eISSN 2255-0569

ORIGINAL

Exercise participation and associated factors in patients with stroke at the stage of sequelae period

Participación en el ejercicio y factores asociados en pacientes con ictus en el periodo de secuelas

Jiajia Sun[1*], Yuling Yang[2,3*], Li Wang[2]

1. School of Nursing, Suzhou Vocational Health College, Suzhou, 215009, China
2. School of Nursing, Medical College, Soochow University, Suzhou, 215006, China
3. Department of rehabilitation department, Affiliated Hospital of Jiangnan University, Wuxi, 214122, China

[*]These authors contributed equally to this work.

Corresponding author
Li Wang
E-mail: li-wang-1@suda.edu.cn

Received: 27 - VI - 2022
Accepted: 4 - VII - 2022

doi: 10.3306/AJHS.2022.37.05.56

Abstract

Objectives: Exercise is important for stroke rehabilitation. However, exercise participation in patients with stroke may not be ideal, and the factors affecting exercise participation may be complicated. This study was aimed to investigate exercise participation status and analyze its associated factors in patients with stroke at the stage of sequelae period (more than 6 months from the last onset).
Methods: A total of 193 patients with stroke at the stage of sequelae period recruited through a convenient sampling method participated in the present study and underwent investigation with questionnaires. Single-factor analysis and multiple linear regression analysis were used to analyze the factors influencing exercise participation in the subjects.
Results: The average exercise level of the patients was 8.1 Mets-h/week, which belonged to the low exercise level. Most patients (64.8%) participated in only one exercise mode, and easy exercise modes were dominant. Single-factor analysis showed that exercise volume differences were found with various factors, including educational degree, working status, marital status, primary caregiver, exercise habit, and the degree of self-care. Multiple linear regression analysis showed that the factors associated with patients' exercise volume included belief in exercise benefits, exercise risk concerns, and exercise support from family.
Conclusions: The exercise volume of patients with stroke at the stage of sequelae period is low, and their exercise modes are monotonous. Belief in exercise benefits, exercise risk concerns and family support are the main factors influencing the exercise level in these patients. Patients who believe that exercise after stroke can promote recovery, have a low exercise risk concerns and families' support have a higher exercise volume.

Key words: Stroke, exercise, rehabilitation, sequelae, physical function.

Resumen

Objetivos: El ejercicio es importante para la rehabilitación del ictus. Sin embargo, la participación en el ejercicio en pacientes con ictus puede no ser ideal, y los factores que afectan a la participación en el ejercicio pueden ser complicados.Investigar el estado de participación en el ejercicio y analizar sus factores asociados en pacientes con ictus en la etapa del período de secuelas (más de 6 meses desde el último inicio).
Métodos: Un total de 193 pacientes con ictus en la fase de secuelas, reclutados mediante un método de muestreo conveniente, participaron en el presente estudio y se sometieron a una investigación con cuestionarios. Se utilizó el análisis de factor único y el análisis de regresión lineal múltiple para analizar los factores que influyen en la participación en el ejercicio de los sujetos.
Resultados: El nivel medio de ejercicio de los pacientes fue de 8,1 Mets-h/semana, que pertenecía al nivel de ejercicio bajo. La mayoría de los pacientes (64,8%) participaron en una sola modalidad de ejercicio, y predominaron las modalidades de ejercicio fáciles. El análisis de un solo factor mostró que las diferencias en el volumen de ejercicio se encontraban con varios factores, como el grado de estudios, el estado laboral, el estado civil, el cuidador principal, el hábito de ejercicio y el grado de autocuidado. El análisis de regresión lineal múltiple mostró que los factores asociados con el volumen de ejercicio de los pacientes incluían la creencia en los beneficios del ejercicio, la preocupación por el riesgo del ejercicio y el apoyo de la familia al ejercicio.
Conclusiones: El volumen de ejercicio de los pacientes con ictus en la fase del periodo de secuelas es bajo, y sus modos de ejercicio son monótonos. La creencia en los beneficios del ejercicio, la preocupación por el riesgo del ejercicio y el apoyo de la familia son los principales factores que influyen en el nivel de ejercicio en estos pacientes. Los pacientes que creen que el ejercicio después del ictus puede promover la recuperación, tienen una baja preocupación por el riesgo del ejercicio y el apoyo de la familia tienen un mayor volumen de ejercicio.

