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Original Article

Effects of nutritional status on prognosis in patients with severe hemiplegia who were recently admitted to a rehabilitation hospital

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Abstract. [Purpose] The purpose of this study was to examine the effect of nutritional status on the prognosis of patients with severe hemiplegia who were recently admitted to a convalescent rehabilitation hospital. [Participants and Methods] Eighty patients with stroke and severe hemiplegia were divided into two groups based on their serum albumin levels: normal (serum albumin 3.5 g/dL or more) and undernourished group (serum albumin 3.4 g/dL or less). Background characteristics, cognitive function, neurological symptoms, physical function at admission, and outcome were compared between groups. [Results] There were no differences found between groups in terms of cognitive function, neurological symptoms, physical function at admission, destination, and length of stay at the hospital. In contrast, age and duration from onset to admission were significantly lower in the normal group than in the undernourished group. The ability to walk and perform activities of daily living (ADL) at discharge was significantly higher in the normal group than in the undernourished group. [Conclusion] As a result, the findings of the present study suggest that in patients with severe hemiplegia, nutritional status at the time of admission determines the improved walking and ADL ability at the time of discharge.

Key words: Severe hemiplegic patients, Nutritional status, Outcome

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INTRODUCTION

Rehabilitation programs for patients after stroke incidents should be planned according to prognostic considerations[1)]. Regaining the ability to walk and to perform activities of daily living (ADL) is a pivotal goal in the rehabilitation of patients after severe hemiplegic stroke. Previous studies have reported that the prognosis of stroke rehabilitation is greatly influenced by age, cognitive function, and severity of paralysis[2–4)]. In addition, undernourished patients with stroke are more likely to develop poor functional outcomes during hospitalization[5)]. Serum albumin is an indicator of the nutritional status of the body and could be a useful predictor of functional outcome[6)]. Previous studies which examined serum albumin levels of patients undergoing acute rehabilitation have shown that relatively high serum albumin levels in patients with acute stroke decreased the risk of a poor outcome[7)]. Serum albumin has been proposed to have a neuroprotective function[8)]. Most previous studies have either been conducted on patients during the acute phase or on patients with total stroke and did not apply prognosis prediction for patients with severe hemiplegic stroke hospitalized in a rehabilitation facility. Early prediction of the success of the treatment for patients with severe hemiplegic stroke being treated at a rehabilitation hospital is difficult[9)]. The potential prediction of the ability or inability to walk at the time of hospital discharge, need of assistance with ADL, and the possibility of returning home after hospital discharge solely based on serum albumin levels at the time of admission can be crucial in designing rehabilitation plans. Paralysis and neurological symptoms were similar at the time of admission to the rehabilita-

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tion hospital. It was hypothesized that even if similar rehabilitation programs were implemented, there would be a difference in the outcomes of walking and ADL abilities depending on the nutritional status. The purpose of this study was to examine the effect of nutritional status at the time of admission to the rehabilitation hospital in patients with severe hemiplegic stroke.

PARTICIPANTS AND METHODS

This study was approved by the Research Safety and Ethics Committee of the Arakawa Campus, Tokyo Metropolitan University (approval number: 15080). The patients and their families were fully briefed prior to the study and provided informed consent. The participants were 80 patients (gender: 50 male, 30 female; age: 62.7 ± 11.6 years) who were admitted to our rehabilitation hospital with severe hemiplegia after a first onset stroke, and their paralysis of the affected lower extremity was classified as stage II or lower according to the Brunnstrom recovery stage. Patients who were not able to independently perform ADL before disease onset, could not undergo intensive rehabilitation because of conditions affecting their heart rate, blood pressure, or respiration, and were transferred to other wards or hospitals due to their need for emergency treatment were excluded.

The type of stroke was cerebral hemorrhage and cerebral infarction in 61 and 19 patients, respectively. The right and the left sides were paralyzed in 34 and 46 patients, respectively. The time from the onset of symptoms until hospital transfer was on average 30.6 ± 15.2 days. The average total serum albumin protein was 6.8 ± 0.6 g/dL at the time of hospital admission. Sixty-one of the 80 patients presented with dysphagia. The average Barthel Index (BI) for the ability to perform ADL was 15.5 ± 14.9 at the time of hospital admission. The data evaluated in this study were background factors (age, gender), the duration from onset until rehabilitation hospital admission, stroke type, paralyzed side, cognitive function (Mini-Mental State Examination [MMSE]), neurological symptoms (modified National Institute of Health Stroke Scale [m-NIHSS]), physical function at admission (Trunk Control Test [TCT]) and knee extension strength/body weight ratio on the unaffected side [KES/BW-US])[9, 10], for which the measurement method was reported previously. The evaluated outcomes were walking ability using the Functional Ambulation Category (FAC)[11], ADL using the Barthel Index (BI) that was determined based on whether the patients were released from the hospital to return to their home or visit a care facility, and the length of stay (rate of home discharge). Patients with FAC scores of 3–5 (ranging from supervised to independently walking ability) and 2–0 (ranging from walking with assistance ability to walking inability) were considered as able and unable to walk, respectively. BI was used as an indicator of rehabilitation efficiency and calculated from the BI score at hospital admission and discharge (BI score at discharge / BI score at admission / length of stay).

The patients were divided into two groups based on their serum albumin levels at the time of admission; the normal (serum albumin 3.5 g/dL or more) and the undernourished group (serum albumin 3.4 g/dL or less) in accordance with the criteriadescrped by Gariballa et al[12]. The groups were compared by each evaluation item.

