

# Improvement in Activities of Daily Living among Post-stroke Patients with and without Internal Disorders in a Recovery-phase Rehabilitation Ward

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## [Abstract]

We investigated whether or not the presence of internal disorders affected the rate of improvement in activities of daily living (ADL) among recovering patients with stroke admitted to a recovery-phase rehabilitation ward. The participants were 71 patients in a recovery-phase rehabilitation ward. The internal disorders addressed were all chronic disorders. The ADL improvement rate was calculated by dividing the difference between functional independence measure (FIM) scores at admission and discharge by the number of days spent in the recovery-phase rehabilitation ward. There were 18 patients with internal disorders and 53 without internal disorders. There was no significant difference in patient characteristics between those with and without internal disorders, although there was a tendency for left hemiplegia to be more common among those without an internal disorder. Our results showed that, even in recovering patients with stroke and internal disorders, there is no difference in the ADL improvement rate if risk management is employed during rehabilitation.

**Key words:** stroke, rehabilitation ward, internal disorders, activities of daily living

## 1. Introduction

Stroke is the most common cardiovascular disorder. Although it is the fourth most frequent cause of death,<sup>1)</sup> the number of deaths from stroke is decreasing, while more patients are requiring rehabilitation post-stroke.

Approximately 30% of people with disabilities experience internal disorders. Heart disease is the second most frequent cause of death.<sup>1)</sup> Pasquale et al. reported that 28% of patients with mild stroke also exhibit signs of myocardial ischemia.<sup>2)</sup> Kohzuki et al. also found that 18% of patients with stroke also experienced ischemic heart disease.<sup>3)</sup> The main symptoms in chronic obstructive pulmonary disease (COPD) are dyspnea on exertion, coughing, and expectoration of sputum. Although there are currently around 200,000 people with COPD, an epidemiological study has estimated that there may be around 5 million individuals with latent COPD,<sup>4)</sup> and the number of patients is expected to increase in future.

Comorbidity with internal disorder increases mortality

among patients with stroke and affects the capacity for rehabilitation. Roth et al. investigated whether coronary artery disease and heart failure have any effect on the outcome of rehabilitation for patients with stroke.<sup>5)</sup> They revealed that the functional prognosis for patients with both coronary artery disease and heart failure was significantly poorer, and that heart failure had a major effect on activities of daily living (ADL) at discharge.

However, those studies were carried out in countries with a healthcare system different from that in Japan. Stroke rehabilitation in Japan is divided into the following three phases: acute, recovery, and maintenance. Most of the patients' rehabilitation time in the recovery phase is spent in a recovery-phase rehabilitation ward, where precedence is given to factors such as the number of units of rehabilitation that can be provided.

In this study, we investigated whether the presence of internal disorders had an impact on the improvement of ADL in patients with stroke in a recovery-phase rehabilitation ward.

Table 1. Patient characteristics

	All	Non-ID group	ID group	p value
Sex (m / f)	33/38	23/30	10/8	0.421
Age (years)	71.6 ± 12.8	71.1 ± 12.8	72.9 ± 13.1	0.615
Diagnosis (cerebral infarction / cerebral emorrhage / subarachnoid hemorrhage / other)	50/14/3/4	38/10/2/3	12/4/1/1	0.950
Paralyzed side (right / left / both / other)	31/31/8/1	19/25/8/1	12/6/0/0	0.073
Internal disorder				
Angina	2	—	2	
Myocardial infarction	1	—	1	
Valve disease	10	—	10	
MMSE	18.9 ± 11.1	19.6 ± 10.7	16.8 ± 12.2	0.359
BRS at admission †				
Upper extremity	5.0 (3.0 - 5.0)	5.0 (3.0 - 5.0)	5.0 (3.75 - 5.0)	0.951
Finger	5.0 (3.0 - 5.0)	5.0 (3.0 - 5.0)	4.0 (3.75 - 5.0)	0.530
Lower extremity	5.0 (4.0 - 6.0)	5.0 (4.0 - 6.0)	5.0 (4.0 - 5.0)	0.983
FIM at admission				
Motor	58.9 ± 21.1	57.1 ± 21.7	64.2 ± 18.7	0.218
Cognitive	26.9 ± 7.7	26.2 ± 8.2	28.8 ± 5.9	0.229
Total	85.8 ± 27.4	83.3 ± 28.7	93.0 ± 22.4	0.197

Mean ± SD, †Median (interquartile range)

ID: internal disorder, MMSE: mini-mental state examination, BRS: Brunnstrom recovery stage, FIM: functional independence measure

## 2. Methods

### 1) Participants

The study participants were patients discharged from the recovery-phase rehabilitation ward of Higashi-nagoya National Hospital between December 2013 and May 2014. Those with progressive disorders (malignant tumors, intractable neurological disorders, or Alzheimer's disease) and those with serious orthopedic or cardiovascular disorders that severely diminished their ADL before the onset of stroke were excluded. In this study, heart disease was defined as only angina, myocardial infarction, or valve disease affecting the heart's pumping ability. Angina was assessed in terms of the subjective complaints by the patient, myocardial infarction by electrocardiography or cardiac catheterization, valve disease by transthoracic ultrasonography, and other internal disorders on the basis of information provided in medical certificates and in interviews with patients, with doctors determining whether the internal disorder was present at the time of admission to the recovery-phase rehabilitation ward. Patients with at least one condition were regarded as

having an internal disorder (ID group), and those with no disorder were classified into the Non-ID group.

