

원저

## Correlation Analysis with Modified Barthel Index and Motor Assessment Scale in Stroke Patients

Seong-Gyu Ko\*, Chan-Yong Jun\*\*

### ABSTRACT

뇌졸중환자의 기능평가척도로서의 MBI와 MAS의 상관성분석

고성규\*, 전찬용\*\*

\* 상지대학교 한의과대학 부속병원 순환기내과학교실

\*\* 경원대학교 부속 인천한방병원 2내과

연구목적 : 뇌졸중환자에 기능회복도의 측정을 위해 가장 신뢰도가 높은 MBI에 대해서 순수하게 뇌졸중환자의 운동기능평가만을 위해 고안된 MAS의 상관성을 각 기간별로 분석하여 MAS의 운동기능평가척도로서의 객관성에 대해 연구한다. 또 한편으로 경과시간에 따른 운동기능 회복도의 차이를 전체그룹과 사상그룹에서 평가한다.

연구방법 : 1998년 1월부터 1998년 6월까지 6개월에 걸쳐 상지대학교 한의과대학 부속한방병원 내과에 입원하여 뇌졸중으로 진단된 환자 중 의식과 언어상태가 명료한 32명을 대상으로 하였다. 입원직후 사상의학과에 의뢰하여 QSCCⅡ 시스템에 의하여 체질진단을 받은 후 본원 운동기능평가실에서 입원직후, 입원 후 2주와 4주 등 3회에 걸쳐 Modified Barthel Index(MBI)와 Motor Assessment Scale(MAS)을 시행하였다. 각 환자에 대한 검사는 2명의 한방순환기내과 전문의와 전공의에 의해 환자에 대한 사전 정보 없이 이루어졌다.

연구결과 : 통계처리는 상관분석을 위해서는 Pearson correlation coefficient, 사상체질에 있어서 각 경과시간에 따른 점수변화는 Repeated ANOVA, 일반적특성 분석에는 Descriptive analysis가 사용되었고, 프로그램은 SPSS/PC+ 7.5 version을 사용하였다.

1. 뇌졸중 환자의 사상의학적인 분포는 태음인이 56.3%로 가장 많았고, 소양인이 28.1%, 소음인이 12.5%, 태양인이 3.1%이었으며, 연령별로는 50대가 32.6%로 가장 많았으며, 평균연령은 60.9세였다.

2. 경과시간에 따른 사상체질간의 MBI, MAS 평균점수변화는 MBI, MAS 모두 반복측정 분산분석 결과 입원당시와 2주 후, 입원당시와 4주 후에서 모두  $P < 0.001$ 의 범위에서 통계학적으로 유의하게 증가하였고, 경과시간과 사상체질간의 교호작용은 없었다.

3. MBI, MAS 모두 각 항목과 기능별 분류군에서도 경과시간에 따른 평균점수의 변화는  $P < 0.001$  범위에서 통계학적으로 유의하게 증가하여 한방치료의 효과가 있음을 보여주었다.

4. MBI와 MAS의 경과시간별 Pearson 상관성 분석결과 입원당시의 MBI와 입원당시의 MAS에서, 2주 후의 MBI와 입원당시, 2주 후, 4주 후의 MAS에서, 4주 후의 MBI와 입원당시, 2주, 4주 후의 MAS에서 모두 높은 상관성을 보여, 두 평가방법 간에는 상관성이 높다고 본다.

Key Words : Stroke, MBI, MAS, Repeated ANOVA.

\* Department of Circulatory Internal Medicine, College of Oriental Medicine Sang Ji University

\*\* Department of Circulatory Internal Medicine, College of Oriental Medicine Kyung Won University

## 접수일: 99. 3. 31      연락처: 고성규 T. 0371-741-9209

## I. INTRODUCTION

The aim of this paper is to analyze how much MAS has correlation to MBI, which is recognized as the most reliable and easiest method to estimate, and has been frequently used for the motor function estimation in stroke patients.

