（Research report）

The relationship between walking ability and physical, psychological and social dimensions among elderly patients with stroke

高齢脳卒中患者の歩行能力と身体的，精神的，社会的側面との関係

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要　旨

背景と目的 ― 歩行能力は，高齢脳卒中患者の ADL や QOL に影響をするため，発症後早期からの歩行への援助は重要である．本研究の目的は，全人的な援助を可能にするために，高齢脳卒中患者の歩行能力と身体的，精神的，社会的側面との関係を明らかにすることとした．

研究方法 ― 高齢脳卒中患者31名を対象とした．従属変数を歩行能力，独立変数をスピリチュアリティ，ソーシャルサポート，運動麻痺，下肢荷重力，年齢とした．

結果 ― 運動麻痺と両側下肢荷重力間（r=0.692，*P*<0.001：r=0.562，*P*<0.001），両側下肢荷重力間（r=0.861，*P*<0.001），スピリチュアリティとソーシャルサポート間（r=0.512，*P*<0.001）に相関があった．SRS-A，運動麻痺，麻痺側・非麻痺側下肢荷重力は，歩行介助群よりも歩行自立群で有意に高かった（P=0.007，P<0.001，P<0.001，P<0.001）．

結論 ― 高齢脳卒中患者の歩行に対しては，年齢で判断せず，身体的・精神的・社会的側面の全人的に援助を行う必要がある．

キーワード：高齢脳卒中患者，歩行能力，スピリチュアリティ，ソーシャルサポート，筋力

Abstract

Background and Purpose ― Walking ability may affect not only activities of daily living but also the quality of life of elderly patients with stroke. Therefore, it is important to assist them in regaining their walking ability from an early stage after the onset of stroke. The purpose of this study was to examine the relationship between walking ability and the physical, psychological and social dimensions of elderly patients with stroke, in order to enable holistic support and intervention.

Methods ― The participants included 31 patients with stroke who were 65 years or older. The dependent variable was walking ability, and the independent variables were motor paralysis, the lower limb loading force of the affected and unaffected sides, spirituality, social support, and age. Correlation test, independent t-test, and Mann–Whitney U test were performed.

Results ― There was a significant correlation between motor paralysis and lower limb loading force of the affected and unaffected sides (r=0.692, *P*<0.001 and r=0.562, *P*<0.001, respectively), between the lower limb loading force of the affected side and that of the unaffected side (r=0.861, *P*<0.001), and between spirituality and social support (r=0.512, *P*<0.001). Spirituality, motor paralysis, and the lower limb loading force of the affected and unaffected sides were significantly higher in the independent-walking group than in the assisted-walking group (P = 0.007, P <0.001, P <0.001, P <0.001).

Conclusions ― It is necessary to understand the walking ability of elderly patients with stroke based on holistic assessments of the person, rather than judging by age.

Keywords : stroke in elderly, walking ability, spirituality, social support, muscle strength

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Introduction

Japan's population is aging, with the number of people aged 65 years and older estimated at 35.15 million in 2017, accounting for 27.7% of the total population (Cabinet Office, 2019). With progressing age, the need for nursing care increases; among the major causes for the need of nursing care, stroke rate was ranked second, at 16.6%, in the year 2017 (Ministry of Health, Labor and Welfare (Japan), 2017). Motor paralysis, which affects muscular activity, muscular output, and muscular strength (Mochizuki, 2006), is a sequela of stroke, leading to a loss of patients' walking ability (Cho, Lee, Lee, & Kang, 2014), and requiring nursing care. With a growing aging population and incidence of stroke, it can be predicted that the number of elderly patients with stroke requiring nursing care is likely to increase.

For patients with stroke, walking ability affects not only their activities of daily living, but also their quality of life (Maeda, Yorizumi, & Yokoyama, 1989; Paul, et al., 2005). Therefore, for elderly patients with stroke, in addition to walking ability, nursing care may also have a significant impact on future outcomes. Research on early rehabilitation in patients with acute stroke has reported that shorter, more frequent mobilization results in favorable outcomes in walking at three months, with a decrease in mortality rate and complications (Bernhardt, et al., 2016). Therefore, it is important for elderly patients with stroke to undergo rehabilitation early after stroke onset, to regain walking ability. Nurses performing round-the-clock patient observation can play an important role in this.

