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Research Article

Physical Activities and Health-related Quality of Life of Individuals Post Stroke

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| Abstract |

PURPOSE: The purpose of this study is to examine the relationship between the physical activities of individuals post-stroke and their HRQL, as well as to determine whether their functional abilities contribute to their amounts of physical activity.
METHODS: The study's subjects included 90 individuals post-stroke. Their amounts of physical activity were measured using the International Physical Activity Questionnaire (IPAQ), and their HRQL was measured using the Medical Outcomes Study 36-Item Short-form Health Survey (SF-36). In addition, the functional abilities of the subjects were measured. For the measures of physical activities and the HRQL, Pearson's correlation coefficients were used to identify the strengths of the associations between the measures. A hierarchical linear regression model was used to determine whether physical activities had independent impacts on the HRQL.
RESULTS: This study found that the physical activities performed by the subjects affected the SF-36 physical component score (PCS) (12%). However, the physical activities and the SF-36 mental component score (MCS) showed no statistically significant relationship, whereas functional abilities and physical activities had a statistically significant relationship ($r = .57\sim.86$, $p<.001$).
CONCLUSION: The present study identified a correlation between physical activity and the PCS. Therefore, individuals post-stroke should be encouraged to carry out more physical activities, including more frequent walking activities.

Key Words: Stroke, Physical activity, Health-related quality of life, Functional ability

Ⅰ. Introduction

In Korea, about 500,000 individuals suffer from strokes, which is the leading cause of death as a single disease (American Heart Association Statistics Committee and Stroke Statistics Subcommittee, 2013). In particular, elderly people exhibit a high incidence of stroke. Therefore, this disease is emerging as an important medical issue in Korea, and it is showing the trend of population aging. According to the International Classification of Functioning, Disability, and Health (ICF) of the World Health Organization (WHO), problems caused by stroke can be explained by three main dimensions: body function and structure, activity, and

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participation(Roth and Harvey, 2000). In the dimension of body function and structure, a stroke causes primary neurological impairments, such as hemiplegia, spasticity, and aphasia. Activity limitations are referred to as a disability and the ability to perform daily functions, such as dressing, bathing, and walking, is reduced(Gresham et al., 1997).

Individuals post-stroke place a high priority on recovering their functional abilities to carry out everyday activities and their abilities to walk independently(Muren et al., 2008). While over 60% of individuals post-stroke recover independent walking, a stroke is accompanied by changes in gait patterns and declines in walking speeds and total distances walked(Pang et al., 2005; Patterson et al., 2007). Individuals post-stroke with medium or moderate severity have about 40% lower levels of cardiovascular and functional capacities than healthy individuals(Courbon et al., 2006; Michael et al., 2005). This reduction will inevitably influence the psychological functions of individuals post-stroke and their well-being in daily life.

The health-related quality of life (HRQL) refers to self-reported measures. It is not confined to the concept of physical, social, and emotional health, but it includes multiple dimensions(Harper and Power, 1998). The HRQL measures are potentially related to patients more deeply than the measurements of impairment or disability. They are also an important post-stroke index outcome that enables a broader description of the disease and its outcomes(Moon et al., 2004; Sturm et al., 2002).

A study reported that healthy older adults who participated in moderate-intensity regular physical activities showed an overall higher level of HRQL than healthy older adults who engaged in fewer physical activities(Rejeski and Mihalko, 2001). The physical activities of older individuals with chronic conditions and arthritis were found to have positive impacts on their HRQL(Abell et al., 2005; Sawatzky et al., 2007). Some studies reported that quality of life declines after a stroke, and disabilities, handicaps, neurological impairments, and functional capacity have correlations with HRQL(Patel et al., 2006). Moreover, the participation of individuals post-stroke in physical activities resulted in the reduced recurrence of strokes and improved quality of life(Carod-Artal, 2006; Greenlund et al., 2002; Sacco et al., 1998). Unlike age, the level of physical activities is a potentially modifiable factor. However, few studies have dealt with the correlation between the HRQL of individuals post-stroke and variable physical activities. In this regard, the purpose of this study is to investigate the relationship between the physical activities of individuals post-stroke and their HRQL, as well as to determine whether their functional abilities contribute to their amounts of physical activity.

Ⅱ. Methods

1. Study subjects

The subjects of this study included 90 stroke patients who listened to explanations about the study and agreed to participate. The inclusion criteria were those who had a stroke at least six months ago, lived in a local community, were capable of walking independently with or without a walking aid, and had intact cognition with 24 points or higher on the mental state examination (MMSE). The exclusion criteria were those who could not carry out basic activities of daily living due to any additional neurological and/or orthopedic deficits. General characteristics of the subjects are shown in Table 1.

