



Original Article

Correlations between the sequelae of stroke and physical activity in Korean adult stroke patients

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Abstract. [Purpose] The present study investigated a wide range of stroke patients living in South Korea using the Korean Community Health Survey raw data to determine the correlation between stroke and physical activity. [Subjects and Methods] This study used raw data from the 2012 Korean Community Health Survey. The total number of participants was 228,921; of the 4,475 stroke patients who had been diagnosed by a medical doctor or an oriental medical doctor, the data for 4,460 patients, excluding 15 whose amount of physical activity was unclear, were used in the analysis. [Results] The amount of physical activity performed by patients who had sequelae was significantly lower than that performed by patients who no longer had sequelae. Similarly, for the type of sequelae, palsy in the arms and legs, facial palsy, communication disability, swallowing or eating disability, and visual disability were associated with lower physical activity. Furthermore, as the number of sequelae increased, patients performed significantly less physical activity. [Conclusion] The findings suggest that when decisions on national policies and budgets are made, methods for increasing the physical activity of patients with a history of stroke should be considered.

Key words: Stroke, Physical activity, Sequelae

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INTRODUCTION

Stroke is the second most common cause of mortality and the most common cause of long-term neurological disability worldwide¹⁾. In developing countries, the survival rate of stroke patients has increased with the improvement of medical technology, and as a result, relevant costs are increasing²⁾. Stroke limits independent activity in daily life³⁾. Therefore, many studies on the limitations of activity and participation in daily life have been conducted.

Physical activity is a key factor in the improvement of personal health, and increasing physical activity is associated with a decreased mortality rate⁴⁾. In addition, physical activity is associated with improved quality of life and decreased levels of depression⁵⁾. According to Bandura^{6, 7)}, low physical activity levels lead to the loss of self-efficacy and a lack of self-confidence in daily life. Therefore, more studies are necessary to improve physical activity.

If medical parameters are stable, it is critical to start physical activity in stroke patients as soon as possible⁸⁾. According to Lacroix et al.⁹⁾, 62% of stroke patients in hospitals and rehabilitation institutions have insufficient physical activity. Furthermore, in a study by Touillet et al.¹⁰⁾ in which nine stroke patients were trained at home, after 3 months, only one performed physical activity in accordance with the guidelines. Therefore, post-stroke physical activity remains an ongoing issue, and research is still required to address this problem.

Studies on the relationship between stroke and physical activity have been conducted, but most included small samples (about 300 participants)^{11–14)}. However, the Korean Community Health Survey (KCHS) is a study conducted in large samples

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of all South Korean residents, and various studies have used the raw data, including those for depressive symptoms, sleep duration, risk factors, and healthcare utilization¹⁵⁻¹⁸). The KCHS is conducted annually; the raw data are provided two years after completion of the investigation. The 2012 KCHS was conducted with 228,921 participants, and more than 4,000 were stroke patients. Thus, the KCHS was broad-based. Furthermore, KCHS is not conducted in a controlled laboratory setting, but rather is a personalized survey at home. Therefore, the present study investigated a wide range of stroke patients living in South Korea by using KCHS raw data to determine the correlation between stroke and physical activity.

SUBJECTS AND METHODS

This study used raw data from the 2012 KCHS, which was conducted under the supervision of the Korea Centers for Disease Control and Prevention (KCDC). The KCHS was conducted to monitor the health level of local residents between August 15, 2012 and October 31, 2012. Among all participants, an average of 900 were selected from a sample representative of the population in a total of 17 areas, including smoking, exercise, medical service use, limitation of activity, quality of life, and heart problems. A sample representative of the population data is selected annually by the Ministry of Public Administration and Security in cooperation with the Ministry of Land, Transport and Maritime Affairs. Sample households were extracted from these data to aid in the investigation of an average 900 individuals for each health center¹⁹⁻²²). Trained surveyors personally visited the sampled households and performed a one-on-one electronic survey with a notebook PC on which a survey program was installed. The total number of participants was 228,921; of the 4,475 stroke patients who had been diagnosed by a medical doctor or an oriental medical doctor, the data for 4,460 patients, excluding 15 whose amount of physical activity was unclear, were used in the analysis. The protocol of the KCHS was reviewed and approved by the institutional review board of the KCDC (2012-07CON-01-2c). Written informed consent was obtained from all KCHS participants. The general characteristics of the patients are listed in [Table 1](#).

