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Original Article

Propensity-matched analysis of the gap between capacity and actual performance of dressing in patients with stroke

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Abstract. [Purpose] Dressing is an activity of daily living for which stroke patients often show discrepancies between capacity and actual performance. The aim of this study was to elucidate the physical function and unilateral spatial neglect in stroke patients that reduce their level of actual performance despite having the capacity for dressing independently. [Subjects and Methods] This retrospective study included 60 first-time stroke patients judged by occupational therapists as able to dress independently. The patients were divided into two groups according to their FIM® instrument scores for dressing the upper and lower body: an independent group with both scores ≥6 and an assistance group with one or both scores ≤5. After adjusting for confounding factors through propensity score matching, the groups were compared by using Stroke Impairment Assessment Set items, the Simple Test for Evaluating Hand Function of both upper limbs, and the Berg balance scale. [Results] The assistance group had a significantly lower score for the Berg balance scale than the independent dressing group (31.0 ± 12.3 vs. 47.8 ± 7.4). [Conclusion] The results of the present study suggested that the balance function has an effect on the discrepancy between dressing capacity and performance.
Key words: Stroke, Balance, Dressing

INTRODUCTION

There can be a difference between patients' performance of a given activity of daily living (ADL) on a day-to-day basis, such as at home or in a hospital ward, and their capacity to perform that ADL as assessed in a controlled environment such as during rehabilitation training. This gap between capacity and performance is often observed in stroke patients[1], and it is important that this gap is minimized to prevent the nonperformance of the ADL and to facilitate the early discharge of the patient. Dressing is an example of an ADL in which such a gap is frequently observed[2]. Independence in dressing is considered necessary for maintaining dignity, self-esteem, and a sense of accomplishment in patients[2]. Furthermore, there is a strong association between independence in dressing at the time of discharge from hospital and near independence in

ADLs at home 5 years after the onset of stroke[3]. Dressing is therefore an activity that patients should achieve independence in before returning home.

Although a previous study showed that the gap between ADL capacity and performance is dependent on patient motivation and environmental conditions[4], to our best knowledge, the relationship between physical functions or visual perception and the gap between capacity and performance has not been investigated, nor have been specific ADLs such as dressing and eating.

Some studies have suggested that motor functions such as that of the affected upper and lower limbs[5], trunk function[6, 7], balance[8, 9], and unilateral spatial neglect[10] are majorly involved in the ability to dress independently. Because of the strong relationship between motor function or unilateral spatial neglect and dressing independence, it was hypothesized in this study that the gap between capacity and performance is influenced by these factors. Therefore, the aim of this study was to investigate the relationship between motor functions or unilateral spatial neglect and the gap between ADL capacity and performance.

SUBJECTS AND METHODS

The study included 60 stroke patients (age, 69.1 ± 12.6 years) admitted and discharged from the convalescent rehabilitation ward of a hospital. The inclusion criteria were as follows: patients with first stroke (a unilateral supratentorial hemispheric lesion), patients able to dress independently in rehabilitation training (as judged by an occupational therapist), and patients with no marked deterioration in motivation (assessed as a score of ≥ 8 by using the vitality index)[9]. Patients with missing assessment records were excluded. The mean time from stroke onset was 85.3 ± 31.0 days. The patients' characteristics are shown in Table 1. Informed consent was not obtained from the patients because this study had a retrospective design without intervention. However, our protocol was deliberated and approved by the institutional ethics review board of Northern Fukushima Medical Center (no. 56) and Tohoku Fukushi University (RS141201).

Data from electronic medical records from the time of discharge were collected and analyzed. FIM® instrument[11] subscores for dressing the upper and lower body were used to assess the actual performance level in dressing. The Stroke Impairment Assessment Set[12] was used to assess the gross motor function of the affected side (by using items for motor function), trunk function (by using items for trunk function), visuospatial deficit (by using items for unilateral spatial neglect), and strength on the unaffected side (by using items for quadriceps strength on that side). The Simple Test for Evaluating Hand Function[13] was used to assess the function of the upper limb, and the Berg balance scale[14] was used to assess balance. Cognitive function was assessed by using the revised Hasegawa Dementia Rating Scale (HDS-R)[15] and the FIM® instrument cognitive subscore.

