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ORIGINAL REPORT

DETERMINANTS OF EARLY RETURN TO WORK AFTER FIRST STROKE IN JAPAN

Satoru Saeki, MD[1] and Toshihiro Toyonaga, MD[2]

From the [1]Department of Rehabilitation Medicine, University of Occupational and Environmental Health, School of Medicine, Kitakyushu and [2]Kyushu Rosai Hospital Center for Preventive Medicine, Japan Labor Health Welfare Organization, Kitakyushu-city, Japan

Objective: **To examine the time to return to work after first stroke and identify determinants of early return to work in Japan.**

Design: **A multicentre, prospective cohort study on the association between characteristics at admission and early return to work after first stroke.**

Subjects: **Among 464 patients after first stroke, 325 were registered in this study. All participants were younger than 65 years and engaged in paid work at the time of the stroke.**

Methods: **Data collected prospectively for 18 months were analysed using the Kaplan–Meier method for time trends, and then a multiple logistic regression model for odds ratio of early to late return to work was conducted.**

Results: **Of the 325 registered patients (mean age 55.1, standard deviation (SD) 7.4 years), 253 (78%) were available for follow-up, and 138 (55%) returned to work. The curve of proportion of return to work was non-linear. Significant determinants of early return to work were gender, function of hemiplegic hand, and ability to perform activities of daily living independently.**

Conclusion: **The curve of time to return to work was influenced by the follow-up days. Patients after stroke who were male and/or had milder physical disabilities tended to return to work earlier.**

Key words: stroke; vocational outcome; Japan.

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Correspondence address: Satoru Saeki, Department of Rehabilitation Medicine, School of Medicine, University of Occupational and Environmental Health, 1-1 Iseigaoka, Yahatanishi-ku, Kitakyushu 807–8555, Japan. E-mail: sae@med.uoeh-u.ac.jp

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INTRODUCTION

Stroke is a source of major disability, particularly in older workers, and is associated with a substantial socioeconomic burden (1, 2). The economic burden of stroke can be identified in terms of direct costs of providing medical care to patients and indirect costs associated with lost productivity (3). In 2004, the direct and indirect costs of stroke in the USA were estimated at $53.6 billion, with a mean lifetime cost estimated at $140,048 per person (4). Indirect costs associated with lost productivity can be up to 58% of lifetime costs (3). Therefore, promoting early return to work (RTW) after stroke could help to reduce indirect costs associated with this disorder.

In addition to being an important outcome, RTW following stroke reflects a patient's social restoration. Vestling et al. (5) showed that having employment after a stroke promoted well-being and life satisfaction for patients. Although returning to work is a goal in post-stroke patients, the speed at which patients can return depends on their recovery (6). A rapid or early RTW indicates an early recovery and minimization of the significance of the stroke. Alaszewski et al. (6) defined rapid RTW after stroke as returning within 3 months from stroke onset. Similarly, another follow-up study in Japan (7) found 2 steep slopes in the RTW curve after stroke, and 2 groups of successful subjects who returned to work (early vs late RTW group). The early RTW group returned to work within 6 months post-stroke; in contrast, the late RTW group returned to work within 18 months post-stroke. Recently, in Japan, acute stroke therapy has been developed and a drastic change in the medical care system has taken place (8, 9). It is unknown, however, whether these changes influence time to RTW.

As reported in 24 studies, the proportion of subjects returning to work after stroke ranges from 11% to 85% (10). Although various studies have reported on RTW in diverse populations, these studies have different follow-up periods and use different definitions of stroke and successful work outcome (4), making comparisons between studies difficult. However, several predictors of RTW after stroke have been identified (3, 4, 10). Positive predictive factors include younger age, higher education level, and white-collar employment, whereas negative predictive factors include the severity of the stroke as determined by neurological parameters. Interestingly, the side of the brain damaged and the location of the stroke were not shown to be correlated with RTW (11, 12). Social and financial factors also significantly influenced RTW (7, 13).