And another aim is to investigate the differences of neurological function improvement by follow-up time in Sasang constitution.

In stroke patients, quantitative estimation of such clinical symptoms caused by neurological damage are essential to a clinical research, clinical decision-making and managements.

Objective stroke estimating scales are necessary for the close monitoring of patient's neurological status and degree of recovery. Therefore we have to analyze the degree of disability by standardized and generalized methods, to set the treatment plan by right estimation value and to find the worthy estimation method to prove the Oriental Medicine's treatment effect in clinical practice.

## II. SUBJECT and METHOD

This study included 32 patients who were admitted at the department Circulatory Internal Medicine, Sang-ji university oriental hospital under the diagnosis of stroke between in January of 1998 and June of 1998. On admission day the patient could express themselves and they are divided into Sasang constitution by the QSCC II system<sup>4, 7)</sup>.

MBI and MAS were used for estimation method. MBI was considered to be most reliable and composed of nine items of self care and six items of mobility. MBI is designed and modified putting BI (Barthel

Index)<sup>14)</sup> into practical use. It estimates the capability of independent function and present the severity by score. MAS is designed by Janet H. Carr<sup>12)</sup> to evaluate stroke patient's function recovery and supplement MBI which is not enough detail upper-limb function estimating items. The score sheet include 8 different items representing 8 areas of upper and lower motor function and one item related to muscle tone on the affected side. Each item is scored on a seven grade from 0 to 6 ( muscle tone is excluded because of its difficulty in objective index). All patients were estimated at the admission time and 2, 4 weeks later by 2 clinicians working with our department.

Herbal medical treatment is based on Sasang constitution prescription. For acupuncture treatment, acupuncture points, LR.3.(太衝), LI.4.(合谷), ST.36.(足三里), GB.39.(懸鍾), SP.6.(三陰交), TE.5.(外關), TE.3.(中渚), 犂.41.(足臨泣), LI.11.(曲池), GB.34.(陽陵泉), SP.9.(陰陵泉), GB.20.(風池), GV.20.(百會), GV.26.(人中), CV.24.(承漿), ST.4.(地倉), ST.6.(頰車) etc. which are explained effective in textbook and considered clinical practice were used.

To analyze correlation between both evaluating method score by follow-up time, we used Pearson correlation coefficient. To analyze the mean response according of the functional state to follow-up time by Sasang constitution, we used Repeated ANOVA and for sphericity, tested Mauchly's test. Descriptive analysis for characteristics and Repeated ANOVA for the mean changes of functional recovery in each item by follow-up time were used.

### III. RESULT

#### 1. General Characteristics of Stroke Patients by Sasang Constitution.

The frequencies of 32 stroke patient by Sasang Constitution were as follows: Taeum-in ; 56.3%(18 persons), Soyang-in ; 28.1%(9 persons), Soeum-in ; 12.5%(4 persons) Taeyang-in 3.1%(1 person).

Table 1.

General Characteristics of Stroke Patients by Sasang Constitution.  
unit : person (%)

	Taeum-in	Soeum-in	Soyang-in	Taeyang-in	TOTAL (%)	
Age (M±S.D)	59.27 ±11.12	61.25 ±10.78	64.11 ±7.99	61.00	60.93 ±11.12	
Sex	Male	9	0	5	0	14(43.7%)
	Female	9	4	4	1	18(56.3%)
Imp <sup>1</sup>	Isch. <sup>2</sup>	12	2	6	0	20(62.5%)
	Hemo. <sup>3</sup>	6	2	3	1	12(37.5%)
Hypertension History	12	3	6	1	22(68.8%)	
Current Drinker	4	0	5	0	9(28.1%)	
Current Smoker	8	0	6	0	14(43.8%)	

<sup>1</sup>Imp. indicates impression.

<sup>2</sup>Isch. indicates Ischemic Cerebrovascular Disease.

<sup>3</sup>Hemo. indicates Hemorrhagic Cerebrovascular Disease.

