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Social Adaption of Persons With Spinal Cord Injury by Modified Barthel Index

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Abstract

The purpose of this study was to evaluate the general characteristics, complications and level of social adaptation of spinal cord injured patients. The subjects were one hundred forty five members who were inpatients or outpatients from October 1, 2004 to April 30, 2005 in general hospitals and municipal welfare centers for the handicapped located in the metropolitan city of Gwangju. The following results were obtained using Modified Barthel Index (MBI). 1) Gender distribution was 77.9% male and 22.1% female. The mean age at the time of injury was 35.4 and the mean age during the study was 44.2. 2) The degree of paralysis among the subjects was as follows: 49.0% had complete paralysis and 51.0% suffered incomplete paralysis. The most frequently injured lesion among the subjects was cervical (49.0%), followed by thoracic (35.9%), and lumbar (15.2%). 3) The mean MBI score was 63.5. There was statistically significant difference in the MBI score in the relation between complete and incomplete paralysis, the relation between cervical, thoracic, and lumbar injury, and the relation between a recovery period of less than three years and more than three years according to the characteristics of injury ($p<.05$). 4) There was statistically significant difference in the MBI score of subjects who had complications concerning spasticity, deformity, urinary tract infection, and sexual dysfunction ($p<.05$). 5) The most serious emotional pain after spinal cord injury resulted from economic issues, which affected 35.2% of the subjects. The group having a shorter recovery period after spinal cord injury complained of psychological matters, the group having a longer recovery period complained about the surrounding environment (lack of convenient facilities), suggesting statistically significant difference ($p<.05$). 6) The most common activities of the group with injuries more than ten years old included meeting schoolmates and working, while most common activities of the group with injuries less than three years old included attending religious functions and miscellaneous others (watching TV, spending time with family), suggesting statistically significant difference ($p<.05$).

Key Words: Modified Barthel Index; Social adaptation; Spinal cord injury.

Introduction

Spinal cord injury is a disability that often threatens life and devastates patients, resulting in sudden functional changes for patients from an independent life to a dependent life (Piazza et al, 1991). Furthermore, it brings about severe disabilities such as the loss of motor and sensory function or the disability of urination, evacuation, or sexual function, leading to losses of jobs or economic difficulty. Some may experience social isolation, changes in body image, and self consciousness of their confinement to or physical limitations within the wheelchair (Dijkers, 1997). Therefore, the purpose of rehabilitation therapy is to prevent inevitable complications caused by spinal cord disability or reduce their severity, to learn physically possible functions, to encourage the motivation to engage in life, and to enjoy an independent lifestyle in daily, school, or job related activities by beginning rehabilitation therapy, such as physical

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therapy, occupational therapy, and vocational training in the early stage along with treatment during the acute period after spinal cord injury (Lee and Lee, 1983). To achieve these goals, doctors, nurses, therapists, and social workers should pay close attention and cooperate (Lee and Lee, 1983). Since such spinal cord injury affects the control of voluntary muscles according to injury level and is accompanied by several physical functional disabilities, activities of daily living (ADL) are limited in many ways according to the injury level. Improving the abilities of daily living is a very important task which becomes the basis of achieving the purposes of the disabled's rehabilitation. While the manual muscle test and the range of motion test are conducted to examine the disabled's physical function, the ADL test is a more general and applied measurement and evaluation of ability which collects physical, psychological, and environmental materials of the patients (Pedretti, 2001).

Because one purpose of rehabilitation therapy is to help people do daily motions by themselves, assessment of ADL has been widely used as a measure of functional evaluation to predict the possibility of an independent life.

The Barthel Index, which has been used as a method for evaluating the performance of ADL, was developed by Mahoney and Barthel in 1965 to evaluate the self-supportive capabilities of patients' to perform ADL. Since it is a sensitive method of evaluation which immediately reflects changes of patients in functional improvement, it contributes to follow-up studies of functional changes (Granger et al, 1979). The Barthel Index was modified and complemented by Fortinsky et al (1981) and finally the Modified Barthel Index was made, which has been widely used to date.