Palabras clave: Ictus, ejercicio, rehabilitación, secuelas, función física.

Introduction

With the characteristics of high incidence, prevalence, mortality, morbidity and recurrence rate, stroke has become the second most common cause of death and stroke-caused disability is continuously increasing[1-3]. The latest study on the Global Burden of Disease Study shows that the overall lifetime risk of stroke in China is 39.9%[4], ranking first in the world, which means that approximately 2 out of every 5 people will suffer from stroke in their lifetime.

Regular exercise has been proven to be beneficial for the rehabilitation of patients with stroke by improving their cardiovascular function[5], pulmonary function[6], body flexibility[7], walking ability[8], muscle strength[9], bone mineral density[10] and quality of life[11] and reducing the stroke recurrence rate[3]. In the rehabilitation guidelines for patients with stroke at the stage of sequelae period, it is recommended that stroke patients regularly participate in exercise, including aerobic exercise, strength training and flexibility training[12]. However, there are studies showing that 70% of patients fail to do so[13], which escalates the negative effects of stroke. Due to the existence of stroke and a series of sequelae, the factors affecting the exercise participation of patients with stroke may be complicated.

The purpose of the present study was to investigate exercise participation in Chinese patients with stroke at the stage of sequelae period (more than 6 months from the last onset) and analyse its associated factors, thereby providing a reference for efforts to improve exercise participation levels.

Material and methods

Participants

With the convenience sampling method, patients with stroke at the stage of sequelae period were recruited from communities and hospitals in Suzhou, China. The recruitment criteria included ① patients who conformed to the stroke diagnosis standard of The Fourth National Conference of Cerebrovascular Diseases and were confirmed by CT or MRI and ② patients who had stroke 6 months prior. Patients with mental disorders, severe cardiovascular disease, or any exercise contraindication therefore not appropriate for exercise or incapable of understanding the investigated questions were excluded. The study purpose and participant's rights and responsibility related to this study were explained to the patients in detail. After full informed consent was obtained, subjects who gave their formed consent were involved in the study. This study was approved by the Ethics Committee of The First Affiliated Hospital of Soochow University (2017024) and conducted in compliance with the guidelines stated in the WMA Declaration of Helsinki and its later amendments or comparable ethical standards.

Questionnaires

Two questionnaires were applied in this study to collect the general information and exercise participation status of patients with stroke. Considering that most stroke patients were old and had difficulty reading and understanding, the survey was performed in a way that investigators dictated the questions to patients and filled in based on patients' answers. Once finished, the completed questionnaires were shown to participants for confirmation.

Questionnaire of general information

The questionnaire of general information included demographic data, disease-related data and the activity of daily living scale (ADL scale). The questions for demographic data (including sex, age, working status, educational status, etc.) and the disease-related data [included course of disease (since the first onset), types of stroke, number of sequelae, history of smoking, etc.] were self-designed. Self-care ability was measured using the ADL scale, which comprises 10 items, including eating, bathing, grooming, dressing, bowel control, toileting, bed and wheelchair transfer, walking on the ground, and stairs. Based on the patient's need for help (or lack) and its degree, the ADL scale is divided into 4 grades of 15, 10,5, and 0 points, with a full score of 100 points[14].

Questionnaires of exercise participation

Exercise participation was investigated by a self-designed questionnaire and a questionnaire modified from the Amateur Exercise Level Questionnaire (AELQ)[15]. The self-designed questionnaire included questions on regular exercise habits before and after stroke, beliefs about exercise benefits, exercise risk concerns, and social support for exercise from medical staff, hospitals, families, and communities. AELQ was revised from the "Variable Exercise Activity Questionnaire" by Professor Bagen Liao based on the characteristics of Chinese people, and it has proven to be suitable for various kinds of populations[16]. AELQ is subject to investigation, in the past year, subjects' exercise participation in 40 exercise modes, including walking, running, climbing, riding bike, etc. Patients were asked to select the exercise mode he/she performed in the past 12 months, fill in the average monthly exercise frequency in each month, and the average exercise time per session. The total exercise volume (Mets-h/week) was calculated based on the formula: months × average monthly exercise frequency × average exercise time each time × METs ÷ 60 min/h ÷ 52 wk/year. Subjects were divided into four groups according to their exercise volume: the nonexercise group (< 10.0 Mets-h/week), low-level exercise group (10~19.9 Mets-h/week), medium level exercise group (20 ~ 39.9 Mets-h/week), and high-level exercise group (more than or equal to 40 Mets-h/week)[16,17].

