

Prognostic Value of Active Movement of Hemiplegic Upper Limb in Acute Ischemic Stroke

Bo Song, Shuo Li, Yuan Gao, Yuming Xu*

DEPARTMENT OF NEUROLOGY, THE FIRST AFFILIATED HOSPITAL, ZHENGZHOU UNIVERSITY,
ZHENGZHOU, 450052, CHINA

E-mail: Xuyuming@zzu.edu.cn

Abstract-Background and Purpose: The purpose of this study is to assess the prognostic value of active movement of affected upper limb on daily life in patients after acute ischemic stroke onset. **Method:** 165 consecutive patients with arm plegia in acute ischemic stroke were evaluated by four bedside tests to evaluate active movement of plegic arm (active finger extension, active finger flexion, shoulder abduction and shoulder shrug) on admission, day 14 and 30. Activity of daily life was assessed by Barthel Index on month 3, 6 and 12 after stroke onset. **Result:** Score of finger flexion and extension on day 30 was associated with 3 month and 12 month prognosis after stroke onset, and the expectation rate declined from 6.022 at 3 month to 2.919 at 12 month. Total score of four tests was associated with medium-term (6 month) prognosis ($p=0.000$). **Conclusion:** Active movement of hemiplegic upper limb in acute ischemic stroke has good predictive value on activity of daily life. [Life Science Journal 2010;7(2):62-65]. (ISSN: 1097-8135).

Key words: ischemic stroke; prognosis; rehabilitation

Introduction

The incidence of first-ever stroke in China ranged from 116 to 219 per 100 000 per year, and the prevalence varies from 259.86 per 100 000 to 719 per 100 000, most of stroke subtype is ischemic stroke.[1, 2,3].

Kwakkel G⁴ suggested that 30%~66% of ischemic stroke patients had impaired active movement of affected upper limb after onset. Active movement of hemiplegic upper limb, especially fine hand use, was directly associated with daily life activity in patients⁵. Therefore, recovery of function of the paretic arm is one of the main concerns of patients after stroke. Katak^{6,7} showed that preservation of proximal movements (shoulder adduction and shrug) after stroke was an early predictor of arm recovery. Nicola S et al⁸ indicated that active finger extension was a reliable early predictor of recovery of arm function in patients with stroke. In Welmer's study⁹, moderate to good correlations between fine hand use and self-care (Barthel Index), were observed from the first week to 18 month after stroke onset, although the strength of the correlations decreased from 0.69 to 0.54.

Published studies suggested good predictivity of active movement of hemiplegic upper limb on prognosis, however, these experiments had some limits, such as small sample size (less than 100 patients) and little

attention on prognosis of daily life activity, et al. We did investigation on prognostic value of active movement of hemiplegic upper limb in patients with acute ischemic stroke in China.

Materials and Methods

Acute ischemic stroke patients were enrolled consecutively for from August, 2007 to April, 2008 in neurology department in the first affiliated hospital of Zhengzhou University. Inclusion criteria and Exclusion criteria as follows:

Inclusion criteria:(1) ischemic stroke;(2) admission within 7 days after onset; (3)muscle strength of proximal or distal end of affected arm < 3 degree; (4)first stroke or another with full recovery from previous ones; (5)intact active movement of affected upper limb before stroke onset.

Exclusion criteria: (1) hemorrhagic stroke.; (2) some factors of this stroke would affected to judge the extent of paralysis upper limb: such as disturbance of consciousness, limb apraxia, self-neglect and sensory aphasia and so on; (3) some other factors which would affected to judge the extent of paralysis upper limb: such as osteopathy, rheumatism and mental diseases and so on; (4) refused to participate in this study.

Patients were assessed for active movement of affected upper limb on admission, day 14 and 30. The evaluation

protocol included 4 potential predictors of arm recovery from Fugl-Meyer arm subset score scale, including shoulder shrug, shoulder abduction, active finger flexion, and active finger extension (score of each test ranged from 0 to 2: 0 totally unable, 1 incompletely, 2 fully accomplish tasks without any hesitation). Prognosis of daily life activity was quantified by Barthel Index (BI score: 0 to 100) on 3, 6 and 12 month after stroke onset by telephone follow-up. BI >60 was defined as good outcome, and BI ≤60 as poor outcome.