This was a retrospective observational study, and was carried out in accordance with the Ethical Guidelines for Clinical Studies.

### 2) Parameters measured

#### (a) Patient characteristics

Data on sex, age, diagnosis, paralyzed side, and time spent in the recovery-phase rehabilitation ward were gathered from medical records. During their time in the recovery-phase rehabilitation ward, patients underwent the Mini-Mental State Examination (MMSE) <sup>6)</sup> and their Brunnstrom recovery stage (BRS) <sup>7)</sup> was evaluated.

#### (b) ADL improvement rate

ADL was evaluated by using the functional independence measure (FIM). FIM scores at admission and discharge were measured, and the difference was defined as FIM gain. <sup>8)</sup> The ADL improvement rate was obtained by dividing FIM gain by the number of days spent in recovery-phase rehabilitation.

Table 2. FIM gain and ADL improvement rate

	Non-ID group	ID group	<i>p</i> value
Duration of hospitalization (days)	62.3 ± 30.1	63.0 ± 37.0	0.945
FIM score at discharge			
Motor	80.0 ± 12.8	71.5 ± 18.4	0.039
Cognitive	30.0 ± 5.4	28.5 ± 6.9	0.430
Total	110.0 ± 17.1	100.0 ± 24.4	0.068
FIM gain			
Motor	0.30 ± 0.28	0.25 ± 0.20	0.405
Cognitive	0.03 ± 0.06	0.04 ± 0.05	0.393
Total	0.33 ± 0.31	0.29 ± 0.21	0.556

Mean ± SD

ID: internal disorder, FIM: functional independence measure

### 3) Statistical methods

Comparisons of patient characteristics between the two groups were undergone using an unpaired t-test, Mann-Whitney U-test,  $\chi^2$  test, and Fisher's exact test. FIM score at discharge and ADL improvement rate were compared by using an unpaired t-test. Statistical analysis was carried out with SPSS ver. 17.0 for Windows (SPSS, Tokyo), with  $p < 0.05$  regarded as significant.

### 3. Results

There were 71 participants whose mean age was 71.6 ± 12.8 years. Patient characteristics are shown in Table 1. There was no significant difference in patient characteristics between two groups. In the ID group, heart disease comprised angina in 2 patients, myocardial infarction in 1, and valve disease in 10. There was a tendency for the incidence of left hemiplegia to be greater in the Non-ID group than the ID group.

Although there was no significant difference in FIM at admission or the duration of hospitalization in the recovery-phase rehabilitation ward between two groups, FIM motor score at discharge was significantly higher in the ID group compared to that in the Non-ID group. There was no difference in the ADL improvement rate with respect to motor, cognitive, or total scores (Table 2).

### 4. Discussion

In the present study, we found that the presence of an internal disorder did not affect the rate of ADL improvement.

Our results in this study showed that there was no difference in the ADL improvement rate among patients with stroke with or without an internal disorder in a recovery-phase rehabilitation ward. The role of recovery-phase rehabilitation wards is to provide active rehabilitation, but some patients may not have sufficient cardiovascular function to participate. Patients with current serious cardiovascular disease that restricted their ADL prior to the onset of stroke were excluded from this study.

The participants in this study included 2 patients (2.8%) with angina and 1 (1.4%) with myocardial infarction, which was an extremely small proportion compared with Kohzuki et al.'s finding that approximately 18% of patients with stroke also had ischemic heart disease.<sup>3)</sup> This may have been the result of selection bias in our study.

However, Roth et al. found that myocardial infarction and angina had almost no effect on ADL at discharge, but chronic heart failure had a major effect,<sup>5)</sup> which supports the results in our study.

FIM motor score at discharge was significantly higher for patients with an internal disorder than for those without an internal disorder. Left hemiplegia also tended to be more common among those without an internal disorder, although this difference was not significant.

Symptoms associated with left hemiplegia are hemispatial neglect and attentional deficit. Hemispatial neglect is a risk factor for falls in patients with stroke,<sup>9)</sup> and such patients with hemispatial neglect or attentional deficit have been reported to have lower FIM scores.<sup>10)</sup> It

is thus possible that the higher FIM scores at discharge among patients with an internal disorder may have been due to the uneven distribution of patients with left hemiplegia, rather than being the effect of the presence of an internal disorder.

This study had several limitations. First, exercise stress testing was not used for the diagnosis of angina. Some patients who experienced angina may have been regarded as not having an internal disorder because they did not undergo an exercise stress test. Second, there was no quantitative diagnosis of higher brain dysfunction. The presence of higher brain dysfunction has a major effect on the ADL of patients with stroke. Future studies investigating the effect of internal disorders alone after adjustment for higher brain dysfunction are required. Third, we only examined heart disease in this study. Prospective studies on the effect of disorders such as respiratory and renal diseases on exercise are therefore required in the future.

Our results showed that, even in recovering patients with stroke and internal disorders, there is no difference in the ADL improvement rate if risk management is employed during rehabilitation. Our results may be helpful for the rehabilitation of patients in the post-stroke recovery phase who also have an internal disorder.

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