To investigate the correlations between the factors related to the sequelae of stroke and physical activity in stroke patients, the types of sequelae were classified as: had no sequelae, recovered after experiencing sequelae, and currently experiencing sequelae. For the type and number of sequelae in patients who were currently experiencing sequelae or had recovered after experiencing sequelae, palsy in the arms and legs, facial palsy, communication disability such as poor pronunciation, swallowing or eating disorder, and visual disabilities such as poor vision, were used. Among these five types of sequelae, the total number that each patient had was calculated (range: 0-5), and these were additionally classified as 0, 1, 2, and 3 or more sequelae of each type.

The KCHS used questionnaires to measure physical activity. Physical activity was classified as strenuous, moderate, and walking, and each question asked the number of days per week and time spent in daily physical activity. Moderate physical activity was defined as that performed more than 3 days a week for more than 20 minutes per day; strenuous physical activity, as that performed more than 5 days a week for more than 30 minutes per day; and walking, as walking 5 days per week for more than 30 minutes per day. In this study, physical activity was defined as performing any physical activity, including moderate physical activity, strenuous physical activity, and walking.

The data were analyzed using IBM SPSS Statistics 21.0 (SPSS Inc., Chicago, IL, USA) for the complex sampling design, and individual weights were applied to estimate the population. A frequency analysis was performed to examine the patient distribution, and a chi-square test was performed to examine the sociodemographic characteristics and compare stroke sequelae and physical activity. Finally, to examine the correlations between the factors related to the sequelae of stroke and physical activity, multiple logistic regression analysis was performed under the control of gender, age, educational level, monthly household income, living with family, occupation, and residential area. The significance level for the statistical test was $\alpha=0.05$.

For the complex sampling design, and individual weights were applied to estimate the population. A frequency analysis was performed to examine the patient distribution, and a χ^2 test was performed to examine the sociodemographic characteristics and compare stroke sequelae and physical activity. Finally, to examine the correlations between the factors related to the sequelae of stroke and physical activity, multiple logistic regression analysis was performed under the control of gender, age, educational level, monthly household income, living with family, occupation, and residential area. The significance level for the statistical test was $\alpha=0.05$.

RESULTS

The stroke prevalence among all patients was 1.3%, and the current stroke treatment rate was 66.2%. Of all patients, 53.7% were male, 66.0% were 65 years or older, 53.7% were elementary school graduates or lower, 48.0% had one million won or less monthly household income, 86.3% lived with family members, 74.4% had no occupation, 71.8% lived in cities, and 44.1% performed physical activity ([Table 1](#)). The comparison between the factors and physical activity showed significant differences based on gender, age, education level, monthly household income, living with family, occupation, residential area, and whether or not currently being treated for stroke ([Table 2](#)).

As a result of the multiple logistic regression analysis with adjustment for gender, age, educational level, monthly household income, living with family, occupation, and residential area to examine the correlation between the factors related to the

sequelae of stroke and physical activity, the ratio of physical activity performed by patients who were currently experiencing sequelae compared to that of patients who were no longer experiencing sequelae was 0.58 (95% confidence interval [CI]: 0.47–0.71). Thus, the amount of physical activity performed by patients who had sequelae was significantly lower. Compared to patients who did not have sequelae, the ratio of physical activity performed by patients who had palsy in the arms and legs was 0.57 (95% CI: 0.47–0.69); facial palsy, 0.70 (95% CI: 0.54–0.91); communication disability, 0.73 (95% CI: 0.59–0.90); swallowing or eating disability, 0.53 (95% CI: 0.39–0.72); and visual disability, 0.63 (95% CI: 0.49–0.80). Thus, the amount of physical activity performed by patients who had stroke sequelae was significantly lower than that performed by patients who had not. Furthermore, compared to patients who had suffered no sequelae, the ratio of physical activity performed by patients who suffered 1 sequela was 0.76 (95% CI: 0.60–0.96); 2 sequelae, 0.72 (95% CI: 0.54–0.95); and 3 or more sequelae,

