



Premorbid instrumental activities of daily living predicts discharge home following stroke



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ABSTRACT

Background and purpose: Stroke survivors who remain dependent require multiple healthcare resources, including rehabilitation and nursing care. The effect of premorbid instrumental ADL (IADL) on the discharge destination, which has not been studied previously in detail, is analyzed.

Materials and methods: Between April and September 2015, 40 stroke patients admitted to hospital were enrolled prospectively in the present study. The ADL (Barthel index) and IADL (Frenchay activities index: FAI) scores in their premorbid status were recorded. Baseline demographic data, stroke severity (NIHSS) and type of stroke, and whether they lived with family were also recorded. Simple univariate regression was performed between the two discharge destination groups (Home or Not Home). Significant factors were then included in multivariate logistic regression in order to determine the adjusted odds ratio for the discharge destination. A *P* value < .05 was taken as significant.

Results: 25 patients (64.1%) returned home. According to univariate analysis, NIHSS on admission and premorbid FAI were significantly associated with the discharge destination. Multivariate analysis found that NIHSS (OR, 0.71; 95% CI 0.56–0.92; *p* = .008) and premorbid FAI (OR, 1.17; 95% CI 1.03–1.33; *p* = .01) were independent predictors of the discharge destination.

Conclusions: Severity of stroke upon admission and premorbid IADL are associated with discharge destination following stroke.

1. Introduction

Stroke is one of the leading causes of disability worldwide, including Japan. Improvements in treatment for acute stroke have led to a reduction in mortality [1,2]. Nevertheless, persons impaired by stroke, even after the acute phase, require a great deal of healthcare resources and social services.

After acute hospitalization, stroke survivors either return to their home or are transferred to an inpatient rehabilitation facility, or a skilled nursing facility. Available social welfare services are limited, so it is preferable to reduce the proportion of patients who require institutionalization following acute medical care. In Japan, national medical expenditure is increasing due to an increasing number of elderly, which is likely to place a burden on the national budget. As a result, the Japanese government is promoting home care by avoiding hospitalization or institutionalization wherever possible [3]. Home discharge would be important in reducing the financial burden, not only for patients but also for all taxpayers. Factors influencing the

destination after discharge include family structure, number of family members, social background and pathology. [4] Instrumental activities of daily living (IADL) have scarcely been studied as predictors of the discharge destination following stroke. We explore in this study the effect of premorbid IADL on the destination immediately after discharge following stroke.

2. Materials and methods

2.1. Patient population

This study was approved by the local institutional review board. In 2015, between 1 January and 30 September, patients admitted to the stroke care unit (SCU) in Nagahama City Hospital were enrolled in the present study, and were analyzed retrospectively.

Criteria for inclusion in this study were: (1) patients had suffered acute ischemic or hemorrhagic stroke; (2) patients were living in their own home before admission (whether independently or dependent); (3)

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informed consent was granted by the patients or by their relatives.

2.2. Data collection

For each patient, demographic data were collected including age, sex, and type of stroke (hemorrhage or ischemia). The following comorbidities were logged: history of stroke, dementia and presence of atherosclerotic risk factors (hypertension, diabetes mellitus or dyslipidemia), current or previous history of smoking, and alcohol intake. Severity of stroke was measured on admission according to the National Institutes of Health Stroke Scale (NIHSS). These data were collected by chart review during the acute hospitalization period. Also, whether or not the patient lived with family was recorded. Premorbid activities for daily living (ADL) and IADL were assessed by interview with patients or their family members upon admission, using the Barthel index (BI) [5] for ADL, and the Frenchay activities index (FAI), [6] for IADL.

The FAI involves 15 items, representing the three areas of domestic chores, leisure/work and outdoor activities. An integer score from 0 to 3 is assigned for each item, based on how often that activity has been undertaken during the previous 3 or 6 months. The FAI was developed to measure lifestyle in terms of complex physical activities and social functioning, and has good psychometric properties, such as reliability [7] and validity [8] when used with people with stroke.

Discharge destination was categorized according to two locations: home (Home) versus other (Not Home).

2.3. Statistical analysis

Characteristics of patients are presented via medians and the interquartile range (IQR), or as frequencies with percentages, depending on the type of data. Continuous variables are compared using the Mann-Whitney *U* test, and category variables by Fisher's exact test.

Univariate analysis of the possible covariates was performed in a search for predictors of the discharge destination with $p < .05$. As the number of patients included in the study was not large, covariates for further analysis were selected on the basis of clinical importance. This was done to reduce the number of potential predictors included in the logistic regression model, so as to prevent over-modeling. Results are reported as odds ratios (ORs) with 95% confidence intervals (CIs), with discharge to somewhere other than home as reference. Adjusted ORs with 95% CIs were derived for significant predictors from the multivariate logistic regression. *P* values less than 0.05 were taken to be significant. Data were processed using the free software package EZR [9].

3. Results

A total of 48 patients were admitted to our SCU during the study period. Of these, 40 patients were eligible for inclusion in the present study. The other 8 patients were excluded because the primary reason for admission was something other than acute stroke. One patient who died of recurrent stroke while in hospital was also excluded from further analysis; as a result, 39 patients were analyzed in full.

A total of 25 patients (64.1%) returned home directly from the acute care hospital. Demographic data showed that Home vs Not Home did not differ according to sex, type of stroke or comorbidities (Table 1). Only the age at admission was different: it was younger in patients discharged home than elsewhere ($p = .04$).