The physical assessment of the walking ability of patients with stroke is easy to carry out, but it is also necessary to consider higher brain dysfunction (Ohashi, 2002), as 80% of the causes for this are stroke. Apathy (Caeiro, Ferro, & Costa, 2013) is reported to occur in 36.3% of cases after stroke, and since it is related to reduced motivation (Kitachi, Suzuki, Harashima, & Miyano, 2014), it may also affect motivation for rehabilitation. In addition, it is necessary to consider the people and environment surrounding the elderly patient with stroke. In assessment of the walking ability, it is necessary to consider not only the physical dimensions, but also the mental dimensions of supporting humans from the inside and the social dimensions of supporting humans from the outside, including assistance from others. Therefore, it is necessary to assess and assist elderly patients with stroke, in their physical, mental, and social dimensions. Although the relationship between walking ability and physical status has been studied, the effects of mental and social dimensions on walking ability have not been widely investigated. Therefore, the purpose of this study was to examine the relationship between walking ability and the physical, mental, and social dimensions of elderly patients with stroke in order to enable holistic support. The results of this study are expected to lead to the examination of existing interventions for elderly patients with stroke.

Methods

Participants

The eligibility criteria for this study were: patients with first stroke (ischemic or hemorrhagic stroke, based on a doctor's diagnosis), 65 years or older, with one month since stroke onset, and undergoing physical therapy. Exclusion criteria were: a score of 21 or higher on the revised Hasegawa's Dementia Scale, and difficulty in following instructions due to higher brain dysfunction or mental confusion. Participants were recruited from a hospital in Aichi prefecture in Japan. In consideration of the burden on and safety of the participants, we targeted patients with stroke who were

no longer under acute care.

Instruments

In this study, the physical dimensions measured included the degree of motor paralysis and lower extremity muscle strength, the psychological dimension measured was spirituality, and the social dimension measured was social support. The measurement items were walking ability, degree of motor paralysis, lower extremity muscle strength, spirituality, social support, and age.

Walking ability

Walking ability was determined by the Functional Independence Measure (FIM) locomotion score (Keith, Granger, Hamilton, & Sherwin, 1987). FIM consists of thirteen motor items and five cognitive items. Each item ranges from 1 to 7 (1 = total assistance, 7 = complete independence) (Keith, et al., 1987). The researcher observed the subject's walking and measured it by FIM.

Spirituality

Spirituality has not been clearly defined so far, but it is considered to be the essence of one's being, and gives meaning and purpose to one's existence (Narayanasamy, 2004), and an individual as a whole, is the integration of body, mind, and spirit (Narayanasamy, 1999). Therefore, since spirituality is the existence of human beings and is related to the their mental dimensions, it can be considered that it affects both the physical and mental dimensions. Therefore, since spirituality can be considered human itself and can be considered as a mental aspect that moves human from the inside, it was used as a psychological variable. Spirituality was measured by Spirituality Rating Scale-A (SRS-A), developed by Higa. SRS-A is a 15-item, five-point scale that includes a no-religion item and is unaffected by disease, sex, or age (Higa, 2002). The highest SRS-A score is 75, and the scores are categorized as follows: ≤29 = very low, 30–39 = low, 40–49 = moderate, 50–59 = high, and 60–75 = very high (Higa, 2006). Cronbach's alpha coefficient for SRS-A was 0.82 (Higa, 2002).