Table 1. Characteristics of stroke patients

Characteristics	n*	%†	%SE
Total stroke patients			
Yes	4,475	1.3	0.0
No	224,446	98.7	0.0
Currently undergoing treatment for stroke			
No	1,443	33.8	1.1
Yes	3,017	66.2	1.1
Gender			
Male	2,250	53.7	1.1
Female	2,210	46.3	1.1
Age (years)			
19–64	1,171	34.0	1.1
≥65	3,289	66.0	1.1
Educational level			
Elementary school or less	2,923	53.7	1.1
Middle school	575	15.4	0.8
High school	674	19.8	0.9
College and over	281	11.1	0.8
Monthly household income (10,000 won)			
≤100	2,475	48.0	1.2
101–200	780	22.4	1.0
201–300	407	11.3	0.7
301–400	188	6.5	0.6
≥401	331	11.8	0.8
Living with family			
Yes	3,656	86.3	0.7
No (alone)	804	13.7	0.7
Occupation			
Yes	1,292	25.6	1.0
No	3,164	74.4	1.0
Residential area			
Urban	1,860	71.8	1.1
Rural	2,600	28.2	1.1
Physical activity‡			
Yes	1,855	44.1	1.1
No	2,605	55.9	1.1

* n: sample size. †%: estimated percent of the population. ‡Physical activity: more than moderate levels of physical activity (moderate physical activity more than 3 days a week, strenuous physical activity for more than 20 minutes a day or moderate levels of physical activity more than 5 days a week, or strenuous physical activity for more than 30 minutes at a time), or walking for more than 30 minutes, 5 days a week, or over 30 minutes at a time.

Table 2. Sociodemographic characteristics of stroke patients and physical activity

Characteristics	No	Yes
Gender*		
Male	50.4 (1.5)	49.6 (1.5)
Female	62.2 (1.6)	37.8 (1.6)
Age (years)*		
19–64	48.6 (2.0)	51.4 (2.0)
≥65	59.6 (1.3)	40.4 (1.3)
Educational level*		
Elementary school or less	59.8 (1.4)	40.2 (1.4)
Middle school	53.9 (2.8)	46.1 (2.8)
High school	52.2 (2.5)	47.8 (2.5)
College and over	46.3 (4.1)	53.7 (4.1)
Monthly household income (10,000 won)*		
≤100	59.1 (1.5)	40.9 (1.5)
101–200	48.9 (2.5)	51.1 (2.5)
201–300	51.6 (3.5)	48.4 (3.5)
301–400	51.3 (4.9)	48.7 (4.9)
≥401	54.9 (3.7)	45.1 (3.7)
Living with family*		
Yes	54.8 (1.2)	45.2 (1.2)
No (alone)	63.0 (2.4)	37.0 (2.4)
Occupation*		
Yes	41.9 (2.2)	58.1 (2.2)
No	60.7 (1.3)	39.3 (1.3)
Residential area*		
Urban	54.7 (1.4)	45.3 (1.4)
Rural	59.0 (1.4)	41.0 (1.4)
Currently undergoing treatment for stroke*		
No	51.5 (1.9)	48.5 (1.9)
Yes	58.1 (1.3)	41.9 (1.3)

* χ^2 test ($p < 0.05$)

0.42 (95% CI: 0.32–0.56). Thus, as the number of sequelae increased, patients performed significantly less physical activity (Table 3).

DISCUSSION

Compared to patients who were not currently experiencing sequelae, the amount of physical activity performed by patients who were currently experiencing sequelae was significantly lower. This result corresponds to the results of a previous study that showed that stroke limited movement²³). In particular, no significant difference in physical activity was found in patients who had recovered from stroke sequelae in this study. This suggests that medical treatment to improve stroke sequelae is critical.

Based on the type of sequela, the amount of physical activity performed by patients who had palsy in the arms and legs was significantly lower than that performed by patients who did not. Previous studies reported that significantly decreased activity of the extensor muscles of the upper arm and the hand muscles would not be adequate for efficient rehabilitation^{24, 25}). In addition, physical activity is reduced due to limitations in walking when leg movement is not natural. Furthermore, as sequelae in the arm have a profound effect on the performance of delicate movements and work, palsy likely contributes to decreased physical activity.

The amount of physical activity performed by patients who had facial palsy was significantly lower than that performed by patients who did not. According to Kim et al.¹⁹), facial palsy decreases the quality of life. Facial palsy causes social phobia, which narrows the radius of activity, and complex palsy, including facial palsy, reduces physical activity.