In reality, many complications and other elements developed in spinal cord injured patients impede their daily and social activities. By examining general characteristics according to injury level, ADL after spinal cord injury, and complications and predicting possible functions, this study intends to seek rehabilitation therapy that is more effective and supportive of the patients' emotional and mental health. Furthermore, this study aims to help people enjoy independent life and adjust to social life by fully learning the remaining functions.

Methods

Subjects

The subjects of this study were 151 patients with spinal cord injuries who were hospitalized in or went to general hospitals or municipal welfare center for the disabled from October 1, 2004 to April 30, 2005 in Gwangju City. Of them, 145 with spinal cord injury of a 6-month duration were finally selected.

Procedures

Subjects with spinal cord injury of a 6-month duration were selected through personal interview and reviewing of medical records. Their performance of ADL was evaluated with the Modified Barthel Index (MBI). Evaluation methods were classified into 15 activities of daily living and a fourth stage score was given to each item. The first stage referred to perform ADL alone without any others' help; the second stage referred to perform ADL without others' help, but with difficulty; the third stage included partially needing others' help, and the fourth stage referred to completely depending on others' help. While the highest score was 53 in self-help activities and 47 in mobilization ability with the total score of 100, the lowest score was 1 (Granger et al, 1979). General items or characteristics of injury were examined by questionnaire survey.

Statistical Analysis

Collected materials were coded by item and analyzed using SPSS 12.0 program. For general items in relation to subjects' injury level, frequency and percentage were found using cross tabulation of variables. To examine the difference of variables in

injury level, χ^2 test (chi-square test) was used. Complications were examined by multiple response. For sex, job, degree of paralysis, and complications, the mean and standard deviation of MBI scores were calculated and their difference was compared using t-test. Also, for injury level and the duration of spinal cord injury, the mean and standard deviation of MBI scores were calculated using one-way ANOVA. To examine group difference more definitely, post-hoc test with Scheffe was conducted.

Results

1. General Characteristics

Of 145 subjects, 71 (49.0%) had cervical injury; 52 (35.9%) had thoracic injury, and 22 (15.2%) had lumber injury. The range of sex was 111 males (77.9%) and 32 females (22.1%). Age ranged from 15 to 72 with a mean age of 44.2. The mean age of onset was 35.4. 14.5% had a job. Lesion ranged from complete (49.0%) to incomplete (51.0%). The mean duration of spinal cord injury from the onset of injury to the present was 8.8 years. Among subjects who had injuries 3~9 years old, 42.3% of the injuries were cervical while 50.0% of the injuries were thoracic. Umber injuries appeared among 59.0% of the subjects whose injuries were more than 10 years old. This distribution demonstrated statistically significant difference ($p<.05$) (Table 1).

2. Score Distribution of the Modified Barthel Index

The mean MBI score of the total subjects was

Table 1. General characteristics of injured level Unit: N(%)

Characteristics	Injured level			Total (%) (N=145)	χ^2
	Cervical (n_1=71)	Thoracic (n_2=52)	Lumbar (n_3=22)		
Gender					
Male	58(81.7)	39(75.0)	16(72.7)	113(77.9)	1.19
Female	13(18.3)	13(25.0)	6(27.3)	32(22.1)	
Age (yrs)					
<20	2(5.6)	0(.0)	0(.0)	2(1.4)	12.08
20~29	6(8.5)	1(1.9)	3(13.6)	10(6.9)	
30~39	23(32.4)	17(32.7)	3(13.6)	43(29.7)	
40~49	20(28.2)	15(28.8)	6(27.3)	41(28.3)	
50~59	11(15.5)	14(26.9)	8(36.4)	33(22.8)	
60≤	9(12.7)	5(9.6)	2(9.1)	16(11.0)	
Job					
No	62(87.3)	42(80.8)	20(90.9)	124(85.5)	1.65
Yes	9(12.7)	10(19.2)	2(9.1)	21(14.5)	
Lesion					
Complete	31(43.7)	27(51.9)	13(59.1)	71(49.0)	1.88
Incomplete	40(56.3)	25(48.1)	9(40.9)	74(51.0)	
Time lapse since onset (yrs)					
<3	28(39.4)	14(26.9)	4(18.2)	46(31.7)	19.45*
3~9	30(42.3)	12(23.1)	5(22.7)	47(32.4)	
10≤	13(18.3)	26(50.0)	13(59.1)	52(35.9)	