For statistical analysis, the SPSS software version 25 for Windows was used. The t-test or χ^2 test was used for group comparisons. The statistical significance level was set at $p<0.05$.

RESULTS

Tables 1 and 2 show the results of each evaluation data as found in both groups at admission and discharge. The mean age and duration from onset to admission were significantly lower in the normal than in the undernourished group. There were no significant differences in the other background factors. No significant differences were found in the MMSE, m-NIHSS, TCT, KES/BW-US values at admission. Walking ability and the BI score at discharge were significantly higher in the normal than in the undernourished group. Moreover, BI efficiency was significantly higher in the normal than in the undernourished group. There were no significant differences in the length of stay and rate of home discharge between the examined groups.

DISCUSSION

This study investigated whether the differences in the nutritional status of patients with severe hemiplegic stroke who were admitted to a rehabilitation hospital affected their performance (walking ability, ADL ability, destination) at discharge. A previous study estimated malnutrition post-stroke reported in the 18 studies reviewed ranged from 6.1% to 62%[13]. In this study, the proportion of patients with severe hemiplegia who had poor nutritional status was as high as 50%, similar to that reported by another study. The comparison of function and ability according to the nutritional status of patients with hemiplegic stroke at the time of admission to the rehabilitation hospital revealed that cognitive function, neurological signs, trunk function, and non-paralyzed lower limb muscle strength were not different between the groups. However, age and duration from onset to admission were significantly different between the groups. Elderly individuals were reported to have many nutritional risks or malnutrition[14]. Disturbances in eating behavior among patients with acute stroke are common and may cause decline in food and fluid intake, leading to further deterioration in nutritional status[15]. Saito et al.[16] reported that a patient with stroke having many complications, may need more days from onset to transfer to the hospital, which will ultimately delay admission to the rehabilitation hospital.

In this study, although the severity of paralysis was similar between the groups, it was considered that the time required for

Table 1. Characteristics of patients in normal group and undernourished group

Items evaluated	Normal group (n=40)	Undernourished group (n=40)	p value
Background factors			
Age (years)	59.4 ± 10.8	66.1 ± 11.5	0.001
Gender (male/female)	25/15	25/15	1.000
Stroke subtype (hemorrhagic/ischemic)	31/9	30/10	1.000
Paresis side (left/right)	20/20	14/26	0.258
Duration from onset until rehabilitation hospital admision (days)	26.3 ± 14.1	34.9 ± 15.1	0.010
Cognitive and neurological deficits and physical function on admission			
MMSE (points)	17.8 ± 10.4	15.7 ± 10.4	0.363
m-NIHSS (points)	10.4 ± 2.4	11.1 ± 2.2	0.195
TCT (points)	39.1 ± 22.6	30.6 ± 26.8	0.128
KES/BW-US (kg/kg)	0.2 ± 0.2	0.2 ± 0.2	0.185

Mean ± SD. MMSE: Mini-Mental State Examination; m-NIHSS: modified National Institute of Health Stroke Scale; TCT: Trunk Control Test; KES/BW-US: Knee Extension Strength/Body Weight ratio on the Unaffected Side.

Table 2. Outcomes of patients in the normal group and the undernourished group

Items evaluated	Normal group (n=40)	Undernourished group (n=40)	p value
Walking ability, ADL, and destination at discharge			
FAC Category (independent/non-independent)	32/8	22/18	0.002
BI (points)	70.2 ± 15.9	52.4 ± 23.8	0.001
BI efficiency (points/day)	0.64 ± 0.36	0.45 ± 0.32	0.016
The legth of stay (days)	97.1 ± 41.3	116.2 ± 46.0	0.055
Rate of home discharge (%)	85.0	77.5	0.568

Mean ± SD. FAC: Functiona Ambulation Category; BI: Barthel Index.

whole-body management was higher in the undernourished group and the time to transfer to the rehabilitation hospital was delayed. Moreover, the normal group had better walking and ADL abilities compared to the undernourished group. However, there was no difference between the groups regarding hospitalization duration and the rate of home discharge. Gariballa et al.[12] reported that patients with stroke and hypoalbuminemia had a poorer functional outcome during hospitalization than those with normal or higher serum albumin concentrations after the acute phase. Moreover, Aptaker et al.[17] reported positive correlations between serum albumin levels and time to discharge from the Modified BI inpatient rehabilitation unit. While the patients exhibited severe motor paralysis during hospitalization, their other functions remained the same. Although the patients underwent the same rehabilitation program, significant differences in walking and ADL abilities were observed and attributed to their nutritional status.

Patients with hemiplegic stroke are allowed to return home after discharge from the hospital depending on their ability to perform ADL at discharge, family structure, number of family members living with the patient, and social background[18, 19]. The undernourished group included more patients who needed walking and ADL assistance, but were able to receive the social support required for patient–family cooperation and home life. Therefore, we conclude that the destination after hospital discharge did not influence hospital stay.

This study was limited only to patients with hemiplegic stroke who were admitted to a rehabilitation hospital, and their intensive standing up and gait training using lower extremity orthosis had to be conducted early after discharge as a measure against motor deficits and gait disturbances. In some cases, dysphagia restricts diet modification and does not improve the nutritional status. This may affect rehabilitation progress, ADL improvement, and hospitalization duration.

In conclusion, patients with severe hemiplegia who are expected to be transferred to a rehabilitation hospital may need to adjust their nutrition in cooperation with hospitals to create an environment that can maximize the rehabilitation effects.

Conflict of interest

The authors declare that they have no competing interests.

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