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Functional assessment of patients with spinal cord injury: measured by the motor score and the Functional Independence Measure

Tetsuo Ota, Kazuto Akaboshi, Masaaki Nagata[1], Shigeru Sonoda, Kazuhisa Domen, Masaru Seki and Naoichi Chino

Department of Rehabilitation Medicine, Keio University School of Medicine, 35 Shinanomachi, Shinjuku-ku, Tokyo, Japan; [1]Department of Rehabilitation Medicine, National Murayama Hospital, 2-37-1 Gakuen, Musashimurayama, Tokyo, Japan

There is some information about the Functional Independence Measure (FIM) score of patients with spinal cord injury (SCI), but there are a few publications dealing with the relationship between the FIM score and the motor score of the American Spinal Injury Association (ASIA). We have studied the relationship of all FIM items with the motor score, and reviewed the disability of patients with spinal cord injury in greater detail. The purpose of this study was to describe the characteristics of impairment and disability in patients with SCI, using the FIM and motor score of the ASIA. The subjects were 100 inpatients with SCI (Frankel A, B). Neurological level, days from the onset, and the FIM were examined. In addition to these items, the ASIA motor scores were calculated for 22 tetraplegic patients. We investigated the relationships among these various respects. We also examined the changes of the physical items of the FIM score (physical FIM) over time for 18 patients. The mean FIM scores of those with tetraplegia with C4, C5, C6, C7, C8 lesions, and those with paraplegia with above T5 levels, and those below T6 were 35, 61, 82, 90, 116, 114 and 114 respectively. The FIM score reached the plateau in approximately 10 months, 6 months and 3 months post-injury, in tetraplegia, paraplegia above T5 and that below T6 respectively. The FIM scores in C6 patients were widely distributed from 56 to 104. On the other hand, the ASIA motor score could subdivide C6 patients and related well to the FIM score. The mean FIM scores for each neurological level were similar to those previously reported, thus they appeared to be plateau scores. With regard to the motor score, we feel that it could reflect the disability of the patients better than considering the neurological levels alone. Also considering the changes in the physical FIM score over time within a year from the onset of the injury, there were differences in the ADL improvement patterns among patients with different neurological levels. It appears that timing of the highest physical FIM improvement for each neurological level can exist. Thus it is important not to delay the start of the rehabilitation of patients with spinal cord injury in proper time.

Keywords: spinal cord injury; Functional Independence Measure; American Spinal Injury Association (ASIA) motor score; disability; rehabilitation

Introduction

The degree of disability of patients with a spinal cord injury can be roughly assessed by neurological examination, but it varies from patient to patient. We have assessed level of disability using the Functional Independence Measure (FIM).[1] Though there have been some studies denoting the relationship between the neurological level of patients with spinal cord injury and FIM scores,[2] as far as publications concerned with the relationship between the FIM scores and the motor scores of the American Spinal Injury Association (ASIA),[3] there are only those dealing with FIM selfcare items.[4] Therefore, we have studied the relationship for all of the FIM items, and have reviewed the disability of spinal cord injury patients in greater detail.

Correspondence: Tetsuo Ota

Subjects

Our study was of 100 patients with spinal cord injury who were admitted to the National Murayama Hospital for rehabilitation between January 1990 and July 1995. The sample included those with motor complete paraplegia or tetraplegia patients with Frankel A and B. Of the 100 patients, 84 were men and 16 were women, with an average age of 35.

The neurological levels varied; 3 at C4; 15 at C5; 16 at C6; 11 at C7; 3 at C8; 16 with a thoracic spinal cord

injury above T5; and 36 with such a lesion below T6. On the average, 29 months had passed since the time of the injury.

Methods

We recorded the months from the onset of the injury and the final FIM scores of 87 patients. Then we rated the ASIA motor scores of 22 tetraplegic patients who were admitted to the hospital after April 1993. At each neurological level, we examined the relationship between the months from the onset of injury and the FIM score, the neurological level and the FIM score, and the motor score and the FIM score. We also examined changes of the physical items of the FIM score (physical FIM) over time for 18 patients who were admitted to the hospital after May 1994.