Most previous studies have focused on whether the stroke patient could RTW, but there is a lack of data on early RTW after stroke. Early RTW after stroke is not only an important issue for individuals after stroke, but also an effective way to reduce associated indirect costs by reducing the number of lost work days. The purpose of the present study was to: (*i*) prospectively examine the current proportion and time trend of RTW

post-stroke; and (*ii*) identify the determinants of earlier RTW in subjects who successfully RTW after stroke.

METHODS

Design

A prospective cohort study of the association between patient characteristics at admission and earlier RTW after first stroke was conducted in a multi-centre collaboration of 21 Rosai Hospitals in Japan. The study was approved by the Japan Labor Health and Welfare Organization (JLHWO) and each hospital's ethics committee. Informed consent was obtained from all subjects.

Subjects

Subjects were recruited from 21 Rosai Hospitals throughout Japan. These hospitals were founded by JLHWO, one of the auxiliary organizations of the Ministry of Health, Labor and Welfare, to treat primarily ill and/or injured labourers. Each hospital follows the same medical protocols. Similar to other hospitals in Japan, these hospitals provide patients after stroke with standard therapy from the acute through the recovery stage, including medical rehabilitation.

Of the 464 patients after first stroke admitted to the hospitals between February 2006 and July 2007, an initial cohort ($n = 325$) was included in this study based on the following criteria: (*i*) first stroke; (*ii*) diagnosis of stroke (cerebral haemorrhage, cerebral infarction, or subarachnoid haemorrhage); (*iii*) age 15–64 years; and (*iv*) active employment status (full-time or part-time competitive employment, or self-employment) at stroke onset. We excluded patients whose occupation was classified as housewife or student.

Data collection

Sociodemographic, diagnostic, and functional data of subjects were prospectively assessed and collected in each hospital by hospital staff, including doctors, nurses, therapists, and medical social workers, using a unified data format entered on a secure website. The staff of each hospital registered the cases, input data in the required format, and transmitted data to the host computer at the head office of the project. The unified format consisted of 3 parts: (*i*) data at admission; (*ii*) data at discharge; and (*iii*) data at follow-up 18 months post-stroke.

Predictors

Potential predictors of early RTW were selected from the data gathered at admission based on a review of the literature (3, 4, 10) and included the following: age, gender, stroke subtype, occupation (white- or blue-collar), education level, marriage, previous alcohol consumption, hypertension, side and severity of hemiplegia, higher cortical dysfunctions (aphasia, agnosia, and apraxia), and ability to perform activities of daily living (ADL), as evaluated by Barthel Index (14).

Severity of hemiplegia was expressed as a function of the hemiplegic hand and leg based on the Brunnström stage (15), which is used widely in Japan: non-functional, stage 1–3; assistive, stage 4–5; and functional, stage 6. Higher cortical function was examined neurologically and any dysfunctions were distinguished. The Barthel Index assessed self-performance of ADL and categorized results as follows: 0–39, totally dependent; 40–79, partially dependent; or 80–100, independent.

Outcomes

The outcome was RTW after stroke, which was defined as active employment at the former or at a new occupation (full-time or part-time competitive employment, or self-employment). Data at follow-up 18 months after stroke onset included employment status, occupation, and the date of RTW after discharge. The follow-up period of 18 months was based on a previous study (7), which determined that the proportion of subjects returning to work after stroke reached a maximum level at 18 months and then plateaued, reflecting the time limit of patients' health benefits from the public fund source in Japan. Follow-up data were obtained using postal questionnaires at 18 months after stroke onset. When the questionnaire was incomplete, telephone interviews were conducted by medical social workers according to a common manual.

Of 325 registered stroke patients (mean and standard deviation (SD) age 55.1 years (SD 7.4), 253 (78%) answered the follow-up questionnaire. The mean age and the gender ratio of the 72 cases lost to follow-up were not significantly different from those of the 253 subjects included in the analysis.