#### 2. Mean Response of the Functional Recovery according to Follow-up Time by Sasang Constitution with MBI.

The mean score changes of the functional state in all Sasang constitution was increased by follow-up time after treatment to the stroke patients (Table 2-1). According to 2×2 contingency (Table 2-2), we can know both, after 2 weeks and 4 weeks than admission day, are statistically significant rise in MBI score.

And interaction effect between follow-up time and constitution had no significance.

Table 2-1.

Mean Response MBI according to Follow-up Time by Sasang Constitution.  
unit : Mean score

Sasang constitution	Follow-up time		
	Admission day	After 2 weeks	After 4 weeks
Taeum-in	31.77±10.68	62.22±14.93	78.61±12.85
Soeum-in	24.25±19.80	59.25±32.82	71.25±33.26
Soyang-in	21.22±21.22	47.88±29.74	68.33±32.29
Taeyang-in	35.00	60.00	64.00

Table 2-2.

The result of Repeated ANOVA\* Mean Response MBI according to Follow-up Time by Sasang Constitution

		Sum of Squares	Degree of Freedom	Mean Square	F-value	Significance
Follow-up time	T <sub>0</sub> -T <sub>2</sub>	10193.409	1	10193.334	49.848	.000
	T <sub>0</sub> -T <sub>4</sub>	486.074	1	486.074	4.956	.034
Follow-up time × Constitution	T <sub>0</sub> -T <sub>2</sub>	156.056	3	52.019	.254	.858
	T <sub>0</sub> -T <sub>4</sub>	139.396	3	49.799	.508	.680
Error	T <sub>0</sub> -T <sub>2</sub>	5725.694	28	204.489		
	T <sub>0</sub> -T <sub>4</sub>	2746.417	28	98.086		

T<sub>0</sub>-T<sub>2</sub> indicates Repeated ANOVA result of the functional state after 2 weeks compared to it in admission day

T<sub>0</sub>-T<sub>4</sub> indicates Repeated ANOVA result of the functional state after 4 weeks compared to it in admission day

\* ① Mauchly's Test of Sphericity : Huynh-Feldt = 0.880 ( P-value = 0.000 )

② Tests of Within-Subjects Effects : F-value = 35.295 ( P-value = 0.000 )

#### 3. Mean Change of Stroke Patient's Functional Recovery after treatment by each Items and Subgroups(Self Care Items, Mobility Items) with MBI.

All items, 15 items, had an statistical significance (P<0.001) and both subgroups, self care items and mobility items, and MBI total also had the same results.

Table 3.

Results of Mean Score Change and the Results of Repeated ANOVA in Stroke Patient's Functional Recovery by Follow-up Time. unit : Score(Mean±S.D)

Items	Follow-up Time			F-value
	Adm. day	2 weeks	4 weeks	
Self Care Items <sup>1</sup>	26.71±11.95	38.81±10.68	42.87±9.65	118.351**
Drink from cup / Feed from dish	5.62±4.53	8.43±3.22	8.90±2.76	77.905**
Dress upper body	1.50±1.52	3.03±1.23	3.56±1.34	52.860**
Dress lower body	0.75±0.98	1.96±1.23	2.56±1.54	39.917**
Don brace or prosthesis	0.00±0.00	0.00±0.00	0.00±0.00	0.307**
Grooming	3.28±2.41	4.37±1.68	4.37±1.68	12.807**
Wash of bathe	0.00±0.00	0.37±1.18	1.37±1.93	11.002**
Bladder continence	7.50±3.36	9.53±1.95	9.68±1.22	29.852**
Bowel continence	7.81±3.34	9.21±2.23	9.84±0.88	18.940**
Care of perineum / clothing at toilet	0.25±0.84	1.93±1.72	2.56±1.54	87.215**
Mobility Items <sup>2</sup>	1.25±4.21	18.84±14.09	31.53±14.01	153.354**
Transfer, chair	0.65±2.07	7.21±5.04	12.28±4.26	158.737**
Transfer, toilet	0.28±0.88	3.00±1.91	4.59±1.64	169.020**
Transfer, tub or shower	0.00±0.00	0.18±0.39	0.28±0.45	14.966**
Walk on level 50 yards or more	0.31±1.76	7.18±6.08	10.62±6.05	106.698**
Up and down stairs for 1 flight or more	0.00±0.00	1.25±2.54	3.75±3.81	42.909**
Wheelchair / 50 yards-only if not walking				
TOTAL	27.96±13.63	57.75±22.25	74.34±22.19	253.770**