2. Measurement

Physical activities were measured using the Korean version of the International Physical Activity Questionnaire (IPAQ) short form. The IPAQ includes questions regarding activities performed during the week prior to the survey, and it assesses the frequency and duration of three types of physical activities: walking (moving from a place to

Table 1. General characteristics of subjects (N=90)

Age (yrs)	64.92±12.06
Weight (kg)	61.66±9.47
Height (m)	1.61±0.08
BMI (kg/m²)	23.41±2.20
Sex	
Male	39 (43.3)
Female	51 (56.7)
On set (month)	23.99±13.54
Stroke type	
Hemorrhage	28 (31.1)
Infarction	62 (68.9)
Paretic side	
Left	49 (54.4)
Right	41 (45.6)

Values are number (%) or mean±standard deviation, BMI: Body Mass Index

another place for leisure, pleasure, or exercises); moderate physical activities without walking (light weightlifting, light cycling at normal speeds, light aerobic workouts, other activities that moderately increase breathing or heart rates), and vigorous physical activities (heavy weightlifting, running, aerobic workouts, rapid cycling, or other activities that significantly increase breathing or heart rates). The data obtained from the questionnaire for the three types of physical activities were added to measure the total time and amount of physical activities per week. Total daily physical activities were estimated using the metabolic equivalent task (MET) value according to each type of physical activity (1 MET=resting energy expenditure). The daily average MET score was expressed based on the scoring protocol of the official IPAQ. Vigorous-intensity activities, moderate activities, and walking were assumed based on 8, 4, and 3.3 METs, respectively (www.ipaq.ki.se).

The HRQL was evaluated using the MOS SF-36, which consists of 36 items as a self-report questionnaire. It is measured as eight domains of functioning, and two summary scores (physical component score: PCS, mental component score: MCS) are yielded. The PCS consists of four domains: physical function, role physical, bodily pain, and general health. The MCS also consists of four domains: vitality, social functioning, role-emotion, and mental health. A higher score indicates a corresponding higher level of HRQL perceived. A study reported that the SF-36 satisfied reliability and validity in individuals post-stroke(Buck et al., 2002).

Functional ability was identified using the following assessments. The Chedoke-McMaster Stroke Assessment (CMSA) was employed to confirm the presence and severity of motor impairments in the leg and foot. Fourteen points is the largest value, and a higher value indicates a corresponding lower level of motor impairment in the lower extremity. This assessment has good concurrent validity with the Fugl-Meyer assessment of sensorimotor recovery and it had a moderate correlation with activities of daily living(Gowland et al., 1993; Valach et al., 2003). The Functional Independence Measure (FIM) measures the level of activities of daily living with a disability. Its 18 items are rated on a seven-point scale along a continuum ranging from 1 (total assistance) to 7 (complete independence). This study used only locomotion scores related to ambulation(Granger et al., 1986). The Berg Balance Scale (BBS) was used to evaluate the subjects' abilities to maintain balance while performing 14 functional tasks. The maximum score is 56 points and a higher score indicates a corresponding level of improvement in balance function. The BBS is a psychometrically sound measure for assessing the balance of individuals post-stroke. The test-retest reliability and the intrarater reliability are ICC=.98 and ICC=.97, respectively(Blum and Korner-Bitensky, 2008).

3. Data analysis

The collected data were analyzed using PASW 18.0. Descriptive statistics was employed to explain the study population. For the measures of physical activities and the

Table 2. Measures of the HRQL, physical activity and functional ability (N=90)

Variables	Mean±S.D
HRQL (SF-36)	
Physical functioning (range, 0-100)	42.28±19.50
Role-physical (range, 0-100)	53.89±12.93
Bodily pain (range, 0-100)	61.41±25.03
General health (range, 0-100)	45.26±12.81
Vitality (range, 0-100)	59.72±17.52
Social functioning (range, 0-100)	53.88±13.97
Role‐emotional (range, 0-100)	40.74±20.46
Mental health (range, 0-100)	50.13±15.18
PCS (range, 0-100)	42.09±8.61
MCS (range, 0-100)	46.51±6.00
Physical activity (IPAQ)	
Total physical activity (MET-min/week)	4136.92±1128.93
Functional ability	
Berg balance scale (range, 0-56)	36.52±9.40
CMSA (leg and foot impairment range, 2-14)	10.44±1.71
FIM (locomotion range, 2-14)	11.17±1.10

Values are mean±standard deviation, PCS: Physical Component Score, MCS: Mental Component Score, MET: Metabolic Equivalent Task (1 MET=resting energy expenditure), CMSA: Chedoke-McMaster Stroke Assessment (leg and foot impairment scores 14 points=no lower extremity motor impairment), FIM: Functional Independence Measure (locomotion includes walking or wheelchair propulsion and stair climbing)

HRQL, Pearson's correlation coefficients were used to identify the strengths of the associations between the measures. A hierarchical linear regression model was used to determine whether physical activities had independent impacts on the HRQL. First, the level of motor impairment in the lower extremity was controlled by entering the CMSA leg and foot impairment scores in the regression model. The levels of physical activities were then entered into the regression model. Next, this study checked whether physical activities was a variable with independent impacts on the HRQL while the level of motor impairment in the lower extremity was controlled, and then, the level of significant increase in the modified R^2 (R^2change) was reviewed. The statistical significance level was set at 0.05.