Results

The relationship between the number of months from the onset of the spinal cord injury and the total FIM score (total FIM) is shown in Figure 1. The left graph plots nine patients with C7 lesion, and the right denotes 16 patients with thoracic cord injuries above T5 (~T5). The number of patients with the months from the onset not exceeding 12 was small. But in both paraplegic and tetraplegic patients the majority of the total FIM scores reached a plateau in 10 months from the onset of the injury and showed no marked subsequent changes. Similar results were obtained for other neurological levels.

The mean FIM score (total FIM) at each neurological level is shown in Figure 2. The mean FIM scores of those with tetraplegia with C4, C5, C6, C7, C8 lesions, paraplegia above a T5 lesion, and that below T6 were 35, 61, 82, 90, 116, 114 and 114 respectively. In those with a cervical lesion, the more caudal the neurological level, the higher was the FIM score. Although we classified thoracic injuries into two groups, above T5 paraplegic patients whose abdominal muscles (important for body support) were paralysed (upper spinal cord injuries group), and below T6 paraplegic patients whose abdominal muscle nerve supply were intact (lower spinal cord injuries group), we found no significant difference in the FIM scores between the two groups.

Figures 3 through 6 show the changes in the patients' FIM scores as they proceeded with their rehabilitation. Figure 3 also shows the changes of physical FIM over time of seven patients with a C5 lesion, Figure 4, three patients with C6, Figure 5, three