\*\* P<0.001 \* P< 0.01

<sup>1</sup> Self Care Items : They include 9 out of 15 items in MBI ;

Drink from cup/Feed from dish, Dress upper body, Dress lower body, Don brace or Prosthesis, Grooming, Wash or Bathe, Bladder continence, Bowel continence, Care of Perineum/Clothing at toilet.

<sup>2</sup> Mobility Items : They include 6 items in MBI ;

Transfer chair, Transfer toilet, Transfer tub or shower, Walk on level 50 yards or more, and Up and down stairs for 1 flight or more, Wheelchair/50 yard only if not walking.

#### 4. Mean Response of the Functional Recovery according to Follow-up Time by Sasang Constitution with MAS.

Like MBI, we analyzed the mean score changes of the functional state in all Sasang constitution was increased by follow-up time after treatment to the stroke patients (Table 4-1). According to 2×2 contingency (Table 4-2), we can know both, after 2 weeks and 4 weeks than admission day, are statistically significant rise in MAS score.

And interaction effect between follow-up time and constitution had no significance.

Table 4-1.

Mean Response MAS according to Follow-up Time by Sasang Constitution. unit : Mean score

Sasang Constitution	Follow-up Time		
	Admission day	After 2 weeks	After 4 weeks
Taeum-in	6.61±3.56	21.27±4.56	30.00±6.75
Soeum-in	6.75±9.60	24.75±21.85	29.75±20.64
Soyang-in	4.77±3.96	18.55±12.37	24.66±14.61
Taeyang-in	6.00	17.00	26.00

Table 4-2.

The result of Repeated ANOVA\* Mean Response MAS according to Follow-up Time by Sasang Constitution

		Sum of Squares	Degree of Freedom	Mean Square	F-value	Significance
Follow-up time	T <sub>0</sub> -T <sub>2</sub>	2627.243	1	2627.243	37.986	.000
	T <sub>0</sub> -T <sub>4</sub>	96.305	1	96.305	5.168	.031
Follow-up time × Constitution	T <sub>0</sub> -T <sub>2</sub>	40.417	3	13.472	.195	.899
	T <sub>0</sub> -T <sub>4</sub>	31.988	3	10.663	.572	.638
Error	T <sub>0</sub> -T <sub>2</sub>	1936.583	28	69.164		
	T <sub>0</sub> -T <sub>4</sub>	521.824	28	18.637		

T<sub>0</sub>-T<sub>2</sub> indicates Repeated ANOVA result of the functional state after 2 weeks compared to it in admission day

T<sub>0</sub>-T<sub>4</sub> indicates Repeated ANOVA result of the functional state after 4 weeks compared to it in admission day

\* ① Mauchly's Test of Sphericity : Huynh-Feldt = 0.703 ( P-value = 0.000 )

② Tests of Within-Subjects Effects : F-value = 31.020 ( P-value = 0.000 )

Table 5.

Results of Mean Score and The results of Repeated ANOVA in Stroke Patient's Functional Recovery by Follow-up Time in MAS. unit : Score(Mean±S.D)