Statistical analysis

The Kaplan–Meier method was used to calculate the proportion of subjects who experienced the event in question (RTW in this study) during the observation period. The length of observation was defined as follows. For censored cases of subjects who were followed up but did not return to work, the observation period was the interval between onset of stroke and the follow-up date of the response to the questionnaire; for non-censored cases (i.e. patients who returned to work successfully) the length of observation was the interval between the onset of stroke and the date of RTW. Because a previous study showed that the RTW curves, as assessed by the Kaplan–Meier method, were non-linear (7), we also performed logarithmic transformation of the observation period for the Kaplan–Meier curve.

We next examined the factors associated with early RTW in subjects who successfully returned to work. Because a previous study revealed that 50% of patients who successfully returned to work had returned to work within 100 days after stroke onset (7), we divided RTW cases into the early RTW group (< 100 days from stroke onset) and the late RTW group (≥ 100 days from stroke onset). Univariate analysis was first performed to identify factors associated with early RTW using the χ^2 test. These factors were then incorporated as independent variables (the key variables), with early RTW as the dependent variable in the multiple stepwise logistic regression analysis. The logistic regression analysis computed odds ratios (ORs) to measure the association of each selected factor with early RTW, adjusting for other factors including the model.

We used JMP® (SAS Institute Inc., Cary, NC, USA) statistical software for statistical analyses. $p < 0.05$ was considered significant.

RESULTS

A total of 138 patients (55%) reported successful RTW by 18 months after stroke onset (Table I). Plots of the cumulative proportion of subjects who successfully returned to work over time are shown in Fig. 1A. The curve is non-linear, with two steep curves, one during the first 400 days and the other during the next 100 days. This finding suggests that subjects who successfully returned to work included those in both the early and late RTW groups. Of the subjects who successfully returned to work, 50% returned to work within 100 days from onset. Fig. 1B. shows plots of the cumulative proportion of subjects who successfully returned to work with the logarithmic transformation of the observation period. This graph is linear between 10 and 400 days follow-up, and also shows the cumulative 50% of cases who successfully returned to work at approximately 100 days.

Univariate analysis showed the following factors were associated with early RTW: gender, function of the hand and leg with hemiplegia, and independence in performing ADL (Table I). Eleven cases with missing key variables were eliminated, leaving 127 patients as subjects for the multivariate analysis. Table II shows the adjusted ORs of each predictor for early

Table I. *Association between factors at admission and early return to work after stroke among patients who successfully returned to work*

Factor	Initial cohort (n=325) n*	Successfully returned to work (n=138) n*	% Early RTW	p†
Age, years				0.133
15–45	34	17	44.2	
46–55	94	57	49.1	
56–64	196	64	31.3	
Gender				0.025
Male	264	113	44.3	
Female	61	25	20.0	
Education				0.172
Less than high school	56	15	20.0	
High school graduate	170	76	44.8	
College graduate	54	32	46.9	
Occupation				0.206
Blue-collar	205	61	36.1	
White-collar	119	59	47.5	
Marriage				0.998
Married	247	112	40.0	
Single/divorced/widowed	67	20	40.2	
Prior alcohol drinking				0.959
Yes	195	76	40.8	
No	118	57	40.4	
Previous hypertension				0.239
Yes	211	90	44.4	
No	97	39	33.3	
Diagnosis				0.865
Cerebral haemorrhage	117	40	40.0	
Subarachnoid haemorrhage	30	12	33.3	
Cerebral infarction	170	82	41.5	
Side of hemiplegia				0.427
None	37	21	42.9	
Left	122	50	46.0	
Right	149	60	35.0	
Bilateral	8	2	0.0	
Function of the hand with hemiplegia				0.001
Functional	214	103	48.5	
Assistive	51	20	20.0	
Non-functional	51	11	0.0	
Function of the leg with hemiplegia				0.024
Functional	246	119	43.7	
Assistive	52	15	13.3	
Non-functional	18	0	0.0	
Aphasia				0.123
Yes	56	11	18.2	
No	260	124	41.9	
Agnosia				0.733
Yes	46	6	33.3	
No	271	129	40.3	
Apraxia				0.761
Yes	21	2	39.4	
No	295	132	50.0	
ADL (Barthel Index)				0.003
Independent (80–100)	73	45	55.6	
Partially dependent (40–79)	74	32	50.0	
Totally dependent (0–39)	158	52	23.1	

*Sum of patients for each factor does not always equal the total number because of missing data.
†Significance by χ^2 test on percentage return to work.
ADL: activities of daily living; RTW: return to work.