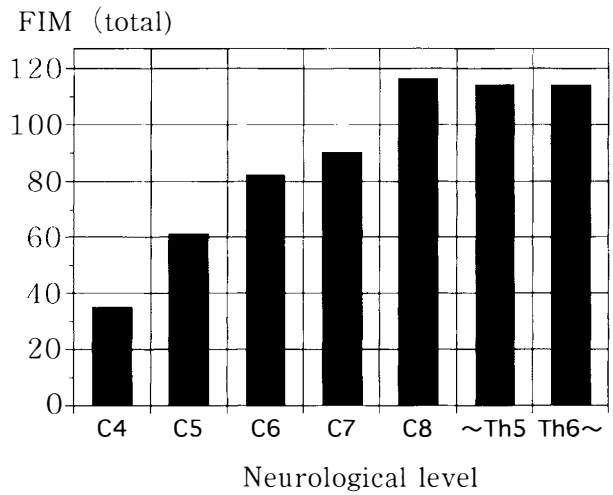

Figure 2 Mean FIM scores by the neurological level

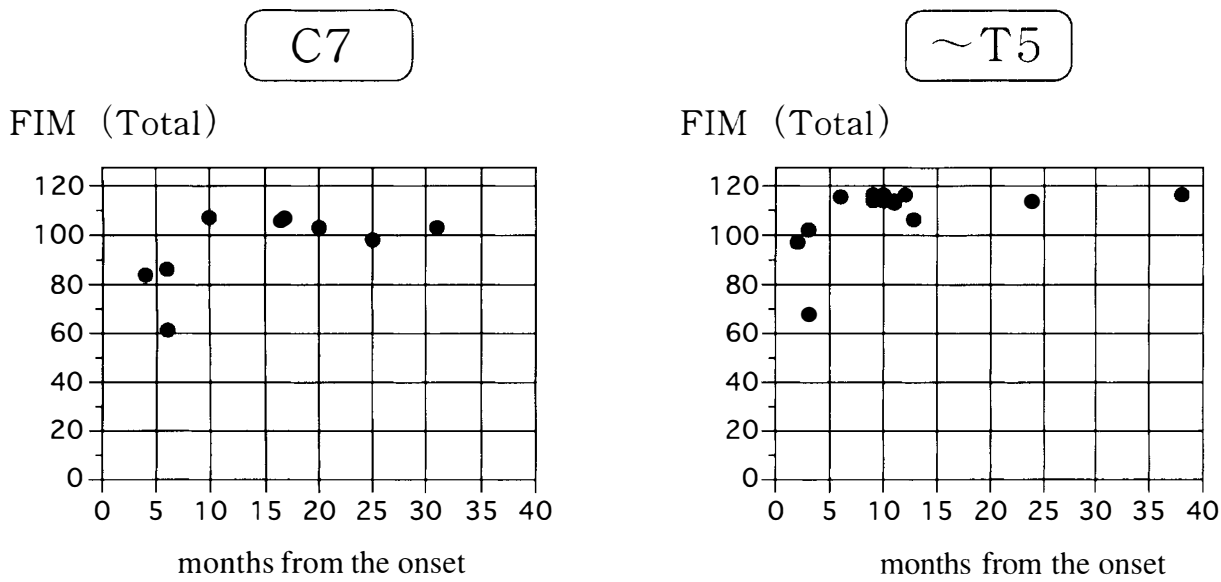

Figure 1 Relationship between the FIM score and months from onset of the SCI

paraplegic patients with a lesion above T5, and Figure 6, five with their lesion caudal to T6 level. The horizontal axis shows the number of months after the onset of injury. All of the C5 lesion patients were assessed less than 5 months after the onset of their injury, and if there were no problems with social cognition and communication in the FIM, it was considered that the physical FIM would show improvements persisting into the future, in view of the average scores shown in Figure 2. Among the C6 level patients, the average physical FIM was about 50 with one patient showing rapid improvement in the ADL level. This patient was a 15 year old male, perhaps in a favorable age and sex category. Among the paraplegic patient group with a lesion above T5, the physical FIM nearly reached a plateau before 7 months after the onset of injury. A patient who was admitted to our hospital 10 months after the onset of injury and who had little rehabilitation, showed improvement in the physical FIM – after beginning active rehabilitation – at the same rate as those who had started rehabilitation at an early stage after the onset of injury. Among the paraplegic patients group with a lesion below T6, improvement in the physical FIM was even quicker than in the group with a lesion above T5, and it was considered that the physical FIM would reach a plateau in a 2 to 4 month period.

As regards the distribution of the physical FIM scores at each neurological level, the FIM scores varied to some extent at the same neurological level (Figure 7). In particular, those with a C6 lesion varied widely, ranging from 56 to 104.

Figure 8 shows the relationship between the motor score and the physical FIM among 22 tetraplegic patients whose motor scores were assessed. The solid circle indicates scores of C6 patients. The distribution of the motor scores was from 14 to 27, which allowed the further subdivision of C6 level patients with different physical FIM scores, but at the same injury level. The open circle indicates the distribution of other patients who were given motor scores. The higher the motor score, the higher was the FIM score, correlation 0.93.

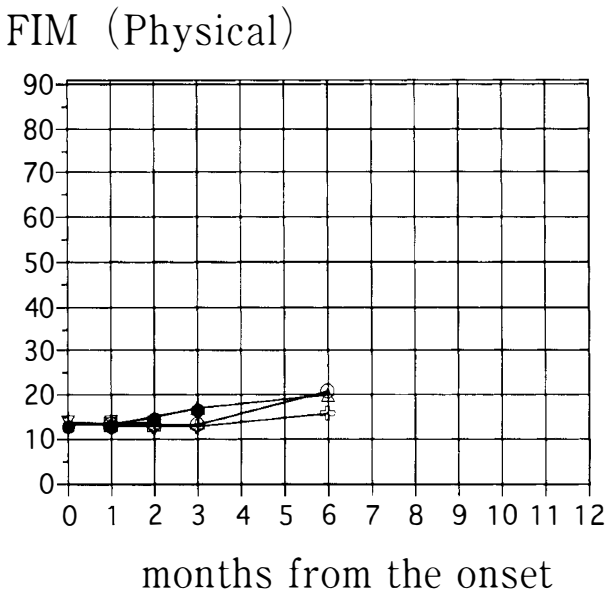

Figure 3 Changes in the patients' physical FIM score (each line indicates seven C5 patients change)

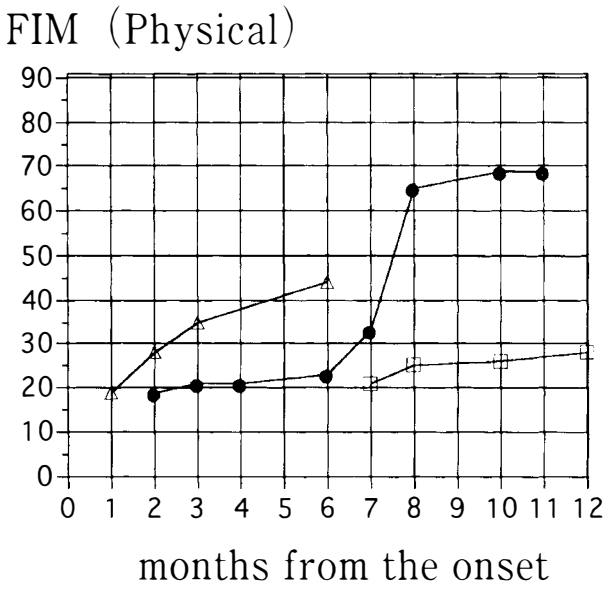

Figure 4 Changes in the patients' physical FIM score (each line indicates three C6 patients change)

