emotional life and consequently the productivity of everyone involved. After suffering a spinal cord injury, the person needs to (re)learn the simplest things, such as dressing, feeding and bathing, to the more complex, such as going up and down stairs, and relating to themselves. Actions that before could be performed with ease and without any reflection, acquire another quality after the spinal cord injury, making the patient's quotidian a succession of obstacles to overcome.

A spinal cord injury can be evaluated through the level of compromise and the classification scale. Regarding the level, quadriplegia can be the result, in which there is impairment of all four, upper and lower limbs, usually the result of a neck injury, or paraplegia, in which there is compromise of the lower limbs. The classification scale of the American Spinal Injury Association (ASIA), standardized the classification of spinal cord injury by evaluating the motricity and sensitivity between thresholds A to E, in which: ASIA A corresponds to (complete spinal cord injury); ASIA B to (complete motor and incomplete sensory injury); ASIA C to (incomplete motor and sensory injury) and ASIA D to (incomplete injury with motor function preserved below the level of the injury).¹

Rehabilitation is the area responsible for enabling the person to train in new skills that make it possible to confront these everyday obstacles. Rehabilitation is to recover an ability that was lost and, therefore, the work of a multidisciplinary team is essential, involving professions from various fields - human, biological and the exact sciences.² In the last decade research into spinal cord injury has progressed on some fronts, especially in rehabilitation for life, providing quality of life for people with spinal cord injuries and enabling them to return to activities carried out before its occurrence, among these work, leisure, sexuality and independence in performing daily activities. Experimental studies also indicate prospects for

these people. Among these there is work with embryonic stem cells, aiming for spinal cord regeneration and recovery of the lost sensory-motor functions. There is also research with equipment called exoskeletons, the primary function of which is to enable the movement of the person without the return of motor or sensory function. All these fronts configure major spaces for science.³⁻⁶

The need for measuring the success in the rehabilitation of people with motor, cognitive and sensory deficits contributed to various scales being created to measure the functional capacity, among which, the Pulses Profile, the Katz Index of Independence in Activities of Daily Living (ADLs), the Barthel Index, and the Functional Independence Measure (FIM) in Portuguese can be mentioned.⁷ Although the FIM is little used in Brazil, there are studies showing its relevance and applicability in people with spinal cord injury.⁸⁻⁹ This scale has also been applied successfully to evaluate other populations, such as the elderly.¹⁰

Functional evaluation is understood as the designation given to a specific function, the ability to perform self-care and to meet the basic daily needs, i.e., activities of daily living (ADLs). The FIM measures functional capacity and independence, estimating the degree of difficulty or limitations attributed to each person. The scale was developed in the 1980s by a team from the United States, organized by the American Academy of Physical Medicine and Rehabilitation and the American Congress of Rehabilitation Medicine, with the aim of creating an instrument capable of measuring the degree of independence of people with disabilities to perform motor and cognitive tasks, and was validated in 1986.¹¹

The translation and validation of the FIM were performed in Brazil¹² based on the original version of the manual in English and the Portuguese language version developed in Portugal, and followed the guidance of the World Health Organization (WHO). The process included a translator and bilingual medical personnel, familiar with the nature of the study, with the conceptual rather than strictly literary translation being emphasized. A version of the instrument in Portuguese was created and translated back to English, and no conflicts of interpretation were found, as the initial translation process already included the acceptance of terms that could be sources of confusion. The cultural equivalence, according to the study, was conducted with 25 health professionals formally trained in its applica-

tion and linked to rehabilitation centers in various Brazilian states.

The Functional Independence Measure (FIM) scale is a multidimensional instrument that evaluates the performance in the motor and cognitive/social domains, considering the aspects: feeding, personal hygiene, bathing, dressing the upper body, dressing the lower body, using the toilet, urine control, fecal control, transfers to the bed, chair and wheelchair, transfer to the toilet, transfer to bath or shower, mobility, mobility on stairs, comprehension, expression, social interaction, problem resolution and memory. Each item is scored on a scale from one to seven, with seven indicating total independence and one indicating total dependence. The intermediate values cover modified independence (score six), moderate dependence with the need for supervision or preparation (score five) or with the need for direct help (scores one to four). Regarding the complete scale, a person without any disability will achieve the score of 126 points and one with total dependency a score of 18 points. The more dependent the lower the score.¹³ The FIM measures what the person is doing exactly at the time of evaluation.