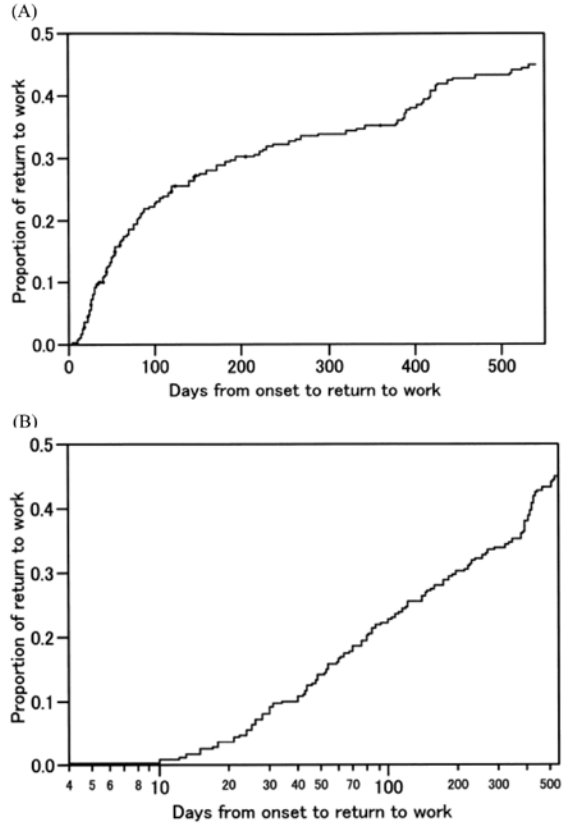

Fig. 1. Proportion of subjects who successfully returned to work after first stroke by (A) Kaplan–Meier method, and (B) logarithmic transformation for follow-up days (n=253).

RTW among subjects who successfully returned to work based on the multiple logistic regression model. The odds of early RTW for male patients after stroke were 3 times greater than female patients. Function of the hemiplegic hand was significantly associated with early RTW, but function of the hemiplegic leg was not. Patients who independently performed ADL

Table II. *Selected factors and adjusted odds ratios for early return to work after stroke among patients who successfully returned to work based on a stepwise logistic regression analysis (n = 127)*

Factor	Odds ratio (95% CI)
Gender	
Female	1.00
Male	3.24*(1.11–10.96)
Function of the hand with hemiplegia	
Assistive or non-functional	1.00
Functional	4.66*(1.40–19.53)
Function of the leg with hemiplegia	
Assistive or non-functional	1.00
Functional	1.40 (0.24–11.18)
ADL (Barthel Index)	
Totally dependent (0–39)	1.00
Partially dependent (40–79)	2.35 (0.86–6.54)
Independent (80–100)	2.71*(1.08–7.03)

*p<0.05.
CI: confidence interval; ADL: activities of daily living.

were 3 times more likely to return to work earlier than those who were totally dependent on others for ADLs.

DISCUSSION

This longitudinal study on RTW after first stroke among subjects younger than 65 years showed the current timeline for subjects to return to work after stroke as well as determinants of early RTW in Japan. Our study was a multicentre-based study, indicating that subjects were more representative of a general population than other hospital-based studies (10). Additionally, we used a prospective cohort design and a uniform follow-up time (18 months) for all subjects.