Statistical Analysis

Data were analysed using the SPSS 24.0 software package (IBM, Armonk, NY, USA). Descriptive statistics of frequency and percentage were used to summarize original data. The Kruskal-Wallis test was used to compare results between and among groups. Correlations between different parameters were analysed with bivariate correlation analysis. Multiple linear regression analysis was used to determine the factors associated with exercise volume. Alpha level was set at P less than 0.05.

Results

A total of 200 patients with stroke at the stage of sequelae period were recruited, and 193 (96.5%) completed and returned the questionnaires that were eligible for data analysis.

1. Sociodemographic characteristics of patients

The 193 subjects (72.4±12.4 years old) included 109 males and 84 females (56.5% vs. 43.5%). Their demographic data and disease-related information are shown in **table I**.

2. Clinical data of patients

In this survey, patients' disease course (starting from the onset of the first time of stroke) ranged from 6 months to 27 years, and 47.2% of patients were 1-5 years old. A total of 78.8% of patients had ischemic stroke, 30.1% of patients had stroke recurrence, 81.3% of patients had various degrees of dysfunction, and 63.2% of patients had reduced physical activity compared with before stroke. Detailed disease-related information is shown in **table II**.

3. Exercise-related information of patients

There were 35.8% of the patients who exercised regularly before stroke and 56.5% after stroke. Most (79.8%) patients believed that exercise could promote their recovery, and 62.2% of patients worried about exercise risk. Information on social support for exercise is presented in **table III**.

The mean exercise volume in all patients was 8.1 Mets-h/week (ranging from 0.1 to 83.4 Mets-h/week), which belonged to the nonexercise level. More than half of the subjects (56.5%) belonged to the nonexercise group (**Table IV**).

A total of 64.8% of the patients performed only one mode of exercise, 28.5% performed two, and only 6.7% performed three or more. The three most common exercise modes were walking (n=144, 84.7%), stair climbing (n=47, 27.6%) and indoor activities (n=36, 21.2%).

4. Single factor analysis of exercise volume

The Kruskal–Wallis test showed that exercise volumes were significantly different among different categories of variables, including educational level, working status, marital status, main caregiver, self-care ability, exercise regularly before stroke, and exercise-related parameters (belief of exercise benefits, exercise risk concerns, exercise support from family, exercise equipment in community) (**Table V**).

Specifically, there was a higher exercise volume among patients with a higher educational level than among those with a primary school education or below (Z=72.30, *P*=0.001). Patients under unemployed

Table I: Sociodemographic characteristics of patients.

Variables	Category	Number	Proportion (%)
Age (years old)	<50 50~69 ≥70	11 56 126	5.7 29.0 65.3
Sex	Male Female	109 84	56.5 43.5
Education level	Primary school and below Junior high school High school and College Undergraduate and above	54 52 57 30	28.0 26.9 29.5 15.5
Working status	Employed Retired Unemployed	14 163 16	7.2 84.5 8.3
Average monthly income (Yuan)	<3000 3000~4999 ≥5000	85 49 59	44.0 25.4 30.6
Marital status	Married Widowed and divorced	149 44	77.2 22.8
Religions belief	Yes No	17 176	8.8 91.2
Medical payment	Urban Medicare Rural Medicare Commercial insurance Self-paid	170 17 2 4	88.1 8.8 1.0 2.1

Table II: Clinical data of patients.