The patients were divided into two groups according to their FIM® instrument subscores (indicating their actual performance level): an independent dressing group (n=46), who scored ≥ 6 for dressing both their upper body and lower body, and an assistance group (n=14), who scored ≤ 5 in one or both of these body sections. The results of the physical function and unilateral spatial neglect and cognitive tests were then compared between the two groups. Student's t-test and the Mann-Whitney U-test were used to compare the groups.

To clarify the effect of motor functions and unilateral spatial neglect on the gap between capacity and performance in dressing, age and cognitive function in both groups were first adjusted through propensity score matching[16, 17] before making the comparison between motor functions and unilateral spatial neglect. Propensity score matching is a method of estimating the causal effect in observational studies when random allocation is impossible. It adjusts confounding factors in which multiple covariates are aggregated into a single variable. In this study, propensity scores were calculated by using binary logistic regression with the independent dressing and assistance groups as dependent variables, and age, HDS-R score, and cognitive items in the FIM® instrument (comprehension, expression, problem solving, social interaction, and memory) as independent variables. The predicted probability was calculated and set as the propensity score. The model discrimination was assessed by using c-statistics, and calibration was assessed by using Hosmer-Lemeshow statistics. One-to-one pairs of independent dressing and assistance group patients were randomly matched by using a caliper width of a quarter of a standard deviation of the estimated propensity scores[16, 17]. The software SPSS Statistics 22.0 was used for the statistical analysis, and the level of significance was set at p<0.05.

RESULTS

In the actual performance of dressing, 23.3% (n=14 of 60) of the patients required monitoring or assistance by caregivers or nurses despite having the capacity to dress independently. Before the propensity score matching, a significant difference was observed between the independent dressing and assistance groups in age; HDS-R score; and FIM® instrument expression, problem solving, and memory item scores (Table 2).

Eleven pairs were selected from the independent dressing and assistance groups in the propensity score matching. The Hosmer-Lemeshow test showed p=0.60 (i.e., there was no evidence of a poor fit), and the c-statistic was 0.83, indicating a strong model. The logistic regression model confirmed the goodness of fit. After matching, no significant differences were observed between the two groups adjusted for age, HDS-R score, and cognitive items in the FIM® instrument; the mean

Table 1. Stroke-related characteristics of the study patients

	Overall (n=60)	Independent (n=46)	Assistance (n=14)
Males (%)	58.3	60.9	50.0
Right-side hemiparesis (%)	21.7	26.1	7.1
Time post-stroke (days)	85.3 ± 31.0	85.3 ± 31.8	85.6 ± 29.5

Data are presented as mean ± SD.

Table 2. Comparison of cognitive functions by group

	Overall		Pairs matched by PS	
	Independent (n=46)	Assistance (n=14)	Independent (n=11)	Assistance (n=11)
Age (years)	67.2 ± 11.9	75.5 ± 13.2 *	73.2 ± 7.7	73.9 ± 13.7
HDS-R	25.0 ± 4.9	20.7 ± 5.4 **	21.7 ± 4.5	21.6 ± 5.4
FIM comprehension	6.4 ± 0.8	5.8 ± 1.2	6.0 ± 0.9	5.9 ± 0.9
FIM expression	6.4 ± 0.9	5.6 ± 1.1 **	6.0 ± 0.9	5.8 ± 1.1
FIM social interaction	6.7 ± 0.8	6.4 ± 0.9	6.8 ± 0.4	6.6 ± 0.7
FIM problem solving	6.0 ± 1.0	4.9 ± 1.2 **	5.3 ± 1.2	5.7 ± 1.0
FIM memory	6.4 ± 1.1	5.5 ± 1.6 *	5.9 ± 1.4	5.7 ± 1.0