Ⅲ. Results

The values resulting from measuring the HRQL, physical activities, and functional abilities of the subjects are presented in Table 2.

While physical activities performed for the one-week period showed a statistically significant correlation with the SF-36 PCS ($r=.39$, $p<.01$), they revealed no correlation with the SF-36 MCS ($r=.12$, $p=.24$). The physical activities had a statistically significant correlation with functional abilities ($r=.57$~$.86$, $p<.001$) (Table 3). A hierarchical linear regression analysis was conducted to confirm the effects of the physical activities of individuals post-stroke on their HRQL, and the results are shown in Table 4. The SF-36 MCS had no correlation with the physical activities. In addition, as the general characteristics of the subjects were

Table 3. Correlation analysis of the amount of physical activity with HRQL and functional ability (N=90)

Variables	Physical activity	
	Correlation coefficient	p
HRQL (SF-36)		
PCS	0.39	0.00
MCS	0.12	0.24
Functional ability		
Berg balance scale	0.72	0.00
CMSA leg and foot impairment	0.86	0.00
FIM locomotion	0.57	0.00

PCS: Physical Component Score, MCS: Mental Component Score, CMSA: Chedoke-McMaster Stroke Assessment, FIM: Functional Independence Measure

Table 4. The influence of physical activity on physical component score of the SF-36 in individuals post stroke (N=90)

	Physical component score of SF-36				
	R^2	R^2change	Unstandardised B	Standardised	p
Step 1	0.27	0.27			0.01
CMSA leg and foot			1.30 (0.49)	0.27	0.01
Step 2	0.39	0.12			0.00
CMSA leg and foot			1.19 (0.61)	0.24	0.02
Physical activity			2.87 (0.00)	0.36	0.01

CMSA: Chedoke-McMaster Stroke Assessment

not correlated with the physical activities in the SF-36, they were not entered into the regression model. First, the CMSA leg and foot scores were entered to control the level of motor impairment in the lower extremity. The total variance accounted for by the SF-36 PCS was 27.3%. When the physical activities were added, the value of the R^2 change resulted in 12% and the model was improved at a statistically significant level (p=.001). The total variance accounted for by the final model was 39.3%.

Ⅳ. Discussion

This study aimed to identify whether the physical activities of individuals with chronic stroke who resided in local communities influence their HRQL, as well as to assess the relationship between functional and physical abilities. Physical activities performed by the subjects for the one-week period were found to influence the SF-36 PCS (12%). The level of physical activities evaluated by the IPAQ (4136.92±1128.93 METs-min/week) was lower than the equivalent for healthy adults (4543±2743 METs-min/week)(Moore et al., 2013). This was a lower level even when compared with previous studies that evaluated the physical activities of 25 individuals with a stroke (4665±13309 METs-min/week), 209 older adults with chronic conditions (4620±3276 METs-min/week), and 45 individuals with neurologic and orthopedic conditions (6510±4452 METs-min/week) using self-report measures (Liu-Ambrose et al., 2010; Moore et al., 2013; van der Ploeg et al., 2007). The US Center for Disease Control and the American College of Sports Medicine guidelines recommended that individuals should engage in 30 minutes or more of moderate-intensity physical activity on a daily basis (equivalent to approximately 1,400 kcal/week), while the US Surgeon General's 1996 report classified moderate physical activity as more than 1,000 kcal/week(Pate et al., 1995; Sawatzky et al., 2007). In fact, most of the stroke patients in local communities do not meet the standard for physical activity at 1,000 kcal/week(US Department of Health and Human Services, 1996).

Strokes are known to influence the HRQL of individuals with conditions due to the sequelae of a stroke(Mayo et al., 2002). The present study also supports this point as proven by previous studies. The SF-36 PCS and MCS scores of stroke patients were lower than those of normal individuals. The SF-36 scores of individuals who experienced a stroke at least one year ago were lowered when their neurological impairment was more severe(Franceschini et al., 2010). Improvements to the HRQL are known as a health benefit from physical activities. Physical activities promote mobility by improving muscle strength and postural balance. Maintaining capacity for independent mobility contributes to a general sense of health and well-being. As a result, it can increase HRQL(Gordon et al., 2004). All functional ability measures have correlations with physical activities. This indicates a greater balance of functions, and reduced motor impairment can enable leisure and recreational activities. The FIM does not provide any specific information about the quality or competency of walking and has a significant ceiling effect for independent ambulators(Patterson et al., 2008). The almost half of the IPAQ items involve walking.

Ⅴ. Conclusion

Improvements to quality of life after a stroke have become the most important goal in rehabilitation and community reintegration. While some factors influencing quality of life are not modifiable (e.g., age), other factors might involve more difficulty in modifying after a stroke (e.g., severity of neurological impairment). In addition, some factors often cannot be improved easily, particularly during the chronic stage. The present study identified a correlation between physical activity and the PCS. Therefore, individuals post-stroke should be encouraged to carry out more physical activities, including more frequent walking activities.

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