*p<.05

63.5. The mean score was 62.5 for males, 67.0 ($p>.05$), for females, 87.8 for the employed group, and 59.4 for the unemployed group ($p<.05$). 49.0% of the subjects suffered complete paralysis, and 51.0% of the subjects suffered incomplete paralysis. To examine the difference in duration of spinal cord injury more definitely, a post-hoc test with Scheffe was conducted. As a result, the difference between those injured less than 3 years ago and those injured 3~9 years ago, and between those injured less than 3 years ago and those injured more than 10 years ago was statistically significant ($p<.05$). To examine the difference in injury levels more definitely, a post-hoc test with Scheffe was again conducted. As a result, the difference between cervical injury and thoracic injury, and between cervical injury and lumber injury was statistically significant ($p<.05$) (Table 2).

3. Complication

The results of multiple response survey suggested that patients who suffered from one spinal cord injury had a mean 3.0 complications. The most frequent complication was sexual dysfunction (74.5%), followed by pain (60.7%), spasticity (35.9%), urinary tract infection (35.2%), decubitus ulcer (33.3%), deformity (23.4%), insomina (19.3%), depression (14.5%), and others (2.8%, renal failure, hypertension, diabetes). While lumber (86.4%) and thoracic (63.5%) injuries were higher in pain than cervical (50.7%) injury, cervical (46.5%) and thoracic (30.8%) injuries were higher in spasticity than lumber (13.6%) injury. It demonstrated statistically significant difference ($p<.05$) (Table 3).

Among the complications, there was statistically significant difference in MBI scores according to spasticity, deformity, urinary tract infection, and sexual functional disability ($p<.05$) (Table 4).

4. Social Adaption

While the difficulties after injury often included

Table 2. Modified Barthel Index Score of general characteristics

Characteristics	MBIS[a]	
	Mean±SD	F(t)-value
Gender		
Male	62.54±33.03	-.67
Female	67.00±35.08	
Job		
No	59.41±34.25	-7.50*
Yes	87.81±10.13	
Lesion		
Complete	57.58±33.33	1.23*
Incomplete	69.23±32.72	
Time lapse since onset (yrs)		
<3	43.02±35.70	
3~9	66.43±34.15	17.80*
10≤	79.04±18.57	
Injured level		
Cervical	41.17±34.42	
Thoracic	82.75±11.59	55.25*
Lumbar	90.23±5.64	

*$p<.05$

[a]MBIS: Modified Barthel Index Score (range 1~100)

Table 3. Complication by injury level (Unit: %)

Complications	Injured level			Total (%) (N=145)	X^2
	Cervical (n_1=71)	Thoracic (n_2=52)	Lumbar (n_3=22)		
Pain	50.7	63.5	86.4	60.7	9.21*
Spasticity	46.5	30.8	13.6	35.9	8.79*
Deformity	31.0	15.4	18.2	23.4	4.47
Decubitus ulcer	31.0	32.7	45.5	33.8	1.62
Urinary tract infection	38.0	38.5	18.2	35.2	3.29
Sexual dysfunction	69.0	75.0	90.9	74.5	4.25
Insomnia	14.1	19.2	36.4	19.3	5.35
Depression	18.3	11.5	9.1	14.5	1.72
Others	4.2	1.9	.0	2.8	1.33

*p<.05

Table 4. Modified Barthel Index Score by complications

Complications		MBIS[a]		
		N	Mean±SD	t-value
Pain	No	88	61.16±34.63	-.69
	Yes	57	65.06±32.72	
Spasticity	No	52	70.45±30.04	3.46*
	Yes	93	51.13±35.81	
Deformity	No	34	66.93±31.93	2.25*
	Yes	111	52.41±36.19	
Decubitus ulcer	No	49	63.74±34.43	.11
	Yes	96	63.10±31.69	
Urinary tract infection	No	51	67.67±33.27	2.25*
	Yes	94	55.88±32.66	
Sexual dysfunction	No	108	75.08±28.67	2.70*
	Yes	37	59.56±34.13	
Insomnia	No	28	63.39±34.21	-.10
	Yes	117	64.07±30.46	
Depression	No	21	64.19±34.37	.59
	Yes	124	59.57±34.27	
Others	No	4	63.81±33.36	.61
	Yes	141	53.50±39.47	