Items	Follow-up Time			F-value
	Adm.day	2 weeks	4 weeks	
General Items <sup>1</sup>	5.75±3.87	17.90±6.83	23.25±6.93	351.54**
Supine to Sidelying onto Intact side	1.37±0.94	3.75±1.64	4.62±1.56	134.35**
Supine to Sitting over Side of bed	1.75±1.29	4.09±1.65	5.15±1.37	226.80**
Balanced Sitting	1.90±1.30	4.75±1.60	5.53±1.24	208.97**
Sitting to Standing	0.59±0.61	3.09±1.78	4.46±1.86	167.80**
Walking	0.12±0.34	2.21±1.51	3.46±1.86	145.90**
Upper Extremity Items <sup>2</sup>	0.34±1.35	2.90±4.56	5.09±5.90	37.68**
Upper-Arm Function	0.18±0.73	1.56±1.79	2.62±2.21	69.18**
Hand movement	0.15±0.62	0.96±1.92	1.59±2.25	17.09**
Advanced Hand Activities	0.00±0.00	0.37±1.18	0.87±1.93	8.31**
TOTAL	6.09±4.54	20.81±10.05	28.34±11.28	243.40**

\*\* P<0.001

\* P< 0.01

<sup>1</sup> General Function Items : 5 Items ; Supine to slide lying on to intact side, Supine to sitting over side of bed, Balanced sitting, Sitting to standing, Walking.

<sup>2</sup> Upper Extremity Items : 3 Items ; Upper arm function, Hand movement, Advanced hand movement.

5. Mean Change of Stroke Patient's Functional Recovery by Follow-up Time in each Items and Subgroups (General Function Items, Upper Extremity Items)with MAS.

Like MBI, all items, 8 items, had an statistical significance (P<0.001) and both subgroups, general function items and upper extremity items, and MAS total also had the same results.

6. The correlation between MBI and MAS score changes

With this result we can see that the changes of scores between two scales have high correlation at every follow-up time of MBI and MAS except admission day' MBI and 4 week's MAS.

Table 6.

Results of Correlation analysis between MBI and MAS score by Follow-up Time.

	T <sub>0</sub> MBI	T <sub>2</sub> MBI	T <sub>4</sub> MBI	T <sub>0</sub> MAS	T <sub>2</sub> MAS
T <sub>2</sub> MBI	.396*				
T <sub>4</sub> MBI	.494*	.865**			
T <sub>0</sub> MAS	.794**	.396*	.296		
T <sub>2</sub> MAS	.292	.716**	.784**	.292	
T <sub>4</sub> MAS	.199	.587**	.780**	.199	.909**

\*\* P<0.01

\* P<0.05

T<sub>0</sub>MBI : MBI score at Admission day

T<sub>2</sub>MBI : MBI score at After 2 weeks

T<sub>4</sub>MBI : MBI score at After 4 weeks

T<sub>0</sub>MAS: MAS score at Admission day

T<sub>2</sub>MAS: MAS score at After 2 weeks

T<sub>4</sub>MAS: MAS score at After 4 weeks

#### IV. DISCUSSION

A stroke can be defined as local and systemic neuronal sudden deficit last over 24 hours in cerebrovascular disease. A stroke occurs 20.1 cases among 1,000 cases a year and commonly happens to people over the age 65 or plus<sup>8)</sup>. In addition, the stroke mortality is relatively high; therefore, about 30% of stroke patients end up dead within a week<sup>5)</sup>. Also, most of stroke survival patients suffer from permanent damages of central nervous systems. Yet, there are some positive reports<sup>21)</sup> suggest that some stroke survival patients were recovered remarkably despite necrosis of central nervous system. These positive recoveries were proved by ongoing experiments<sup>17)</sup>. According to Wade's study in 1985<sup>21)</sup>, most of the stroke mortalities occur within the first 2 weeks. Ironically, some of stroke patients rapidly recovered their neurological function within the first 2 weeks and 90% of stroke patients, who survived from stroke, recovered their

neurological function within 3 months. According to Prescott<sup>16)</sup>, basic motor function and activity of daily living (ADL) can be recovered gradually within 4 months. Chamber<sup>9)</sup> suggested that stroke survival patients showed gradual recovery progress from 3 months to 6 months. Based on these theories, we can estimate the degree of recovery during the first month after onset and by that estimation value we can know the degree of improvement and prognosis<sup>5,9,17,20,21)</sup>. Therefore, we need standardized, generalized and organized methods to estimate the stroke patient's prolonged prognosis and the degree of recovery correctly.