We found that 55% of the 253 first-stroke patients returned to work. Though caution is required when comparing the current RTW rate among countries due to the different backgrounds and methods, the rate of our subjects was higher than that in the UK (35%) (16) and similar to that in New Zealand (53%) (17). On the other hand, it is surprising that the rate of 55% was almost same as that in a previous study in Japan, performed 10 years ago, which reported a RTW rate of 58% (18), despite different medico-social backgrounds, subjects, and methods. The conditions for stroke rehabilitation in Japan have changed drastically over the past decade, including an increased incidence of ischaemic stroke (8), approval of intravenous recombinant tissue plasminogen activator (9), and hospital specialization influenced by the introduction of convalescent rehabilitation wards and public long-term care insurance. Regardless of those changes during the past decade in Japan, the steady rate of RTW may mean that the proportion of subjects who are able to return to work has reached its maximum. In this respect, not only the quantitative aspect of successful outcome in RTW, but also qualitative aspects, such as promoting early RTW, are important.

The curve of the cumulative proportion of subjects who successfully returned to work was non-linear, and had two steep slopes, one during the first 400 days and the other during the following 100 days. This finding is in agreement with the previous report that social factors, such as duration of sickness benefits, influenced RTW (7), and indicates that subjects who successfully returned to work included those in both the early and late RTW groups.

The graph of the logarithmic transformation of the observation period was linear between 10 and 400 days, and showed that the proportion of subjects who successfully returned to work between 20 and 40 days from stroke onset was the same as that between 200 and 400 days. The time-dependent curves of RTW may reflect the specificity of post-stroke disability beyond the change of medical and social conditions; however, the reconfirmed time-trend of RTW has been reported only in Japan. Further research is necessary to determine whether a similar time-trend may be seen in other countries where social and cultural backgrounds are different from Japan (10).

Though several studies have reported the predictors of overall successful RTW (3–7, 10–13, 18–22), to our knowledge, this is the first study to examine determinants of early RTW in post-stroke patients who successfully RTW in Japan.

Determinants of early RTW after stroke were different from those of overall successful RTW because the analyses included only subjects who returned to work. The multiple logistic regression model indicated that male gender, functional hand on hemiplegic side, and independence regarding ADL were positive predictors of early RTW among patients who successfully returned to work.

The association between gender and RTW varies in the literature (3, 10). Two early studies (11, 23) reported an association between the male gender and RTW. In contrast, several studies have found no association between gender and RTW (10, 18, 20, 24). A recent study in the UK found that female gender was a negative predictor of RTW (16). Although it is unclear what caused these differences, we propose 2 possibilities: (*i*) female gender is generally associated with disadvantages in employment; and (*ii*) male patients may be forced to RTW earlier to support the household. Further studies are needed to identify the reasons for the differences between studies.

The function of the hand on the hemiplegic side and ADL measured by Barthel Index were positive predictors of early RTW. There was no correlation between these 2 factors, thus they should be considered separately. Many studies have found that the presence of greater severity of hemiplegia after stroke adversely affects RTW (3, 4, 7, 10, 18, 19). In particular, hand function of the hemiplegic side is an important factor in early RTW due to its direct influence on the ability to work.

Independence in performing ADL was most important for early discharge from the hospital, which precedes early RTW. Several studies have reported the association between independence in ADL and RTW after stroke (11, 16, 18, 20). Two studies showed that functional disability, as measured by the Barthel Index, is an important predictor of RTW (11, 16).

This study has several limitations. First, 22% of subjects were lost to follow-up. However, the characteristics of the cases lost to follow-up were not significantly different from those of subjects included in the analyses; therefore, the selection bias is likely to be small. Secondly, measurement or information bias may exist, especially from data obtained during the 18 months of follow-up using a postal questionnaire or telephone interview. However, the unified and common evaluation methods that were used in the 21 hospitals would minimize this bias. Thirdly, factors not included in our model may have increased the possibility of confounding. Finally, this study focused on the prognostic factors at initial evaluation on RTW, and changes or improvements in these factors during inpatient rehabilitation were not considered.

Despite these limitations, our study shows the time to RTW and the discriminants of early RTW after first stroke among Japanese patients. Future research on time to RTW in other countries focusing on the qualitative aspect of RTW is needed.

In conclusion, the results of this prospective study demonstrate that the curve of the cumulative proportion of subjects who successfully returned to work was non-linear and time-dependent. In addition, male gender, functional hand on the hemiplegic side, and independently performing ADL were positive predictors of early RTW.

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