The functional evaluation is carried out so that the personal care and the performance of the individual in activities of daily living can be assessed. For this, the score of the scale using the 18 aspects directs the interdisciplinary team in the planning of the goals to be achieved for the patient's independence or to train the family, observing and highlighting the patient's preserved ability and the possibilities of intervention. It is administered by a previously trained healthcare professional, with its implementation recommended at two moments: on admission or within the first 72 hours, and at the time of hospital discharge, usually 72 hours before the departure of the patient.¹⁴

Although the development of the functional independence of the person with spinal cord injury is the paramount goal within a rehabilitation program, little is done to evaluate the potential for growth and efficacy of these programs in the context of rehabilitation. One of the advantages of the application and use of the FIM is the ability to set goals and objectives at the time of the admission of the person into the rehabilitation program and the modification of these goals and objectives according to their development and effective participation in the program until the moment of their discharge.

Knowing the functional independence of people with spinal cord injury participating in the rehabilitation services allows these services to reorganize to meet the demands of this population more efficiently. It enables monitoring of the progress of the patients in their rehabilitation process, contributing to the refinement of the therapeutic interventions and the verification of gains until a reduction is established in the velocity of the acquisition of improvements.¹² The FIM is used to quantify the effective improvement within a rehabilitation program and, due to being a standardized instrument, is more used in rehabilitation.¹⁴ The evaluation of the results of a rehabilitation program through the FIM allows work with the development of the program, making it possible to establish functional goals according to each person, in order to reinsert them as soon as possible, enabling them for family and social life. To evaluate the functional capacity of people with spinal cord injuries provides members of the healthcare team with a more accurate view of the degree of independence of each person.

In Brazil, apart from the previously mentioned studies, there is a lack of other, basic studies evaluating the functional improvement of people with spinal cord injury in rehabilitation programs, particularly to answer key questions such as: did the person, after attending a rehabilitation program, obtain some success in performing everyday activities? In which areas? How can this success be measured?

In this sense, the present study was conducted with the aim of filling this gap, evaluating the functional independence of people with spinal cord injury treated at a rehabilitation center of national reference, considering the aspects: ability to perform bodily care (eating, getting ready, bathing, dressing upper body, dressing lower body and using the toilet); sphincter control (bladder and bowel control); transfer (bed, chair, wheelchair, toilet, bathtub or shower), and mobility (walking, wheelchair, going up and down a flight of stairs). In this study the items of the motor domain were used, without evaluated the items of the cognitive/social domain, since people with spinal cord injury, without associated brain trauma, do not generally exhibit such changes.

MATERIALS AND METHOD

This was an exploratory and descriptive, cross-sectional, retrospective study with a quantitative approach, which aimed to investigate

changes in FIM scores, in the aspects related to the bodily care, of people with spinal cord injury hospitalized in a rehabilitation center in northeast Brazil considered a national reference center. The Institution possesses computerized patient records in which the professionals record patient information, the actions taken and the progress.

Regarding the study population, the patient records were selected of people with spinal cord injury who were enrolled for the first time into the Spinal Cord Injury Rehabilitation Program, during the period from 1st January 2002 to 31st December 2005. The inclusion criteria were as follows: patients with traumatic paraplegia, who remained in the program for a minimum of 15 days and maximum of 90 days and completed the rehabilitation program provided, as established by the Uniform Data System for Medical Rehabilitation.¹⁴ This last criterion was necessary because some patients entered the rehabilitation program, however, this was interrupted by clinical events, not allowing the final evaluation of the FIM, only the initial one. The exclusion criteria were, to have acquired the injury other than by trauma, to have previously performed a rehabilitation program in any institution, to have high spinal cord injury - quadriplegia; and/or to also have brain damage. Data were collected during the months of September and October 2006, from all the patient records that fulfilled the inclusion and exclusion criteria. The population consisted of 228 patient records.

For the statistical analyzes, descriptive evaluations of the sociodemographic and clinical data were initially conducted, with frequency distribution, as well as calculating measures of position and dispersion. A level of significance of 5% was used for the inferences. With the aim of comparing the FIM scale before and after the rehabilitation program, the paired Student t test was used, comparing dependent samples through the means of the data, due to the normal distribution according to the *Kolmogorov-Smirnov* normality test.