*p<.05
[a]MBIS: Modified Barthel Index Score (range 1~100)

employment (economic problem) (35.2%), the most serious emotional pain in relation to injury level included domestic (couple) matters for those with thoracic injury, psychological matters for those with cervical injury, and surrounding environmental matters for those with lumber injury (p<.05). Other subjects (35.9%) ranked social activities as the most problematic. In relation to injury level, subjects with

lumber injury had the most problems with private clubs and religious activities, those with cervical injury with hobbies and miscellaneous other issues, and those with thoracic injury with occupation ($p>.05$) (Table 5).

The amount of serious pain was closely related to the duration of spinal cord injury. The complaint rate of psychological problems was statistically significantly high in the shorter duration period, while the complaint rate of surrounding environmental problems was statistically significantly high in the longer duration period ($p<.05$). In the social activity category, occupation and participation in private clubs were statistically significantly high in the longer duration period, while religious activity and others were statistically significantly high in the shorter duration period ($p<.05$) (Table 6).

Table 5. Social adaption by injury level (Unit: %)

Social adaption	Injured level			Total (%) (N=145)	χ^2
	Cervical (n_1=71)	Thoracic (n_2=52)	Lumbar (n_3=22)		
Difficulties after injury					
Job (economic) matter	36.6	32.7	36.4	35.2	
Home (husband and wife) matter	11.3	23.1	4.5	14.5	
Social (personal relations) matter	4.2	9.6	4.5	6.2	21.64*
Psychological matter	33.8	13.5	9.1	22.8	
Surrounding environment matter	14.1	21.2	45.5	21.4	
Social activity					
Private club (alumni association)	7.0	11.5	22.7	11.0	
Religious activity	7.0	11.5	22.7	11.0	
Hobby	32.4	25.0	18.2	27.6	11.45
Occupation	12.7	19.2	9.1	14.5	
Others	40.8	32.7	27.3	35.9	

*$p<.05$

Table 6. Social adaption by time lapse since onset (Unit: %)

Social adaption	Time lapse since onset (yrs)			χ^2
	<3 (n_1=46)	3~9 (n_2=47)	10≤ (n_3=52)	
Difficulties after injury				
Job (economic) matter	34.8	31.9	38.5	
Home (husband and wife) matter	17.4	6.4	19.2	
Social (personal relations) matter	8.7	4.3	5.8	20.39*
Psychological matter	30.4	34.0	5.8	
Surrounding environment matter	8.7	23.4	30.8	
Social activity				
Private club (Alumni association)	6.5	8.5	17.3	
Religious activity	13.0	10.6	9.6	
Hobby	10.9	40.4	30.8	37.82*
Occupation	4.3	10.6	26.9	
Others	65.2	29.8	15.4	

*$p<.05$

Discussion

According to Jeong (2004) and Kim (2003), the highest spinal cord injury level was in the thorax, followed by the cervical, and lumbar, whereas this study found that the rate of cervical injury was 49.0%, followed by thoracic (35.9%) and lumbar (15.2%).

In Korea, Roh (1989) treated 50 inpatients with spinal cord injuries and reported a mean MBI of 68.4; Park et al (1994) reported a mean MBI of 57.6 in 27 male patients among whom he could conduct follow-ups after they left the hospital; and Lee (1997) reported a mean MBI of 63.1 in 83 inpatients and outpatients among whom he could conduct follow-ups after they left the hospital. Tozato et al (2005) of Japan reported a mean of 64.2 in 293 inpatients and outpatients using the Barthel Index. The mean MBI of this study was 63.5 in 145 spinal cord injured patients.

A relationship between injury level and MBI score was noted by Roh (1989), who suggested that when injury level was low after rehabilitation therapy, the MBI score was high. Park et al (1994) reported similar results and linked higher scores with lower injury levels and higher social participation. This study confirmed that lower injury levels were linked to higher scores. This study also found that there was significant difference in score between cervical and thoracic injuries, and between cervical and lumber injuries, whereas there was no significant difference in score between thoracic and lumbar injuries. It is considered that since subjects with thoracic and lumbar injuries had a wide range of use in the upper limbs, their ability to mobilize and perform self-help activities was better than that of those with cervical injury, but the ability of patients with thoracic and lumbar injuries to perform self-help activities was not very different.