Variables	Category	Number	Proportion (%)
Course of disease (year)	<1 1~5 5~10 ≥10	8 91 55 39	4.1 47.2 28.5 20.2
Diagnosis of type	Hemorrhagic Ischemic Mixed	30 152 11	15.5 78.8 5.7
Number of strokes	1 2~3 >3	135 42 16	69.9 21.8 8.3
Number of legacy symptoms	0 1~2 ≥3	36 107 50	18.7 55.4 25.9
Self-care ability	Fully self-care Slightly dysfunction Moderately dysfunction Severely dysfunction	149 23 9 12	77.2 11.9 4.7 6.2
Number of complications	0 1~2 ≥3	34 152 7	17.6 78.8 3.6
Smoking	Yes No	18 175	9.3 90.7
Drinking	Yes No	16 177	8.3 91.7
Main care giver	Family member Nannies or nurses Oneself	90 17 86	46.6 8.8 44.6
Physical activity compared with before stroke	Significant increase Slightly increase Unchanged Slightly decrease Significant decrease	3 14 54 29 93	1.6 7.3 28.0 15.0 48.2

Table III: Exercise-related information of patients.

Variables	Category	Number	Proportion (%)
Exercise habit before stroke	Yes, ≥3times/week Yes, 1~2times/week No	65 4 124	33.7 2.1 64.2
Exercise habit after stroke	Yes,≥3times/week Yes, 1~2times/week No	104 5 84	53.9 2.6 43.5
Belief of exercise benefits	Yes No	154 39	79.8 20.2
Exercise risk concerns	Yes No	120 73	62.2 37.8
Medical staff stress the importance of exercise	Yes No	134 59	69.4 30.6
The hospital provides exercise demonstration facilities	Yes No	156 37	80.8 19.2
Exercise support from family	Yes No	96 97	49.7 50.3
Exercise equipment in community	Yes No	139 54	72.0 28.0

Table IV: Exercise volume of patients.

Variables	Number (%)	Mean (P_{25}, P_{75}) Mets-h/week
Total	193 (100)	8.1 (2.7, 19.1)
No exercise group	109 (56.5)	3.2 (1.1, 6.3)
Low level exercise group	43 (22.3)	14.4 (12.9, 17.8)
Medium level exercise group	31(16.1)	26.8 (23.1, 32.0)
High level exercise group	10 (5.1)	49.9 (44.5, 58.1)

statuses or at widowed/divorced statuses had lower exercise volumes than retired and employed or married patients (Z=117.79, *P*= 0.028, Z=102.29, *P*=0.015). The patients who could take care of themselves had higher exercise volumes than those were taken care by family members and nannies or nurses (Z=90.23, *P*=0.048). The patients with slight dysfunction had lower exercise volumes than those without dysfunction (Z=104.02, *P*=0.016). The patients who exercised two times/week before stroke had a lower exercise volume than those who exercised more than three times/week (Z=116.31, *P*=0.003). The patients who believed the exercise benefits had higher (H=108.92, *P*<0.01) and the ones worried about exercise risk had lower (H=82.01, *P*=0.004) exercise volume than those who did not. The patients with exercise support from family and exercise equipment in the community had higher exercise volumes than those without (H=118.15, *P*<0.01, H=104.54, *P*=0.003). Exercise volumes were not significantly different among patients at different ages (Z=129.95, *P*=0.057).

5. Multiple linear regression analysis of exercise volume

Multiple linear regression analysis showed that the factors significantly associated with exercise volume in these patients included three aspects: belief in exercise benefits, exercise risk concerns, and exercise support from family (**Table VI**). The patients who had beliefs about exercise benefits and exercise support from family had higher exercise volumes than the patients who had no. The patients who had exercise risk concerns showed lower exercise volumes than the patients who had no worry about exercise risk.

Table V: Single factor analysis of exercise volume.