To evaluate the level of correlation between the functional independence gain and the variables of age, length of hospitalization and time of the injury, Pearson's correlation coefficient was used. For the variables education and the ASIA scale Spearman's nonparametric coefficient was applied. The ratio of the difference in gain between admission and discharge, by the number of days hospitalized was considered as the efficiency index.

The mean degree of independence was compared with the etiology of the injury, the injury

level and the ethnicity using the ANOVA (Analyses of Variance) test. To verify the degree of homogeneity of the degree of independence between the groups, Levene's test was used. When the difference was not significant, the Tukey's post-hoc test was applied. The categorical variables were dichotomized, days in the hospital, companion and gender were compared with the degree of independence and analyzed using the Student's t test for independent samples. The project was submitted to the Research Ethics Committee of the Institution where the research was conducted, being approved by letter issued on 06/09/2006. This study involves no conflict of interest.

RESULTS

A total of 228 records were analyzed, of which 193 (84.6%) were of males and 35 (15.45%) of females. Of these the predominant age group was 20 to 31 years, with 96 cases (42.1%), followed by the group 31 to 42 years, with 63 events (27.6%). Regarding the injury, data related to the ASIA scale, etiology, time since injury, motor level and length of stay were evaluated, according to table 1.

Table 1 - Characteristics of the sample related to the injury. Fortaleza-CE, 2006

Characteristics	n	%
ASIA scale		
"A"	163	71.5
"B"	23	10.1
"C"	20	8.8
"D"	22	9.6
Etiology of the injury		
Traffic accident	67	29.4
Aggression (knife attack and others)	11	4.8
Impact by object	07	3.0
Injury by firearms	114	50.0
Fall	29	12.8
Time since injury (months)		
<= 12	70	30.7
12.01 – 24.00	42	18.4
24.01 – 36.00	24	10.5
36.01- 48.00	12	5.3
48.01 – 60	12	5.3
60.01+	68	29.8
Motor level		
T1 - T6	85	37.3
T7 - T12	99	43.4
Lumbar	31	13.6
Thoracolumbar transition	13	5.7

Length of hospitalization (days)		
<= 20	07	3.1
21 – 27	32	14.0
28 – 34	112	49.1
35 – 41	58	25.4
42 – 48	17	7.5
49 +	02	0.9

Predominant among the study population were the ASIA A (71%) classification of the injury,

etiology of injury by firearms (50%), time since injury of less than 12 months (30.7%) or greater than 60 months (29.8%), lower thoracic motor level T7 - T12 (46%), length of hospitalization from 28 to 34 days (49.1%) and without the presence of a companion during the hospitalization (95.2%).

Regarding the FIM aspects evaluated in the study, the results are summarized in table 2, showing the motor domain with minimum, maximum and mean scores at admission and discharge.

Table 2 - Relationship of gain in the FIM scale at admission and discharge. Fortaleza-CE, 2006

FIM items	Admission			Discharge			Average gain
	Minimum	Maximum	Average	Minimum	Maximum	Average	
Bodily Care							
Eating	5.00	7.00	6.96	7.00	7.00	7.00	0.04
Personal hygiene - toilet	4.00	7.00	6.88	5.00	7.00	6.98	0.10
Bathing	1.00	7.00	5.17	3.00	7.00	6.70	1.53
Dressing the upper body	1.00	7.00	6.59	6.00	7.00	6.97	0.38
Dressing the lower body	1.00	7.00	3.87	1.00	7.00	6.34	2.47
Post-elimination hygiene	1.00	7.00	4.75	1.00	7.00	6.63	1.88
Sphincter control							
Bladder control	1.00	7.00	2.66	2.00	7.00	5.84	3.18
Bowel control	1.00	7.00	3.15	1.00	7.00	5.96	2.81
Transfers							
To and from the bed	1.00	7.00	4.02	1.00	7.00	6.29	2.27
To and from the toilet	1.00	7.00	3.67	1.00	7.00	6.02	2.35
To and from the shower	1.00	7.00	3.08	1.00	7.00	4.94	1.86
Mobility							
Wheelchair/walk	1.00	7.00	4.89	1.00	7.00	6.05	1.16
Stairs	1.00	6.00	1.31	1.00	7.00	1.53	0.22
Mean length of stay							33 days
General efficiency index							0.62 points

Regarding the data contained in tables 1 and 2, it can be affirmed that the mean FIM gain, i.e., the difference in the mean of the score at discharge and the mean of the score at admission, divided by the mean number of days of hospitalization, produced a general efficiency index of 0.62 points, distributed unequally in different aspects. Sphincter control and transfers were prominent with higher gains and eating, personal hygiene, toilet and dressing the upper body with lower gains.