The MBI scores of this study in relation to duration of spinal cord injury were 43.0 for injuries less than 3 years old, 66.4 for injuries 3~9 years old, and 79.0 for injuries more than 10 years old, which suggested higher scores for longer duration periods. In relation to injury level, the rate of cervical injury was higher than the rates of thoracic and lumbar injuries among subjects with injuries less than 10 years old, while the rates of thoracic and lumbar injuries were higher than the rate of cervical injury among subjects with injuries more than 10 years old. It is considered that patients with spinal cord injuries of less than 10 years used rehabilitation facilities constantly to improve and maintain their ability to mobilize and perform self-help activities, while patients with injuries more than 10 years old who suffered cervical injury with decreased mobilization ability used rehabilitation facilities very little. Thoracic and lumbar injured patients could mobilize and perform self-help activities somewhat independently, but continuously used rehabilitation facilities due to difficulty returning to their occupations.

Rhee et al (1994) reported that in the distribution of sexual function, 31.1% of his subjects had direct insertive sex. Choi et al (1992) reported that 90% of male patients complained of difficulty with sexual relations through vaginal sex due to poor erection lasting less than 5 minutes. Most of the subjects used non-sexual methods and only 20% of them experienced ejaculation. This study found that the highest sexual functional disability appeared among subjects with lumbar injury, followed by those with thoracic and cervical injuries. Subjects with lumbar injury were the least sexually functional, although they generally are adept at the tasks of daily living, This discrepancy may be due to neurological principles, but as Kang et al (2000) reported, the sexual life of spinal cord injured men should be understood in the physical, psychological, and social aspects, not only in the aspect of simple sexual behavior or marital relations. Furthermore, individualized service which considers the diverse values of life that each patient holds should be provided for the process of sexual rehabilitation. These services should focus on recovering the significant aspects of life, not only on physical survival or training. If the individuals' adjustment needs/methods and conditions are understood and flexible sexual rehabilitation programs are

provided, spinal cord injured patients could achieve better social adjustment.

Kim (1996) suggested that the level of pain related to injury was greatest among cervical injuries, followed by thoracic, and lumbar injuries. Subjects with higher level injuries complained of a higher percentage of pain. However, in this study, the pain of lumbar, thoracic, and cervical injuries was high in order and those with low level injuries complained of a higher percentage of pain. Lee and Lee (1983) suggested that as the duration of spinal cord injury became longer, the percentage of complaints about pain increased (68%) and that since spinal cord injured patients with lasting pain had difficulties in daily living, emotional stability, and rehabilitation therapy, it is very important to treat pain appropriately.

Since sudden increase in spasticity accompanied by spinal cord injury causes other medical problems such as cystitis, weakened skin, and fever, it should be watched. Severe spasticity obstructs normal functions and causes difficulty for both patients and therapists (Pedretti, 2001). In this study, spasticity was most frequent in cervical, then thoracic, and finally lumber injuries and the results were identical to the study by Kim (1996) in showing that the high level injuries were severer.

Decubitus ulcers develop in 25~85% of spinal cord injured patients and account for 8% of the source of modality. Moreover, they extend the period of rehabilitation, as well as presenting an economic burden (Oh, 1997). Pedretti (2001) suggested that it was one of the very common complications with a variety of incidence and Park et al (2000b) reported an incidence of 29.6%. In this study, its incidence was 33.8% with 31.0% of the incidence appearing with cervical injuries, 32.7% with thoracic, and 45.5% with lumbar. The highest percentage of lumbar injury may result from its high risk of relapse. Furthermore, since the subjects with injuries in the lower limbs had a wide range of abilities pertaining to daily living, mobilization and many other activities, they often get hurt due to the changes in seating position and careless safety.

According to Yarkony and Chen (1996), deformity occurred more in quadriplegic patients than paraplegic patients. Park et al (2000b) also reported significantly higher incidence in quadriplegic patients. Similary, this study found higher incidence in cervical injuries than thoracic and lumbar injuries.