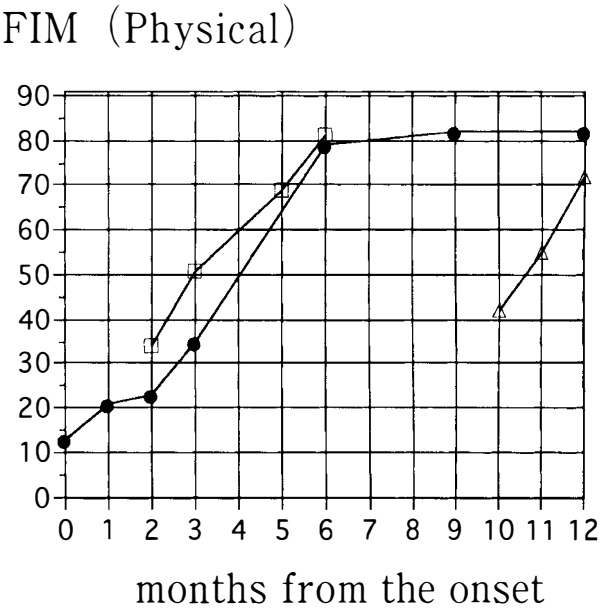

Figure 5 Changes in the patients' physical FIM score (each line indicates three above T5 paraplegic patients change)

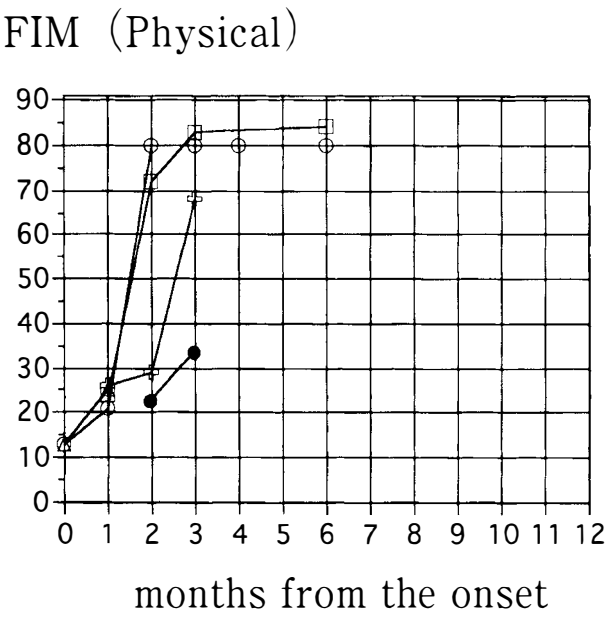

Figure 6 Changes in the patients' physical FIM score (each line indicates five below T6 paraplegic patients change)

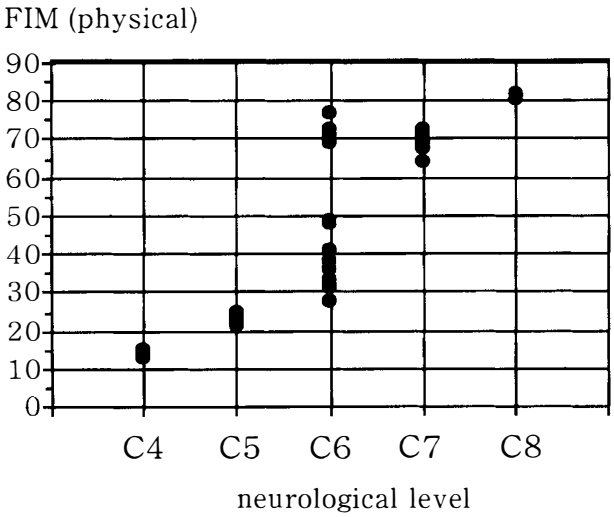

Figure 7 Distribution of the physical FIM score at each neurological level

Discussion

The mean FIM scores by a study of the neurological levels were almost the same as those reported previously.[2] Thus in Japan, the ADL at each neurological level seems to be at this level. In terms of the average total FIM score, the score for C8 level patients was 116 while the score for paraplegic patients was 114. The scores for C8 patients were slightly higher and can be accounted for by the fact that the number of C8 patients was only 3 and their average age was only 25. Although experiencing the effects of a cervical