When personal characteristics and those of the injury are related with the gain in functional independence, it was found that female patients presented a higher mean gain than men, but with no significant difference ($p=0.690$). Likewise, there were no significant differences in education or

the etiology of the injury with gain in functional independence.

The following resulted in significant associations: Regarding the age group, there was a greater functional gain in the age group of up to 20 years; regarding the level of the motor injury, it was found that there difference in functional independence gains between the injury levels ($p<0.05$). For this, three groups were listed related to the level of injury: the thoracic (upper and lower), the thoracolumbar transition and the lumbar. The mean FIM gain presented the following sequence, from lowest to highest: thoracic (upper and lower), thoracolumbar transition and lumbar. In relation to the classification of the injury (ASIA), this study showed an inverse relationship between the clas-

sification (ASIA A, B, C, D or E) and the functional gain, i.e.: the more severe the injury, the greater was the functional gain acquired ($p < 0.05$). Likewise there was a significant association between the FIM gain and time since the injury.

DISCUSSION

The mean FIM gain of 0.62 found in this study is in line with other studies that showed an improved motor score after hospitalization.¹⁶⁻¹⁷ This finding highlights the importance of rehabilitation for the functional independence of people with spinal cord injury. In this sense, the use of the FIM allowed the gain in functional independence of hospitalized people to be measured, indicating the domain where this gain occurred and thus directing the multidisciplinary rehabilitation actions performed during the hospitalization period.

The FIM gain did not occur evenly among the different participants, with age (under 20), level (lumbar), classification (ASIA - A), and time since injury, found to be significantly associated with greater functional gain. In Brazil there are many studies that investigate the sociodemographic characteristics of people with spinal cord injury,^{8,14,16-18} however, there is a lack of studies that associate FIM gain with any of the previously mentioned characteristics. In this sense, the analyses performed here have more value for clinical rationale than for the comparison with other studies.

Concerning the age and FIM gain variables, it appears that there is a greater possibility of readaptation (physical, mental, social, emotional and spiritual) for those with lower ages. As spinal cord injury implies a readjustment of the subjects in their integrality, age becomes an important aspect in gaining independence. The contrary was not investigated, i.e., the older the patient, the lower the gain, which deserves further studies.

For the analysis of the variables: injury level and FIM gain, the number of physical aspects involved in the spinal cord injuries must be considered: the higher the injury, the greater the total compromise of the body (sensory and motor, including the proprioception and balance mechanisms). Thus, the higher the injury, the greater number of skeletal muscle mechanisms involved that must be recovered to achieve functional independence. Because the FIM measures independence for the realization of simple activities, which, however, involve complex bodily mechanisms - more involved in high injuries, the gain

is greater in patients with lower injuries: lumbar, followed by thoracolumbar, followed by thoracic.

Another aspect is the reasoning in relation to the classification of the injury and the FIM gain. It was found that ASIA A (complete injury) patients had greater gains than the others (B, C or D - incomplete) It is understood that this finding may be due to there being a greater loss with complete injury, with a lower FIM score when hospitalized. Rehabilitation enables the combination of remaining unaffected body reinforcements, leading to the recovery of other limbs in order to perform tasks in a less dependent way. In other words: with incomplete injury there is less loss of independence, and consequently less possibility of gain. Unlike this study, another held in Portugal, reported better recovery in patients with incomplete spinal cord injury, particularly in those classified as C in the ASIA scale.¹⁹ The difference between the two studies was that the second data collection moment of the Portuguese study was after three years of rehabilitation, while in the present study this was at the end of the hospitalization period.

The finding that the time since injury has a significant association with FIM gain, being fundamental to the rehabilitation activity, confirms the findings of other studies.^{2,19} However, this differs from the findings of a study conducted in the municipalities of Greater São Paulo, which showed that the time since injury influences the functional independence without the need for rehabilitation,¹⁶ i.e., it was shown that 13 months after the injury, the FIM had similar values in people who participated in rehabilitation programs and in those who did not participate. It is understood, however, that early rehabilitation is essential and influences the prognosis for the functional independence of a person with spinal cord injury.