Another stroke sequela, aphasia, has a profound effect on daily living, and many studies have been conducted on the difficulty of treating this sequela^{19, 26}). In the present study, the amount of physical activity performed by patients who had communication disability was significantly lower than that performed by patients who did not. Such communication disabilities decrease quality of life and can have other negative sequelae, such as depression. Therefore, relieving symptoms through appropriate treatment is critical¹⁷).

Table 3. The association between sequelae in stroke patients and physical activity

	No	Yes	aOR (95% CI)†
Occurrence of sequelae			
No	48.6 (1.7)	51.4 (1.7)	1.00
Recovery	51.6 (2.9)	48.4 (2.9)	0.93 (0.71–1.22)
Yes	63.6 (1.5)	36.4 (1.5)	0.58 (0.47–0.71)*
Type of sequelae			
Palsy in the arms and legs			
No	50.5 (1.4)	49.5 (1.4)	1.00
Yes	63.7 (1.6)	36.3 (1.6)	0.57 (0.47–0.69)*
Facial palsy			
No	54.7 (1.2)	45.3 (1.2)	1.00
Yes	62.7 (2.8)	37.3 (2.8)	0.70 (0.54–0.91)*
Communication disabilities			
No	53.4 (1.3)	46.6 (1.3)	1.00
Yes	62.1 (2.0)	37.9 (2.0)	0.73 (0.59–0.90)*
Swallowing or eating disorders			
No	54.4 (1.1)	45.6 (1.1)	1.00
Yes	70.8 (3.1)	29.2 (3.1)	0.53 (0.39–0.72)*
Visual disability			
No	53.4 (1.2)	46.6 (1.2)	1.00
Yes	67.6 (2.3)	32.4 (2.3)	0.63 (0.49–0.80)*
The number of sequelae			
0	49.3 (1.6)	50.7 (1.6)	1.00
1	57.8 (2.2)	42.2 (2.2)	0.76 (0.60–0.96)*
2	58.1 (2.9)	41.9 (2.9)	0.72 (0.54–0.95)*
≥3	70.1 (2.4)	29.9 (2.4)	0.42 (0.32–0.56)*

*Tested with multiple logistic regression analysis (p<0.05). †aOR, odds ratio adjusted for gender, age, educational level, monthly house hold income, living with family, occupation, and residential area

Stroke in the cerebral hemispheres or brain stem leads to dysphagia in 30–80% of cases, and dysphagia is directly associated with swallowing^{27–31}). In the present study, the amount of physical activity performed by patients had swallowing or eating disability sequelae was significantly lower than that performed by patients who did not. This result is similar to that reported in a previous study that patients with Parkinson's disease had worsened swallowing disorders as their disease progressed, and this lowered their quality of life³²). Therefore, more active interventions based on the prescription of a rehabilitation doctor, such as electrotherapy of the muscles related to dysphagia, are required.

The amount of physical activity performed by patients who had visual disability sequelae was significantly lower than that performed by patients who did not. A previous study reported that unilateral spatial neglect is a serious disability that can result from stroke, and this sequela can lead to a poor rehabilitation outcome. The present study showed that visual disability narrows the radius of the living environment and increases the amount of time patients remain at home, which results in reduced physical activity. Therefore, decreased physical activity due to visual disability should be improved through various methods, such as neuropsychological rehabilitation as well as cognitive rehabilitation, which is currently being applied in the clinical setting³³).

The amount of physical activity decreased significantly as the number of sequelae increased to 1, 2, and 3 compared to no sequelae. This result is related to the finding that brain atrophy is associated with reduced physical activity³⁴). Therefore, even though post-stroke survival through surgery is very important, interventions to reduce the number of sequelae must be applied throughout the post-stroke recovery period.

This study has the following limitations. Data for all South Korean residents were presented in the raw KCHS data. If the data had been presented by region, detailed differences according to the regional environment could have been provided. In future studies, the correlations between stroke and physical activity according to regional characteristics of South Korea should be presented for a better understanding of this subject.

In conclusion, in this study, the correlations between stroke and physical activity were investigated using data from the KCHS, a nationwide survey of South Korean residents. As a result, significant differences were found between the amount of physical activity and stroke sequelae, including palsy in the arms and legs and facial palsy, communication disability, swallowing or eating disorders, visual disability, and the number of sequelae. Therefore, when decisions on national policies and budgets are made, methods for increasing the physical activity of patients with a history of stroke should be considered.

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