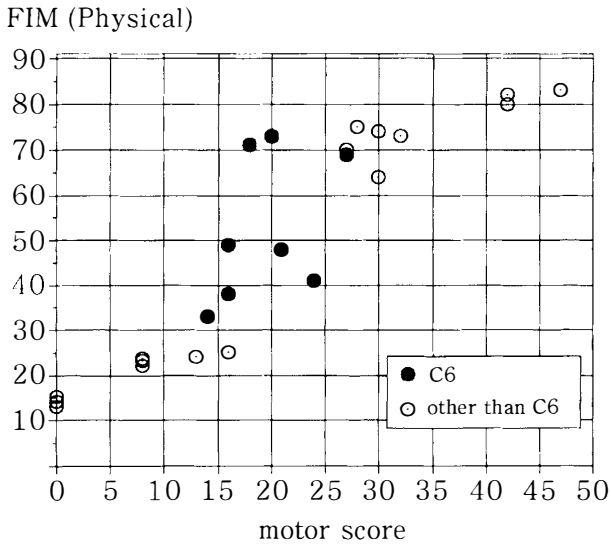

Figure 8 Relationship between the motor score and the physical FIM score

spinal cord injury, it was considered possible for them to acquire the same ADL level as the paraplegic patients.

With regard to the relationship between the number of months from the onset of injury and total FIM score: the FIM scores reached a plateau in about 10 months from the time of the injury. Considering that the average time having the injury in hospitalized patients exceeded 10 months, we concluded that this average FIM score indicates the plateau of each neurological level.

Furthermore, we have considered the changes in the physical FIM over time within a year from the onset of injury. Regarding spinal cord injury patients, social cognition and the communication items of the FIM, disturbances were not found and were not a problem. Therefore, we concentrated on the assessment of the physical items. In C5 level patients, up to a three-month period from the time of the injury, total care was continued and the physical FIM score was in the lowest 13 points. Then, gradual ADL improvement was seen, but the items were limited to improvements in eating and in selfcare. Those who could operate an electric wheelchair have shown improvement in mobility. Among the younger patients, some were able to move about on their own within the hospital, using an electric wheelchair. When considering the plateau FIM score, further improvements in the ADL can be expected. Therefore this level of FIM was considered to be improved over a period of more than 6 months. Among C6 level patients, all three differed in their physical FIM improvement. It was considered that age and the timing of the start of active rehabilitation related closely to improvement. We felt that those who were late in starting rehabilitation appeared to be slow in ADL improvement. In order to confirm this, we must continue the assessment.

Among those who had a thoracic spinal cord injury or more caudally, when we compare the groups with a lesion above T5 and below T6, we found no difference in the final total FIM score, but a slight difference was found in the period just before the plateau. The group with a lesion above T5 took 6 months to reach a plateau, while the group with a lesion below T6 took about 3 months to reach the same plateau. Among the latter group, since the abdominal muscles are available to support the body, it was considered that they could maintain the sitting position. Therefore, the time for the acquisition of selfcare (bathing and dressing) and transfer was shorter in this group compared to the former group. In case of paraplegic patients, unlike tetraplegic patients, even when the initiation of active rehabilitation was delayed, smooth ADL recovery was observed when proper training was introduced. Therefore, it can be said that a postponement in starting rehabilitation does not have serious effects in the expansion of ADL later on if there is no significant complication.

In terms of the relationship between the neurological level and the physical FIM, we found some differences in the physical FIM scores between tetraplegic patients with a lesion at the same neurological level. Therefore, it is somewhat difficult to predict the degree of disability only from knowledge of neurological levels; and it is not considered appropriate to decide the ADL level and rehabilitation goals simply based on the neurological level of spinal cord injury patients. In this regard, we compared the motor score with the physical FIM score. By using the motor score, we were able to further sub-categorize patients with the same neurological level. Since there exists a good correlation between the motor score and the FIM score, it was considered that the motor score better reflected the degree of disability of the spinal cord injury patients.

Conclusion

We conclude that the ASIA motor score with the FIM score are useful for functional assessment of patients with a spinal cord injury.

We should assess the disability of spinal cord injury patients in more detail by using these items for each patient, and for each period over time.

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