In oriental medicine, we consider hemiplegia is the one of the main symptoms of stroke. But we didn't have good method to measure levels of improvement and prognosis correctly; therefore, we need to use more accurate method to estimate motor function. To estimate degree of improvement, following methods can be suggested: Katz Index<sup>13)</sup>, Kenny Self-Care Evaluation<sup>18)</sup>, Barthel Index<sup>14)</sup>, Trunk Control Test<sup>19)</sup>, PULSES<sup>15)</sup>, Motor Assessment Scale<sup>12)</sup>, Canadian Neurological Scale<sup>10)</sup>, NIH Stroke Scale<sup>11)</sup>, etc.

Based on previous study, we selected MBI as ADL estimation method. MBI which is the most reliable and simple method and to estimate levels of loss in motor function; furthermore, we added MAS, which is designed for only stroke patients by Janet H Carr to enhance the upper arm motor function estimation.

In the distribution of Sasang constitution, Taeunin was, the most numerous, 56.3%, Soyangin was 28.1%, Soeumin was 12.5%, Taeyangin was 3.1%. Total mean age was

60.93±11.12 years old. Male was 43.7%(14 persons), Female was 56.3%(18 persons). These statistics are similar to Bae<sup>6)</sup> and Ko's<sup>1, 2, 3)</sup> reports.

The changes of score in each follow-up time are as follows; admission day--28.0 points, after 2 week--57.8 points, and after 4week--74.3 points (The best score was 100). Points of MAS is 6.1, 20.8, and 28.3 points (best score was 48). MBI, MAS, both had statistically significant of  $P<0.001$  after 2 weeks, 4 weeks by admission day, in mean response according to follow-up time by Sasang constitution. And both had no interaction effect between follow-up times and Sasang constitution.

Mean changes of patient's functional recovery by follow-up time in each items had a statistical significance of  $P<0.001$  at all items of MBI, MAS.

The correlation between MBI and MAS score changes by follow-up time had high correlation at every follow-up time of MBI and MAS except admission day' MBI and 2 week's MAS, admission day's MAS and 2, 4 weeks MAS.

In conclusion, even though oriental medical therapy is very effective in curing stroke patients, we still need to generate the data by using systemic method such as MBI, MAS etc. Moreover, we need to develop reliable and credible method to estimate and generate more accurate and trustworthy statistics to overcome difficulties and problems on the stroke.

## V. RESULT

The aim of this paper is to analyze how much MAS has correlation to MBI, which is recognized as the most reliable, easy method to estimate, and has been frequently

used for the motor function estimation in stroke patients.

And another aim is to investigate the differences of neurological function improvement by follow-up time in Sasang constitution.

This study included 32 patients who were admitted at the department Circulatory Internal Medicine, Sang-ji university oriental hospital under the diagnosis of stroke between in January of 1998 and June of 1998. The patient could express themselves and they are divided into Sasang constitution by the QSCC II system.

We have estimated the progress of the function in stroke patients with well known ADL score "Modified Barthel Index(MBI)" and "Motor Assessment Scale(MAS)". All patients were estimated at the admission time and 2, 4 weeks later.

This study was done by 2 clinicians working with our department.

In Analysing method, We used Correlation analysis, Repeated ANOVA analysis, Descriptive analysis with SPSS/PC+ program(7.5 version) for statistics.

The results were as follows.

1. In the distribution of Sasang constitution, Taeunin was, the most numerous, 56.3%, Soyangin was 28.1%, Soeumin was 12.5%, Taeyangin was 3.1%. Total mean age was 60.9 years old. Male was 43.7%(14 persons), Female was 56.3%(18 persons).

2. MBI, MAS, both had statistically significant of  $P<0.001$  after 2 weeks, 4 weeks by admission day, in increase of mean response according to follow-up time by Sasang constitution. And both had no interaction effect between follow-up times and Sasang constitution.