Table 2 contains the FIM scores according to the domains, guiding the work of the healthcare and nursing team in the rehabilitation, indicating which actions are necessary for people with spinal cord injury to gain independence. A study showed that people with spinal cord injuries have more difficulty regarding mobility, e.g., going up and down stairs,¹⁸ corroborating data from this study, which detected this as a great difficulty, with lower FIM scores in the following aspects: going up and down stairs, bladder and bowel control, the transfers, and dressing the lower body. All these domains highlight the importance of the nursing work, the care for the independence of the other, especially in vesico-intestinal retraining, a deter-

minant of the quality of life of people with spinal cord injury.²⁰ Through the rehabilitative practice, it appears that this gain was influenced by the acquisition of knowledge in relation to the care of the bladder, through classes on vesical retraining conducted by the institution with the intermittent catheterization program in the majority of cases, through vesical retraining classes and daily learning on the ward regarding bladder care. The mean FIM gain obtained for this domain – 3.18 for bladder control and 2.81 for bowel control, indicates the quality of the nursing work of the research institution and the progress obtained by the person with spinal cord injury regarding their functional independence, as well as reinforcing the FIM instrument as a parameter for the provision of nursing care.

The domain dressing the lower body, with the gain in the FIM score of 2.47, showed that almost all of the patients had become independent by the discharge, reinforcing the importance of nursing work for self-care and the need for the multidisciplinary planning of the rehabilitation process, in which each profession contributes individually and collectively to the functional independence of a person with spinal cord injury.

Although the variables that led patients to achieve a greater gain in the bodily care item were not verified, this can be observed from the daily care provided and the experience in the area, with innumerable aspects involved in this domain, ranging from the motor level of the injury to the functional adaptations performed in the location where there the daily bodily hygiene takes place. This aspect indicates the need for further studies aimed at environmental accessibility, an issue that goes beyond the individual work of the nursing and rehabilitation professionals.

The item with the lowest functional gain was feeding, registering a mean gain of 0.04. This is explained by the fact that the majority of the patients presented prevalence of injuries below T7-T12, not presenting difficulties in the hospitalization. Spinal cord injury does not prevent the pincer grip, nor hinder the movement of the upper limbs and extremities, essential for independence related to feeding.

Evaluating the group for mobility, it was found that despite gains occurring, these were small, with the item related to going up and down stairs the one with the lowest FIM gain, already presenting a very low score on admission. This finding is similar to those of other studies that

suggest this item as one of the most limiting^{16,18} for people with spinal cord injury. Again, the need for public policies regarding accessibility becomes apparent. These policies should compensate for the limitations resulting from spinal cord injury and transcend the work of the multidisciplinary rehabilitation team.

CONCLUSION

The use of the FIM as an evaluation instrument for the rehabilitation of people with spinal cord injury proved to be important in this study since it showed which domains of functional independence change with the practice of the rehabilitation team. Particularly for nursing care, the FIM can direct actions aimed towards independence of people with spinal cord injury, with regard to self-care, especially sphincter control, hygiene, feeding and getting dressed. These points are essential so that the person with spinal cord injury can face the limitations imposed by the new condition.

The rehabilitation of people with spinal cord injuries to their new condition of life depends on how that person regards their new life, especially their rehabilitation, which should start and be conducted by a multidisciplinary team in order to restore the full functional capacity, conforming to its potential, quickly reinserting the person into the community, with quality of life.

Considering the complexity of the spinal cord injury topic, it appears that this study has some limitations, among which the following are highlighted: study based on computerized medical records, where sometimes the information may be underreported; shortage of articles, both national and international, related to the topic studied; and study performed in a single Rehabilitation Center, causing a bias in the sample, since the representation studied was composed only by clients who participated in the rehabilitation program at this Center.

The following points are emphasized as suggestions for further studies, the importance of performing studies articulating the FIM to the nursing care in rehabilitation; and studies to correlate the FIM scores in the various aspects of the motor domain with the variables: time since injury, physical activity, level and classification of injury. The necessity for the development of research into the factors that affect the non-improvement of the scores after completion of nursing care is also indicated.

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