Data are presented as mean ± SD. *$p < 0.05$, **$p < 0.01$.
PS: propensity score; HDS-R: Hasegawa Dementia Rating Scale, revised

Table 3. Comparison of motor functions by group

	Independent (n=11)	Assistance (n=11)
Motor function of affected-side limbs		
Knee–mouth test (SIAS)	4.1 ± 0.9	3.6 ± 1.6
Finger-function test (SIAS)	3.7 ± 1.5	3.3 ± 1.7
Hip-flexion test (SIAS)	4.5 ± 0.9	4.2 ± 1.2
Knee-extension test (SIAS)	4.6 ± 0.7	3.9 ± 1.4
Foot-pat test (SIAS)	4.3 ± 1.1	3.6 ± 2.0
Sensory function of affected-side limbs		
Upper-limb light touch (SIAS)	2.6 ± 0.7	2.5 ± 0.7
Lower-limb light touch (SIAS)	2.4 ± 0.9	2.5 ± 0.7
Upper-limb position sense (SIAS)	2.7 ± 0.9	2.6 ± 0.7
Lower-limb position sense (SIAS)	2.6 ± 0.9	2.6 ± 0.5
Motor function of trunk		
Verticality test (SIAS)	3.0 ± 0.0	2.9 ± 0.3
Abdominal muscle strength (SIAS)	2.7 ± 0.5	2.3 ± 0.5
Muscle strength of unaffected side		
Grip strength (SIAS)	2.6 ± 0.7	2.0 ± 0.4
Quadriceps strength (SIAS)	2.9 ± 0.3	2.6 ± 0.8
Motor function of upper limb		
Affected side (STEF)	90.6 ± 4.7	86.0 ± 10.6
Unaffected side (STEF)	59.8 ± 35.3	36.8 ± 38.9
Balance		
Berg balance scale	47.8 ± 7.4	31.0 ± 12.3 **
Visuospatial deficit (SIAS)	3.0 ± 0.0	2.8 ± 0.4

Data are presented as mean ± SD. **$p < 0.01$.
SIAS: Stroke Impairment Assessment Set; STEF: Simple Test for Evaluating Hand Function

values were also similar. In terms of motor function, a significant difference was observed between the two groups only in the Berg balance scale (Table 3), with the independent dressing group showing significantly better balance scores ($p < 0.01$).

DISCUSSION

The results of this study showed that balance has an effect on the gap between the capacity to dress and the actual performance of dressing in stroke patients. A previous study suggested that motivation and environmental conditions are linked to such a gap[4]. In the present study, however, motivation and environmental conditions were adjusted for through the inclusion criteria (the absence of a marked deterioration in motivation and the patients all being in the same hospital ward); this allowed investigating the relationship between motor functions and the capacity–performance gap in dressing. Confounding factors such as age and cognitive function were also adjusted for by using propensity score matching before the motor functions were analyzed. To the best of our knowledge, this is the first study to investigate the causes of the gap between ADL capacity and performance from the standpoint of motor functions.

Motor functions associated with the level of independence in dressing is related to the gross motor function of the affected upper and lower limbs[5], verticality in the seated position[6], abdominal muscle strength[7], and balance[8, 9]. However, the results of this study suggested that the balance function is a more important factor affecting the gap between capacity and performance in dressing than the motor function of the affected side and trunk. A poor balance function is associated with a reduction in a patient's ability to dress in normal life because it induces a fear of falls in both the patient and the caregivers. In other words, patients with a deteriorated balance function maintain a low level of independence in dressing performance despite being able to dress independently because of the priority placed on safety. It is therefore possible that balance exercises may improve the level of actual performance of dressing independently.

One of the limitations of this study is that many samples for which matching was difficult with the present propensity score matching procedure were dropped from the analysis, resulting in a population that was not exactly the same between before and after matching[18]. Moreover, the number of successfully matched patients was not sufficient. In addition, this study had a small sample size. Additional investigation is warranted to overcome these issues.

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