Variables	Classification	M (P_{25}, P_{75}) Mets-h/week	H/ Z	*P*
Age (years old)	<50 50-69 >70	13.3 (8.3, 21.5) 7.7 (3.9, 24.0) 7.3 (1.7, 16.6)	129.95 103.05 91.43	0.057
Educational level	Primary school or below Junior high school High school and College Undergraduate and above	4.3 (1.6, 9.5) 8.1 (2.4, 19.2)[a] 11.6 (5.6, 24.1)[a] 10.9 (3.8, 23.4)a	72.30 97.12 115.18 106.73	0.001*
Working status	Employed Retired Unemployed	12.9 (5.2, 21.1) 8.1 (2.4, 19.6) 4.3 (1.2, 7.8)[ab]	117.79 98.31 65.50	0.028*
Marital status	Married Widowed or divorced	8.7 (3.2, 20.9) 4.5 (1.1, 13.8)[a]	102.29 79.09	0.015*
Main care giver	Family member Nannies or nurses Oneself	6.5 (1.6, 16.5) 4.3 (2.0, 12.6) 11.9 (4.0, 21.1)[ab]	90.23 79.44 107.56	0.048*
Self-care ability	Fully self-care Slightly dysfunction Moderately dysfunction Severely dysfunction	9.6 (3.2, 20.9) 4.3 (1.4, 8.7)[a] 4.7 (1.3, 11.7) 4.0 (0.8, 13.3)	104.02 72.85 71.67 75.13	0.016**
Exercise habit before stroke	Yes, >3 times/week Yes, 1-2 times/week No	14.4 (5.5, 23.2) 5.8 (2.7, 24.5) 6.2 (1.6, 14.0)	116.31 92.00 87.04	0.003*
Belief of exercise benefits	Yes No	11.1 (4.3, 21.1) 2.2 (0.7, 4.6)	108.92 49.95	<0.01**
Exercise risk concerns	Yes No	5.4 (1.1, 13.7) 9.6 (3.2, 21.1)	82.01 106.12	0.004*
Exercise support from family	Yes No	13.1 (5.5, 24.0) 4.3 (1.6, 12.9)	118.15 76.07	<0.01**
Exercise equipment in community	Yes No	3.2 (10.3, 21.1) 4.7 (1.7, 10.8)	104.54 77.59	0.003*

*: *p* <0.05, **: *p* <0.01; a: significantly different from the first category; b: significantly different from the second category.

Table VI: Multiple linear regression analysis of exercise volume.

Independent variables	ß	ß'	SE	T	*p*	Corrected R squared	F	*P*
Constant	32.74		7.37	4.44	< 0.001	0.25	6.07	<0.001
Belief of exercise benefits	-5.45	-0.16	2.48	-2.20	0.029			
Exercise risk concerns	4.86	0.17	1.89	2.52	0.011			
Exercise support from family	-7.27	-0.27	1.92	-3.79	< 0.001			

Reference variables were set as the ones with the answer of "yes".

Discussion

In the present study, exercise participation status and associated influencing factors were investigated in 193 patients with stroke at the stage of sequelae period through AELQ combined with self-designed questionnaires.

1. The general and disease related information

Among the 193 patients with stroke in this study, more patients were males and elderly and had ischemic stroke type, which is consistent with the epidemic facts of stroke[4]. The long course of disease (6 months to 27 years) and high percentage of dysfunction (81.3%) demonstrate that patients with stroke may be plagued by disease sequelae for a long time and that rehabilitation, including exercise, is necessary and important.

2. Exercise status of stroke patients in sequelae

In this study, the overall exercise volume of the patients with stroke was low (~8.1 Mets-h/week), which belonged to the nonexercise level. According to the American Heart Association/American Stroke Association stroke rehabilitation guideline recommendation, the patients with stroke at the stage of sequelae period should participate in moderate intensity exercise no less than three times a week for 20 to 60 minutes per session[13], which equals ~24.70 Mets-h/week. However, 84.7% of the patients in the present study were far below this level. The harm of a sedentary lifestyle or shortage of exercise has been discovered in many studies, including leading to reduced cardiopulmonary adaptability, causing cardiovascular diseases, and further reducing the patient's physical fitness. Based on our findings, primary health care workers should pay more attention to stroke prevention and rehabilitation knowledge education, especially emphasizing the importance of poststroke exercises, raising patients' awareness of post stroke exercises, and thereby promoting exercise participation[18].

Apart from the low exercise volume, the exercise modes adopted by the patients with stroke were generally monotonous (93.3% engaged in one or two kinds of exercise, and only 6.7% participated in more than three), and easy and convenient exercise modes with little demand on skill, furniture, and effort (such as walking and climbing stairs) dominated. This is consistent with previous findings that most elderly individuals in the community participate in simple exercises[19]. The preferable easy exercise mode may be accounted for by the fact that most patients lack exercise skills for other exercises, especially those need special learning and practice, such as swimming, Ta Chi, ball games, etc.