Social support

Social support was defined as mutual interaction between individuals, including one or more of emotional involvement (emotional support), instrumental assistance (instrumental support), informational assistance (informational support), and evaluation assistance (evaluative support) (Inaba, ura, & Minami, 1987). It has been reported that the size of social support affects the stress buffering effect (Cohen, & Wills, 1985). Social support was measured by the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version) (Iwasa, et al., 2007). the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version) is a seven-item, seven-point scale based on the results of a factor analysis. The maximum score is 49 and a higher score indicates higher perceived social support (Iwasa, et al., 2007). Cronbach's alpha coefficient for the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version) was 0.85 (Iwasa, et al., 2007).

Degree of motor paralysis

Degree of motor paralysis was determined by the lower extremity Brunnstrom stage (Brunnstrom, 1970). The lower extremity Brunnstrom stage was measured by the participants taking Stage II and III in the supine position, Stage IV in the sitting position, and Stage V and IV in the standing

position. The evaluation was conducted by a single researcher.

The lower extremity muscle strength

The lower extremity muscle strength was measured by the lower limb loading force. Although it is not clear which muscle is measured by the lower limb loading force, there is a significant difference in walking ability among patients with stroke (Otao, et al., 2007; Murata, et al., 2008), and a correlation has been reported between the lower limb loading force of the affected and unaffected side, and the Brunnstrom stage, FIM, and walking speed (Murata, Otao, Arima, & Mizogami, 2005). Since Brunnstrom stage, FIM, and walking speed represent the characteristics of gait disturbance in patients with stroke, it is considered that the lower limb loading force can be used as a measure for lower limb muscle strength in elderly patients with stroke. The lower limb loading force was measured by a forceful step on a commercial bathroom scale (Murata & Miyazaki, 2005). The following steps were adhered to in the measurement of lower limb loading force: the participant sat at the edge of a bed 45 cm high and 8 cm from the patient's popliteal region. The participants placed their right or left sole on a bathroom scale (HD-654, TANITA) and forced the sole down vertically with maximum effort for 30 seconds. The participants were free to take any posture, without lifting their buttocks from the bed, such that the movements in the sagittal and frontal planes of the trunk were not limited (Murata & Miyazaki, 2005). The measurement was performed twice on each of the affected side and the unaffected side, and the maximum value of each limb denoted the lower limb loading force (in kg), which was converted to a body-weight ratio percentage (%). A 30-second interval was allowed between each measurement. The intra-class correlation coefficient of the lower limb loading force was 0.823 (Murata, & Miyazaki, 2005).

Data Collection

Data were collected from January 2015 to March 2016. The researcher explained the purpose, procedure, and ethical considerations, and a signed informed consent was obtained from patients who were willing to participate. Thereafter, the researcher administered the SRS-A and The Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version) , and measured the lower extremity Brunnstrom stage, the lower limb loading force of the affected and unaffected side, and walking ability. In addition, information about their age, height, weight, sex, and stroke profiles were collected.

The researcher complied with the Helsinki Declaration and fully explained to the subject the research purpose, method and ethical considerations. After confirming that the subject understood this information, they obtained written informed consent by the subject's free will and proceeded with the study procedures. This study was approved by the Ethics Committee of the facility where data were collected.

Data Analysis

Based on the FIM locomotion score, the participants were divided into two groups: an independent-walking group (FIM locomotion score ≥ 6) and an assisted-walking group (FIM locomotion score < 6).

The relationship between each variable was examined using Spearman's rank correlation coefficient test. Further, the differences between the independent- and assisted-walking groups were compared. For the scores on SRS-A, the lower limb loading force of the affected and unaffected side,

and age, the independent t-test was applied, and for the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version) , and the lower extremity Brunnstrom stage, the Mann–Whitney U test was applied. The chi-square test and the independent t-test were used for between-group comparisons of participant characteristics. The statistical analyses were performed using IBM SPSS version 24, and the level of significance was set at less than 0.05.

Results

Of the 31 participants that met the eligibility criteria, 18 were classified under the independent-walking group and the remaining 13 under the assisted-walking group. The patients' demographic characteristics are shown in Table 1.