The MBI score of factors in relation to complications was statistically significantly low in groups who complained of spasticity, deformity, urinary tract infection, and sexual functional disability. Since such complications bring about difficulties in daily living and rehabilitation therapy, it is necessary to help patients achieve emotional stability and social adjustment through early effective treatment.

According to Kim (1997), the most serious problems after spinal cord injury were psychological issues and the surrounding environment. In this study, subjects complained of occupational (economic) problems the most frequently. In relation to injury level, psychological problems were the highest among those with cervical injury; marital (home) problems among those with thoracic injury, and the surrounding environment among those with lumbar injury.

According to Lee (1997), the distribution of social activity was the highest in the others category, with 49.5% choosing family, 22.8% choosing religious activity, and 14.5% choosing occupation. In this study, the others category (watching TV, spending time with family) was chosen most often (35.9% of subjects), followed by hobbies (27.6%) and occupation (14.5%). The group with spinal cord injury of a duration of more than 10-years showed high involvement in occupation and private clubs (such as alumni associations), while the group with spinal cord injury of a duration of less than 3 years showed high involvement in religious activities and other activities. It is considered that spinal cord injured people need motivation to adjust themselves to and live in society and to have an optimistic attitude toward life.

While Tozato et al of Japan (2005) reported that

28.7% of his subjects had an occupation and Park et al (2000a) reported that 36.9% returned to an occupation, this study found that only 14.5% had an occupation. Such a result may be caused by more backward industrial facilities in certain areas, conditions specific to Japan, or the lack of working facilities for the disabled in the industrial field in general. Also, this study regarded 13 inpatients (9%) as unemployed. The MBI score of the subjects with occupation was 87.8 in the employed group and 59.4 in the unemployed group, which suggests that the employed group was higher the level of activities of daily living than the unemployed group. It demonstrates that training for activities of daily living positively influenced the return to work.

Such results suggest a variety of degrees of complications according to injury level or activities of daily living. Therefore, to achieve successful rehabilitation, a professional rehabilitation center should be established to treat problems in relation to injury in the early stages through accurate and comprehensive evaluation and to conduct continuous management after leaving the hospital. Furthermore, it is necessary to prepare a social system which provides work opportunities after systematic vocational training to fulfill their roles as independent and productive members of society (Park et al, 2000a). Accordingly, it is considered that to improve the problems of spinal cord injured patients, further study should focus on comprehensive rehabilitation treatment under the integrated plan of social rehabilitation. Further studies should also examine how such treatment may influence/empower/encourage patients to work as healthy members of society.

Conclusion

The subjects were one hundred forty five members who were inpatients or outpatients in general hospitals and municipal welfare centers for the disabled located in the metropolitan city of Gwangju. The subjects were inpatients or outpatients from October 1, 2004 to April 30, 2005.

The following results were obtained using the Modified Barthel Index (MBI).

1) Gender distribution was 77.9% male and 22.1% female. The mean age at the point of time of injury was 35.4 and the mean age during the study was 44.2.

2) The degree of paralysis was distributed as follows: 49.0% of the subjects suffered complete paralysis and 51.0% suffered incomplete paralysis. The most injured lesion was cervical (49.0% of subjects), followed by thoracic (35.9% of subjects), and lumbar (15.2% of subjects).

3) The mean MBI score was 63.5. There was statistically significant difference of the MBI score in the relation between complete and incomplete paralysis, the relation between cervical, thoracic, and lumbar injury, and the relation between injury onset less than and more than three years ago according to the characteristics of injury ($p<.05$).

4) There was statistically significant difference in the MBI score according to the following complications: Spasticity, deformity, urinary tract infection, and sexual dysfunction ($p<.05$).

5) The most serious/common psychological/emotional pain after spinal cord injury was due to job (economic) matters, affecting 35.2% of the subjects. The group with more recent spinal cord injury complained of psychological matters, while the group with less recent spinal cord injury complained of the surrounding environment (such as lack of convenient facilities), suggesting statistically significant difference ($p<.05$).

6) The most popular activities of the group with injuries more than 10 years old included meeting schoolmates and working, while those of the group with injuries less than 3 years old included religious functions and others (watching TV, spending time with family), suggesting statistically significant difference ($p<.05$).

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