This study and previous studies have shown that the most common exercise method used by patients with sequelae of stroke is walking[20]. Walking is an effective exercise method with many advantages, such as convenience, little demand for space and skills, and easy adjustment of walking speed (exercise intensity)[13]. With the improvement of the social economy and health consciousness, products such as pedometers and sports bracelets have been created to encourage people to participate in walking[21].

The guidelines for exercise rehabilitation in patients with stroke note that exercises requiring the coordination of different parts of the body are better than those requiring only a single part of the muscle[13]. Some exercises, such as yoga, are mild (not intensive) and need all parts of the body to participate, which is suitable for stroke patients[22]. Therefore, it is necessary to create conditions helping and encouraging patients with stroke to learn and develop more exercise skills and participate in diverse modes of exercise.

3. Factors associated with exercise participation

3.1 Belief of exercise benefits

In our study, we found that the belief of exercise benefits was one of the factors associated with the exercise level in these patients with stroke at the stage of sequelae period. Among the patients investigated, 79.8% believed that exercise would benefit health recovery. A positive attitude towards exercise for stroke and belief in the benefits of exercise promote more participation in sports, thereby improving physical activity and exercise levels[23].

3.2 Exercise risk concerns

This study found that worrying about the risk of exercise is associated with lower exercise levels in these patients. Among the patients investigated, 62.2% had exercise risk concerns, and this percentage was quite high. Stroke happens more commonly in older populations, who have a high incidence of chronic diseases, which will reduce their physical ability and control, thereby increasing worries about the risks of exercise. The high incidence of sequelae after stroke must also contribute to increased worries. In fact, many studies have pointed out that poststroke exercises generally do not cause secondary injuries[11,24], and exercises should not be given up because of excessive fear of exercise risks. The American Heart Association/American Stroke Association pointed out that patients should take a pre-physical fitness test under the guidance of a physician before exercise[13] to clarify exercise tolerance. In this survey, no patients mentioned that they had received pre-exercise physical function assessment and guidance. To improve exercise participation in these patients, it is necessary to take measures to increase their exercise-related knowledge and decrease their concerns about exercise risks.

3.3 Exercise support from family and marital status

This study found that the patients who had support from family members for exercise had a higher level of exercise, which was consistent with previous findings[25]. Camak et al found that family supervision is one of the factors to improve the exercise level of stroke patients in the sequelae stage[25]. The result of this factor is consistent with the result of marital status from single factor analysis, which showed that patients of married status had higher exercise volume than widowed or divorced patients. In China, partners are the most common caregivers for older people[26]. Some patients may not be able to exercise independently, and in this case, the assistance of family members is important and necessary to help them overcome the difficulties in exercises. Additionally, family members can modify living furnishings, prepare exercise equipment, and reduce the burden of housework, thereby promoting the exercise participation of patients.

3.4 Other factors

Apart from the above mentioned contributors to exercise volume, univariate analyses indicated that exercise volume in patients with stroke demonstrated differences across a large number of variables, including educational level, working status, marital status, main caregiver, self-care ability, exercise habit before stroke, and exercise equipment in the community.

The lower exercise volume in unemployed patients than in working and retired patients may be related to the greater stress for survival and less contact with society. With higher educational level, the patients usually have stronger ability to learn and understand knowledge, which may help increase the patients' understanding importance and knowledge of post stroke exercise, thereby helping improve their exercise volume. In addition, a study found that patients with higher education levels often have better personal financial conditions, pay more attention to their own health and are more equipped to carry out high-quality exercises, which may also improve their exercise levels. The patients who could take care of themselves had a higher exercise volume, which may also be related to their higher self-care ability. It is generally believed that people with exercise habits have better health awareness and adherence to long-term exercise, which explains the higher levels of exercise in patients with exercise habits before stroke. Patients with exercise facilities in the community have relatively higher levels of exercise, suggesting the benefits of material support. This is consistent with previous findings that patients' rehabilitation needs the support of relevant infrastructure and that perfect exercise facilities in the community will facilitate patients to develop good exercise habits and awareness[27]. Our investigation also showed that most patients (72%) lived in communities with exercise equipment, which may be related to the study location, Suzhou, a city with relatively good living conditions.