Spearman's rank correlation coefficients between the variables are presented in Table 2. FIM locomotion score correlated with the lower extremity Brunnstrom stage, the lower limb loading force of the affected and unaffected sides (r=0.771, $P<0.001$, r=0.714, $P<0.001$ and r=0.688, $P<0.001$ respectively). The lower extremity Brunnstrom stage correlated with the lower limb loading force of the affected and unaffected sides (r=0.692, $P<0.001$ and r=0.562, $P<0.001$, respectively). The lower limb loading force of the affected side correlated with that of the unaffected side (r=0.861, $P<0.001$). SRS-A correlated with the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version) (r=0.512, $P<0.001$).

The results of the independent t-test and Mann–Whitney U test are presented in Table 1. SRS-A, the lower extremity Brunnstrom stage, lower limb loading force of the affected and unaffected side were significantly higher in the independent-walking group than in the assisted-walking group ($P=0.007$, $P<0.001$, $P<0.001$, $P<0.001$, respectively). There were no significant differences between groups in sex, disease type of stroke, Hemiplegic side, or Body mass index.

Discussion

In this study, significant differences were found in spirituality, motor paralysis, and the lower limb loading force of the affected and unaffected sides, between the independent- and assisted-walking groups.

Walking ability correlated with motor paralysis, the lower limb loading force of the affected and unaffected sides. These were similar to those reported in previous research. Since it has been reported that the lower extremity muscle strength affects independent walking in elderly people (Nishijima, et al., 2004), interventions for improving lower extremity muscle strength are required for elderly patients with stroke. Moreover, after stroke onset, although there is a tendency to focus on the affected side, interventions for the unaffected side are also necessary.

SRS-A, which measures spirituality as a mental dimension, was significantly different between the two groups. Spirituality is considered to be the essence and integration of human beings (Narayanasamy, 1994; 2004). There is scope for future research on spirituality. Spirituality includes the processes of spiritual coping strategies that help patients empower themselves, which in turn, may enhance motivation for rehabilitation. By enhancing motivation, elderly patients with stroke can find hope for the future, which may influence rehabilitation for functional recovery. A high level of motivation for rehabilitation has been associated with improvement in activities of daily living (Maclean, Pound, Wolfe, & Rudd, 2000); from the results of this study, it can be hypothesized that a

Table 1: Participant Characteristics, independent t-test, Mann–Whitney U test and chi-square test comparing the variables Between "Independent walking group and Assisted-walking group"

Characteristics	Total (n=31)	Independent walking group (n=18)	Assisted-walking group (n=13)	P Value
Sex				0.755
Male	17 (55%)	10	7	
Female	14 (45%)	8	6	
Age (year)	75.61±6.6	75.44±6.99	75.84±6.28	0.816
Disease type of stroke				0.53
Cerebral infarction	18 (58%)	11	7	
Cerebral hemorrhage	13 (42%)	7	6	
Hemiplegic side				0.06
Right hemiplegic	15 (48%)	11	4	
Left hemiplegic	16 (52%)	7	9	
Body mass index (kg/m2)	21.41±3.46	21.92±3.74	20.69±2.87	0.345
FIM locomotion score	5.03±1.94			
SRS-A	47.39±11.49	51.61±10.95	41.54±9.82	0.007
JAMSPSS	37.58±8.86	39.00±7.78	35.62±10.17	0.242
Brunnstrom stage	II 4 (13%) III 6 (19%) IV 5 (16%) V 4 (13%) VI 12 (39%)	III 2 (11%) IV 3 (17%) V 2 (11%) VI 11 (61%)	II 4 (30%) III 4 (30%) IV 2 (15%) V 2 (15%) VI 1 (8%)	<0.001
LLLF - affected side (%)	22.35±9.99	27.56±8.14	15.15±7.66	<0.001
LLLF - unaffected side (%)	27.58±9.11	32.28±6.36	21.08±8.45	<0.001

(n=31)
Data are mean ± standard deviation (SD)
JAMSPSS indicates the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version); LLLF, the lower limb loading force.