In performing statistical analysis, we did single factor analysis in the first step, i.e., Mann-Whitney test. We hypothesized that the single factor might associate with prognosis when it met the significance level at $p < 0.05$. Then we selected those factors with positive results in single factor analysis to put into logistic regression analysis. Data were analyzed using the SPSS statistical package, 15.0 version.

Results

165 patients which met the criteria were enrolled consecutively. During the study, we observed 19 drop-outs, including 11 deaths. The others were completed 3 months, 6 months and 1 year follow-up.

Single factor analysis: Mann-Whitney test: Mann-Whitney test was performed to assess the correlation between active movement of plegic upper limb and prognosis on activity of daily life. To specify active movement of affected upper limb, we categorized it into proximal score (shoulder shrug + shoulder abduction), distal score (active finger flexion + active finger extension), total score (proximal score + distal score). The positive results were shown in Table 1.

Table 1.
Single factor analysis: association between active movements of plegic upper limb and prognosis (Mann-Whitney Test)

	BI (3 months)				BI (6 months)				BI(12 months)			
	>60	≤60	z	P	>60	≤60	z	P	>60	≤60	z	P
NIHSS	97	61	-6.57	0.00	102	49	-5.49	0.00	104	42	-4.25	0.00
Total score On admission	98	61	-5.02	0.00	103	49	-4.29	0.00	105	42	-3.54	0.00
Total score day 14	98	61	-6.33	0.00	103	48	-4.83	0.00	105	41	-4.05	0.00
Total score Day 30	98	59	-7.94	0.00	103	47	-6.52	0.00	105	40	-5.06	0.00
Proximal score On admission	98	61	-4.62	0.00	103	49	-3.26	0.00	105	42	-2.34	0.02
Proximal score day 14	98	61	-5.75	0.00	103	48	-4.83	0.00	105	41	-3.19	0.00
Proximal score day 30	98	59	-7.04	0.00	103	47	-5.45	0.00	105	40	-3.92	0.00
Distal score On admission	98	61	-4.13	0.00	103	49	-3.91	0.00	105	42	-3.08	0.00
Distal score Day 14	98	60	-5.07	0.00	103	48	-4.26	0.00	105	41	-4.00	0.00
Distal score Day 30	98	59	-7.05	0.00	103	47	-6.16	0.00	105	40	-5.17	0.00

Logistic regression analysis: prognosis (Barthel Index) at 3, 6 and 12 month was set as independent variables respectively, and factors associated with prognosis at each time point as dependent variables. All above variables were put into logistic regression analysis as illustrated in Table 2. It is drawn from the table that distal active movement (active finger flexion + active finger

extension) of plegic upper limb on day 30 was associated with prognosis on 3 months ($p=0.000$) and 12 months ($p=0.000$) after stroke onset; The expectation rate declined from 6.022 on 3 months to 2.919 on 12 months; total score (shoulder shrug + shoulder abduction + finger flexion + finger extension) on day 30 was correlated with activity of daily life on 6 months ($p=0.000$).

Table 2

multiple factors analysis: active movements of plegic upper limb and prognosis (Logsic regression analysis)

	BI	B	Wald	Sig.	Exp(B)	95.0% C.I
Distal socre Day 30	3M	1.795	17.057	0.000*	6.022	2.569-14.119
	12M	1.071	13.499	0.000*	2.919	1.648-5.170
Constant	3M	5.610	10.586	0.001	273.069	
	12M	-0.280	0.831	0.362	0.756	
Total score Day 30	6M	0.730	15.824	0.000*	2.074	1.448-2.976
Constant	6M	1.039	1.458	0.227	2.827	

*p<0.05, sig.=p.