According to univariate analysis, NIHSS upon admission (OR, 0.78; 95% CI 0.65–0.94; $p = .01$) and premorbid FAI (OR, 1.09; 95% CI 1.00–1.18; $p = .04$) were statistically significant predictors of discharge destination (Table 2). In multivariate analysis, both of these variables remained independent predictors (NIHSS on admission: OR, 0.71; 95% CI 0.56–0.92; $p = .008$, premorbid FAI: OR, 1.17, 95% CI 1.03–1.33; $p = .01$); see Table 3.

Since age showed a trend in predicting discharge destination in

Table 1

Comparison of baseline demographic and comorbidities between patients who returned home and those who did not return home.

	Home	Not Home	P value
Age (median(IQR))	73(13.0)	82(14.3)	0.04
Sex (%female)	52.0	42.9	0.74
Type of stroke(%hemorrhagic)	40.0	50.0	0.74
Living alone(%)	12.0	28.6	0.23
Past stroke history(%)	28	14.3	0.45
Dementia(%)	8	35.7	0.07
Atherosclerotic risk factor (%)	71.4	80	0.70
Smoking(%)	28.6	40	0.73
Alcohol drinking (%)	44	21.4	0.19

Values are presented as median (interquartile range) or percentage. Bold shows "statistically significant".

Table 2

Univariate logistic regression analysis of significant risk factors for discharge destination of home.

	OR	95% CI	P value
Age	0.93	0.87–1.00	0.05
Sex (female vs male)	1.44	0.38–5.39	0.58
Stroke type(hemorrhage vs ischemia)	0.66	0.17–2.49	0.54
Living alone	2.93	0.55–15.60	0.20
NIHSS on admission	0.78	0.65–0.94	0.01
Premorbid FAI	1.09	1.00–1.20	0.04
Premorbid BI	1.09	0.99–1.2	0.07

Bold shows "statistically significant".

Table 3

Multivariate logistic regression analysis of significant risk factors for discharge destination of home.

	OR	95%CI	P value
NIHSS on admission	0.71	0.56–0.92	0.008
Premorbid FAI	1.17	1.03–1.33	0.01

Bold shows "statistically significant".

univariate analysis (OR, 0.93, 95% CI 0.87–1.00; $p = .05$), we undertook a further multivariate analysis including age as a covariate. Premorbid FAI (OR, 1.17, 95% CI 1.01–1.35; $p = .03$) and NIHSS on admission (OR, 0.72, 95% CI 0.55–0.93; $p = .01$) remained significant in this multivariate analysis, but age did not (OR, 0.99, 95% CI 0.90–1.09; $p = .91$).

4. Discussion

The present study demonstrated that stroke severity on admission and premorbid IADL are both correlated with the discharge destination following stroke: home or somewhere else.

Various factors influencing discharge destination have been examined previously. As here, stroke severity as measured by NIHSS on admission was found to be a strong predictor of hospital disposition following acute ischemic stroke [10]. In regard to functional status at the time of admission, BI [11], functional independence measure scale [12], and motor assessment scale [13] were all investigated; a lower functional status predicted that the discharge destination would not be the patient's home. Of the other factors mentioned above, only BI on admission gave a trend of discharge home (OR = 1.09, $p = .07$) in the present study, possibly because of the small number of patients studied.

Külzer et al. [14] reported that, in patient with acute stroke, the total premorbid FAI score predicts clinical outcome as measured by the modified Rankin scale at discharge. These authors suggested that higher mental, physical and social activities before the stroke could reduce functional damage caused by cerebrovascular accident through

increased cerebral blood flow. We did not measure the modified Rankin scale as a reflection of clinical outcome, but if a BI score of 90 or more at 6 months is defined as favorable outcome, which is equivalent to a modified Rankin scale of 0 to 2 [15], then the premorbid FAI total score proved to be a significant predictor of favorable outcome in a separate univariate analysis (OR: 1.20, 95% CI: 1.06–1.34, $p = .002$). The present study is the first to study premorbid FAI as a factor influencing destination following discharge.

Reeves et al. [16] reported that living alone predicts a discharge destination other than home in Canada, although they did not report psychosocial measures such as FAI. The present study did not replicate this result. This is perhaps because of current Japanese government policy that even disabled patients should spend their lives in their community or in a familiar environment; Japan has inherently less social capital than Western countries [17].

5. Limitations of this study and future perspectives

Our study enrolled only a small number of patients. Also, our hospital is located in a rural region in which aging and depopulation have been taking place, so it would be surprising if our results were generalizable worldwide. A prospective, general population-based cohort study would be needed to generalize the results. Cognitive function, which is a well-known predictor of discharge destination [18], was not investigated; only a history of dementia was recorded. Future studies with a large sample size might clarify the extent to which premorbid IADL status should be taken into account in discharge planning. Moreover, improvement in the premorbid IADL of community dwellers could assist in reducing the consumption of healthcare resources, in association with discharge to rehabilitation or a nursing home. Maintenance of IADL is also important for quality of life, self-efficacy and economic burden [19]. We should therefore also promote social programs to enhance the IADL of elderly members of the community, which might improve stroke outcome as measured by discharge disposition [20].

6. Conclusion

Whether a patient goes home or somewhere else upon discharge from hospital following stroke is predicted by stroke severity on admission and (separately) by premorbid IADL. Increasing severity of stroke is associated with greater likelihood of discharge to rehabilitation or nursing facilities. The significance of premorbid IADL for discharge disposition, which has not been considered before, makes premorbid IADL a valuable predictor of the discharge destination following stroke.

Author contribution statement

TS conceived the idea, collected the data, analyzed the data, and wrote the manuscript. TK and MO supervised the study.

All authors discussed the results and the contributed to the final manuscript.

Declaration of Competing Interest

None.

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