Table 2: Spearman's Rank Correlation Coefficient between the variables (n = 31)

	SRS-A	JAMSPSS	Brunnstrom stage	LLLF - affected side (%)	LLLF - unaffected side (%)	Age (years)	FIM
SRS-A	1.000	0.512**	-0.092	-0.072	-0.015	-0.274	0.135
JAMSPSS	0.512**	1.000	0.062	0.012	-0.035	-0.249	0.209
Brunnstrom stage	-0.092	0.062	1.000	0.692**	0.562**	0.053	.771**
LLLF - affected side (%)	-0.072	0.012	0.692**	1.000	0.861**	0.053	.714**
LLLF - unaffected side (%)	-0.015	-0.035	0.562**	0.861**	1.000	-0.032	.688**
Age (years)	-0.274	-0.249	0.053	0.053	-0.032	1.000	-0.183
FIM	0.135	0.209	.771**	.714**	.688**	-0.183	1.000

**P<0.01
JAMSPSS indicates the Japanese version of the Multidimensional Scale of Perceived Social Support (shorted version); LLLF, the lower limb loading force.

higher level of spirituality enhances motivation for rehabilitation, leading to active engagement in rehabilitation, and improvement in walking ability. Therefore, elderly patients with stroke may also benefit from aids including spiritual care.

There was no significant difference in social support between the independent-walking group and the assisted-walking group, but social support correlated with spirituality. It has been reported that patients with advanced illness with good support from the family and society have enhanced spirituality (Fombuena, et al., 2016), and that spirituality plays an important role in connecting with others (Janssen -Niemeijer, Visse, Van Leeuwen, Leget, & Cusveller, 2017). Therefore, it can be

said that social support and spirituality can influence each other positively.

There was also no significant difference in age between the two walking ability groups, and no correlation with other variables. Therefore, the results of this study revealed that age does not affect walking ability. Since it has been reported that walking ability can be improved even in old age (Hirano Nitta, Takahashi, Nishio, & Kigawa, 2014), in making interventions plans for walking ability, in addition to age, there is a need to assess other factors and conditions.

Implications for Clinical Practice

The results of this study reveal that while assessing the walking ability of elderly patients with stroke, it may be necessary to carry out holistic assessments, which include their physical, mental, and social dimensions, without judging based on preconceptions relating to age. As for the physical dimensions, patients require intervention to improve their lower extremity muscle strength on the affected and unaffected sides. It is reported that shorter, more frequent mobilization from an early stage after stroke onset results in favorable outcomes (Bernhardt, et al., 2016). Therefore, in addition to formal rehabilitation, integrating rehabilitation into daily life is also important. As for the spiritual and social dimensions, since spirituality and social support interact with each other, it is necessary to provide assistance to enhance them. For spirituality, interventions based on spiritual care are necessary, and for social support, interventions such as increasing family support are necessary. Future research is needed to identify specific interventions. Since the number of studies on spirituality as defined in this study, are few, the results of this study not only illuminate the relationships between elderly stroke patients and their walking ability, but also provides significant direction to future research.

Limitations

In order to ensure the safety of the elderly patients with stroke, the participants were recruited over a month after stroke onset, and therefore, the study may be biased toward patients with low severity. In addition, stroke treatment and brain lesions associated with the stroke were not investigated, and the sample size was small. Therefore, the results of this study may have limited application. In the future, it is necessary to replicate similar studies with a larger number of participants, and also to conduct research on elderly patients in the early phase after the onset of stroke, and on those who have a higher degree of severity, in order to identify interventions for improving walking ability from the early stage after the onset of stroke.

Conclusion

The purpose of this study was to evaluate the relationship between walking ability and the physical, mental, and social dimensions of elderly patients with stroke. There were significant differences in spirituality, motor paralysis, and lower limb loading force of the affected and unaffected side between the independent-walking group and the assisted-walking group. In addition, an association was found between spirituality and social support. It is necessary to assess the walking ability of elderly patients with stroke through holistic assessments, without judging by age.

Disclosures

None.

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