Discussion

The present study, focusing on predictable value of active movement of hemiplegic upper limb on activity of daily life (issued by Barthel index) after stroke onset, was first implemented in Han population in China. The study suggested that active movement of affected upper limb in acute ischemic stroke, especially active distal movement, predict good prognosis in short-, medium- and long-term prognosis on activity of daily life. The probable reason lie in capability of active distal movement of affected arm could help patients manage tasks on Barthel index , such as eating and dressing.

Our observation was in accordance with Smania⁸ and Welmers⁹ views: Smania proposed that active distal movement could better predict early recovery of affected arm than proximal movement; while Welmer indicated that fine hand use in acute stroke was positively associated with self-care (Barthel index) on prognosis in short- and long-term run.

The present study also indicates that the strength of association between active finger movement and activity of daily life declined with time, expectation rate declined from 6.022 at 3 month to 2.919 at 12 month. This may be explained as follows: 1. the active movement of affected arm could be further recovered after acute phase; 2.patients took time to learn to use unaffected arm to perform those tasks in Barthel index, and this could compensate their inability in affected arm in daily use. It was also discussed in Welmer and Feyss¹⁰ researches.

There is no correlation between active proximal movement of affected arm and activity of daily life in the present study. In contrast, Katrak ^{7,8} showed that proximal movement, i.e. shoulder shrug and shoulder

abduction, was a reliable predictor for arm recovery. However, Katrak focused on ability of active movement of plegic upper limb when evaluating prognosis, while we use Barthel index to evaluate prognosis of activity of daily life. Barthel index consists of many tasks requiring active distal movement to manage instead of proximal use, which might explain the negative result in the present study.

According to the present study, neurologists may use four simple bedside tests to evaluate active movement of hemiplegic upper arm in patients with acute ischemic stroke. It could not only help doctors to predict prognosis of patients on activity of daily life, but also ease the anxiety of patients and encourage them to better devote themselves to rehabilitation.

Conclusion

Active movement of hemiplegic upper limb in acute ischemic stroke, especially distal active movement, has promising prognostic value on activity of daily life.

References

1. National 8.5 CVD collaborative Group. Community comprehensive preventive study on cardial and cerebral vascular diseases. *Chin J Prevent Med* 1998; **32** (suppl): 3–4.
2. Shi FL, Hart RG, Sherman DG, Tegeler CH. Stroke in the People's Republic of China. *Stroke*. 1989; 20: 1581–85.
3. Liu M, Wu B, Wang WZ, et al. Stroke in China: epidemiology, prevention, and management strategies. *Lancet Neurol*. 2007; 6(5): 456-64.

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4. Kwakkel G, Kollen B, Wagenaar R. Therapy impact on functional recovery in stroke rehabilitation: a critical review of the literature. *Physiotherapy*. 1999; 13:4 57–470.

5 Sharma N, Pomeroy VM, Baron JC. Motor imagery : A backdoor to the motor system after stroke? *Stroke*. 2006, 37 (7):1941-1952.

6 Katrak P , Bowring G , Conroy P et al. Predicting upper limb recovery after stroke the place of early shoulder and hand movement[J]. *Arch Phys Med Rehabil*, 1998, 79(7):758-761.

7 Katrak PH. Shoulder shrug--a prognostic sign for recovery of hand movement after stroke. *Med J Aust* 1990;152(6):297-301.

8 Nicola S, Stefano P, Michele T et al. Active Finger Extension: A Simple Movement Predicting Recovery of Arm Function in Patients With Acute Stroke[J]. *Stroke* 2007;38;1088-1090.

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9 Welmer AK, Holmqvist LW, Sommerfeld DK. Limited Fine Hand Use After Stroke And Its Association With Other Disabilities. *J Rehabil Med*. 2008; 40(8): 603-608.

10 Feys HM, De Weerd WJ, Selz BE et al. Effect of a Therapeutic Intervention for the Hemiplegic Upper Limb in the Acute Phase After Stroke : A Single-Blind, Randomized, Controlled Multicenter Trial[J]. *Stroke* 1998; 29; 785-792.