3. Mean changes of patient's functional recovery by follow-up time in each items had a statistical significance of  $P < 0.001$  at all items of MBI, MAS.

4. The correlation between MBI and MAS score changes by follow-up time had high correlation at every follow-up time of MBI and MAS except admission day' MBI and 4 week's MAS, admission day's MAS and 2, 4 weeks MAS.

### 참고문헌

1. 고성규, 조기호, 김영석, 배형섭, 이경섭 : 중풍환자의 반신마비 회복도에 대한 임상적 관찰, 대한한의학회지 14 : 77-97, 1993.
2. 고성규, 고창남, 조기호, 김영석, 배형섭, 이경섭 : 뇌졸중환자의 기능평가방법에 대한 연구, 대한한의학회지 17 : 48-83, 1996.
3. 고성규, 오희라 : 급성기 뇌졸중 환자의 기능회복도에 관한 임상적 관찰, 한방성인병학회지, 3 : 206-230, 1997.
4. 김선호 외 : 四象體質分類검사지(QSCC)Ⅱ의 표준화 연구, 사상학회지, 7:187-246, 1996
5. 김진국, 하정상, 변영주 : 급성 뇌경색 환자의 기능회복에 관한 예비적 연구, 대한신경과학회지 10 : 298-307, 1992.
6. 배철환 외 : 폐쇄성 뇌졸중에 대한 임상적 연구, K.H.UNIV.O.MED.J. 10:665-687, 1987.
7. 이정찬 외 : 사상체질분류검사지(QSCC)Ⅱ에 대한 타당화 연구, 사상의학회지, 7 : 247 - 280, 1996.
8. Barnett HJM, Mohr JP, Stein BM, Yatsu FM : Stroke ; pathophysiology, diagnosis, and management 2nd ed, New York, Churchill Livingstone pp3-27, 1992
9. Chamber BR, Norris JW, Shurvell BL, Hachinski VC : Prognosis of acute stroke, Neurology 37 : 221-225, 1987.
10. Cote R, Hachinski VC, Shurvell BL, Norris JW, Wolfson C : A Preliminary Study in Acute Stroke, The Canadian Neurological Scale ; Stroke 17 : 731-737, 1986.
11. Goldstein LB, Bertels C, Davis JN : Interrater Reability of NIH Stroke Scale, Arch. Neurol. 46 : 660-662, 1989.
12. Janet H CARR, Roberta B.Shepherd, Lena Nordholm, Denise Lynne: Investigation of a new Motor Assessment Scale for stroke patients, Physical therapy, 65(2):175-179, 1985.
13. Katz S, Ford AB, Moskowitz RW : Studies of illness in the aged. The index of ADL : A standardized measure of biologicaland psychosocial function. J. A.M.A. 185:914-919, 1963.
14. Mahoney FI, Barthel DW : Md St J Ed 14:61, 1965.
15. Moskowitz E, McCann CB : Classification of disability in the chronically ill and aging. J chronic Dis, 5:342-346, 1957.
16. Prescott FJ, Garraway WM, Akhtar AJ : Predicting functional outcome following acute stroke using a standard clinical examination, Stroke 13 : 641-647, 1982.
17. Raisman G, Filed PM : A quantative investigation of the development of collateral reinnervation of the septal nuclei, Brain Research 50 : 241-264, 1973.
18. Schoening HA, Anderegg L, Bergstrm D : Numerical Scoring of self care status of patients. Arch Phys Med Rehabil, 46:689-69, 1965.
19. Sheikh K, Smith DS, et al : Assessment of motor function in studies of chronic disability, Rheumatology and Rehabilitation 19:83-90, 1980.
20. Skillbeck CE, Wade DT, Hewer RL, Wood VA : Recovery after stroke, J. Neurol. Neurosurg. Psychiatry 47 : 475-485, 1984.
21. Wade DT, Victorine AW, Hewer RL : Recovery after stroke-The frst 3 months, J. Neurol. Neurosurg. Psychiatry 48 : 7-13, 1985.