Additionally, this study showed that the exercise volumes of patients at different ages were close to significant (P=0.057). Such results may be related to the small sample size in this study. Liu Yafang pointed out that younger stroke patients need to shoulder the responsibility of the family and society and have a higher degree of urgency and demand for rehabilitation. This is a strong motivation for young patients to participate in sports exercise[28]. Aging itself will bring about a series of deteriorations in physical functions, resulting in reduced energy and limited limb function. Most elderly people have problems such as being too weak and having concurrent diseases[29], which may hinder their participation in exercise.

Conclusions

In summary, the exercise participation in the patients with stroke at the stage of sequelae period is not ideal, illustrated mainly by the extremely low exercise volume and the monotonous exercise modes involved. Having the belief of exercise benefits, exercise risk concerns and families' support are the main factors influencing the exercise level in these patients. Amount of exercise are different in patients of different educational level, working status, marital status, exercise habit before stroke, and self-care ability. It is lower if the patients are less educated, unemployed, having no accompany, with less self-care ability or living in the communities without exercise furniture. Our study provides data on patients with a high risk of insufficient exercise participation who may benefit from interventions that focus on multiple associated factors related to health education and promotion.

Acknowledgements

We would like to thank all participants for their time and effort.

Interests conflict

The authors declare that they have no conflict of interest.

Funding

This study was funded by the Start-up Foundation of Soochow University [No. Q412700114].

References

1. Sang S, Chu C, Zhang T, Chen H, Yang X. The global burden of disease attributable to ambient fine particulate matter in 204 countries and territories, 1990-2019: A systematic analysis of the Global Burden of Disease Study 2019. Ecotoxicol Environ Saf. 2022; 15(238):113588. doi: 10.1016/j.ecoenv.2022.113588.

2. Norrving B, Kissela B. The global burden of stroke and need for a continuum of care. Neurology. 2013;80(3 Suppl 2):S5-12. doi:10.1212/WNL.0b013e3182762397.

3. Kim DY, Jung SY, Seo BD. Effect of exercise intervention on changes in free Fatty Acid levels and metabolic risk factors in stroke patients. J Phys Ther Sci. 2014;26(2):275-9. doi:10.1589/jpts.26.275.

4. Wang Y, Zhou L, Guo J, Wang Y, Yang Y, Peng Q, et al. Secular trends of stroke incidence and mortality in China, 1990 to 2016: The Global Burden of Disease Study 2016. J Stroke Cerebrovasc Dis. 2020;29(8):104959. doi:10.1016/j.jstrokecerebrovasdis.2020.104959.

5. Tang A, Eng JJ, Krassioukov AV, Madden KM, Mohammadi A, Tsang MY, et al. Exercise-induced changes in cardiovascular function after stroke: a randomized controlled trial. Int J Stroke. 2014;9(7):883-9. doi:10.1111/ijs.12156.

6. Kim J, Park JH, Yim J. Effects of respiratory muscle and endurance training using an individualized training device on the pulmonary function and exercise capacity in stroke patients. Med Sci Monit. 2014;20:2543-9. doi:10.12659/msm.891112.

7. Jun EM, Roh YH, Kim MJ. The effect of music-movement therapy on physical and psychological states of stroke patients. J Clin Nurs. 2013;22(1-2):22-31. doi:10.1111/j.1365-2702.2012.04243.x.

8. Dite W, Langford ZN, Cumming TB, Churilov L, Blennerhassett JM, Bernhardt J. A Phase 1 exercise dose escalation study for stroke survivors with impaired walking. Int J Stroke. 2015;10(7):1051-6. doi:10.1111/ijs.12548.

9. Lee NK, Kwon JW, Son SM, Kang KW, Kim K, Hyun-Nam S. The effects of closed and open kinetic chain exercises on lower limb muscle activity and balance in stroke survivors. NeuroRehabilitation. 2013;33(1):177-83. doi:10.3233/nre-130943.

10. Pluskiewicz W. Skeletal consequences in patients after stroke. Endokrynol Pol. 2011;62(1):48-50.

11. Pang MY, Charlesworth SA, Lau RW, Chung RC. Using aerobic exercise to improve health outcomes and quality of life in stroke: evidence-based exercise prescription recommendations. Cerebrovasc Dis. 2013;35(1):7-22. doi:10.1159/000346075.

12. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2016;47(6):e98-e169. doi:10.1161/str.0000000000000098.

13. Billinger SA, Arena R, Bernhardt J, Eng JJ, Franklin BA, Johnson CM, et al. Physical activity and exercise recommendations for stroke survivors: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45(8):2532-53. doi:10.1161/str.0000000000000022.

14. Yang CM, Wang YC, Lee CH, Chen MH, Hsieh CL. A comparison of test-retest reliability and random measurement error of the Barthel Index and modified Barthel Index in patients with chronic stroke. Disabil Rehabil. 2020:1-5. doi:10.1080/09638288.2020.1814429.

15. Yuling Y, Li W. Development and reliability and validity test of motor knowledge-attitude-social support questionnaire for patients with stroke sequelae. Nursing Journal of Chinese People's Liberation Army. 2018;35(08):27-30+4.

16. Ba-gen L, Xin-hua L, Shao-xiong G. Amateur physical activity, constitution and risk factors of coronary heart disease in middle-aged and elderly people. Chin J Sports Med. 2000(03):261-3. doi:10.3969/j.issn.1000-6710.2000.03.011.

17. Zhongfang Y. Exercise status survey of senile diabetes mellitus patients in Shanghai [Master]: Fudan University; 2014.

18. Clarke DJ. Nursing practice in stroke rehabilitation: systematic review and meta-ethnography. J Clin Nurs. 2014;23(9-10):1201-26. doi:10.1111/jocn.12334.

19. Can G, Xiuhua W, Guoping H. Study on the correlation between exercise level and self-rated health status of the elderly in community. China Journal of Modern Medicine. 2012;22(19):90-5.

20. Kendall BJ, Gothe NP. Effect of Aerobic Exercise Interventions on Mobility among Stroke Patients: A Systematic Review. Am J Phys Med Rehabil. 2016;95(3):214-24. doi:10.1097/phm.0000000000000416.

21. Sullivan JE, Espe LE, Kelly AM, Veilbig LE, Kwasny MJ. Feasibility and outcomes of a community-based, pedometer-monitored walking program in chronic stroke: a pilot study. Top Stroke Rehabil. 2014;21(2):101-10. doi:10.1310/tsr2102-101.

22. Tong Z. Chinese Stroke Rehabilitation Guidelines (2011 full edition). Chin J Rehabil Theor and Prac. 2012;18(04):301-18.

23. Lin B, Zhang Z, Mei Y, Liu L, Ping Z. The Influential Factors of Adherence to Physical Activity and Exercise among Community-Dwelling Stroke Survivors: A Path Analysis. J Clin Nurs. 2021. doi:10.1111/jocn.16091.

24. Harris JE, Eng JJ. Strength training improves upper-limb function in individuals with stroke: a meta-analysis. Stroke. 2010;41(1):136-40. doi:10.1161/strokeaha.109.567438.

25. Camak DJ. Addressing the burden of stroke caregivers: a literature review. J Clin Nurs. 2015;24(17-18):2376-82. doi:10.1111/jocn.12884.

26. Li Z. Primary Caregivers and the Chinese Older Adult Demand on Community Services. Journal of Zhejiang business and University. 2021(03):129-40.

27. Wang TC, Tsai AC, Wang JY, Lin YT, Lin KL, Chen JJ, et al. Caregiver-mediated intervention can improve physical functional recovery of patients with chronic stroke: a randomized controlled trial. Neurorehabil Neural Repair. 2015;29(1):3-12. doi:10.1177/1545968314532030.

28. Maaijwee NA, Rutten-Jacobs LC, Schaapsmeerders P, van Dijk EJ, de Leeuw FE. Ischaemic stroke in young adults: risk factors and long-term consequences. Nat Rev Neurol. 2014;10(6):315-25. doi:10.1038/nrneurol.2014.72.

29. Billinger SA, Mattlage AE, Ashenden AL, Lentz AA, Harter G, Rippee MA. Aerobic exercise in subacute stroke improves cardiovascular health and physical performance. J Neurol Phys Ther. 2012;36(4):159-65. doi:10.1097/NPT.0b013e318274d082.