VERIFICATION OF PROPER EXERCISE FOR PREVENTING IATROGENIC STROKE

AVALIAÇÃO DE ATIVIDADES FÍSICAS APROPRIADAS PARA A PREVENÇÃO DE ACIDENTES VASCULARES CEREBRAIS IATROGÊNICOS

EVALUACIÓN DE ACTIVIDADES FÍSICAS APROPIADAS PARA LA PREVENCIÓN DE ACCIDENTES VASCULARES CEREBRALES IATROGÉNICOS

Original Article
Artigo Original
Artículo Original

Jia Xu[1]
(Physical Education Professional)

1. Changzhou College of Information Technology, Jiangsu, China.

Correspondence:
Jia Xu
Jiangsu, China. 213161.
czwangjingfang@163.com

ABSTRACT

Introduction: Iatrogenic stroke is a cerebrovascular clinical event. It quickly leads to localized or diffuse brain dysfunction. After the onset, the patient develops motor dysfunction. Objective: To study the effect of evidence-based physical exercise on the physical function and daily life ability of stroke patients with hemiplegia. Method: 160 patients with iatrogenic stroke were selected and randomly grouped. The exercise group received rehabilitation training in addition to conventional drug therapy, while the control group only received drug therapy. Finally, the rehabilitation effect was evaluated. Results: The performance of the exercise group was better than that of the control group. The difference between the two groups was statistically significant. Conclusion: Systematic evidence-based exercise and effective rehabilitation methods can alleviate the motor dysfunction of stroke patients with hemiplegia. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Cardiovascular Stroke; Sports; Rehabilitation Exercise; Limb Dystonia.

RESUMO

Introdução: O acidente vascular cerebral iatrogênico é um evento clínico que, em pouco tempo, leva à disfunção cerebral localizada ou difusa, fazendo com que o paciente desenvolva disfunções motoras. Objetivo: Estudar o efeito de atividade física baseada em evidências sobre a função física de pacientes de AVC com hemiplegia sobre sua capacidade de executar suas atividades da vida diária. Método: 160 pacientes com AVC iatrogênico foram selecionados e separados aleatoriamente em grupos. O grupo Exercício recebeu treino reabilitativo, além de terapia medicamentosa convencional básica, enquanto o grupo Controle recebeu apenas terapia medicamentosa. Em seguida, os efeitos da reabilitação foram avaliados. Resultados: A performance do grupo Exercício foi melhor que a do grupo Controle. A diferença entre os dois grupos foi estatisticamente significativa. Conclusão: Atividade física sistemática e baseada em evidências e métodos de reabilitação eficientes podem aliviar a disfunção motora de pacientes de AVC com hemiplegia. ***Nível de evidência II; Estudos terapêuticos – investigação do resultado de tratamentos.***

Descritores: *Infarto do Miocárdio; Esportes; Terapia por Exercício; Distonia.*

RESUMEN

Introducción: El accidente vascular cerebral iatrogénico es un evento clínico que, en poco tiempo, ocasiona disfunción cerebral localizada o difusa, haciendo que el paciente desarrolle disfunciones motoras. Objetivo: Estudiar el efecto de actividad física basada en evidencias sobre la función física de pacientes de ACV con hemiplejia sobre su capacidad de ejecutar sus actividades de vida diaria. Método: Fueron seleccionados y separados aleatoriamente en grupos 160 pacientes con ACV iatrogénico. El grupo Ejercicio recibió entrenamiento de rehabilitación, además de terapia medicamentosa convencional básica, mientras que el grupo Control recibió solo terapia medicamentosa. A continuación, los efectos de la rehabilitación fueron evaluados. Resultados: El rendimiento del grupo Ejercicio fue mejor que la del grupo Control. La diferencia entre los dos grupos fue estadísticamente significativa. Conclusión: Actividad física sistemática y basada en evidencias y métodos de rehabilitación eficientes pueden aliviar la disfunción motora de pacientes de ACV con hemiplejia. ***Nivel de evidencia II; Estudios terapéuticos – investigación del resultado de tratamientos.***

Descriptores: *Infarto del Miocardio; Deportes; Terapia por Ejercicio; Distonía.*

DOI: http://dx.doi.org/10.1590/1517-8692202228022021_0479 Article received on 11/03/2021 accepted on 12/23/2021

INTRODUCTION

Stroke is currently one of the three diseases with the highest mortality and disability rate in humans. With the continuous improvement of diagnosis and treatment levels in recent years, the fatality rate has been significantly reduced, but about 70% of patients have sequelae of varying degrees. These sequelae will seriously affect work and life ability and increase the burden on family and society. Strokes mostly occur in middle-aged and older adults.[1] Although advanced medical technology has improved the survival rate of patients, the disability rate remains high. Studies have shown that the disability rate in surviving stroke patients is

as high as 80%. In recent years, rehabilitation treatment technology has developed rapidly across the country, but most patients only start to standardize rehabilitation training during the recovery period. This led to delays in the optimal treatment time, which greatly affected functional recovery. In this study, 160 patients with acute stroke and hemiplegia admitted to our department were randomly divided into exercise and control groups, with 80 cases in each group.[2] The exercise group started rehabilitation training at the very early stage of onset, and the recovery of limb motor function and daily living ability achieved satisfactory results after four weeks.

METHODS

General information

We selected 160 patients with acute stroke hemiplegia admitted to our hospital from January 2019 to December 2020. We randomly divided them into an exercise group of 80 cases and a control group of 80 cases.[3] Both groups of patients had their first onset, were diagnosed by imaging examinations, and had limb dysfunction. Before the onset, no other diseases caused disability, no severe aphasia and cognitive impairment, and serious organ diseases.

Evaluation criteria

We use Fugl-Meyer Assessment Method (FMA) to evaluate the improvement of limb function. The maximum score is 100 points, 66 points for upper limbs, and 34 points for lower limbs. The higher the score, the better the exercise function. We use the Barthel index score to assess the ability of daily living (ADL). The content includes ten items, and eight items are self-care activities (grooming, bathing, eating, toileting, dressing, urination control, bed, and chair transfer), two items are behavior-related activities (walking, going up, and downstairs). The total score is 100 points.[4] The higher the score, the better the independence and the smaller the dependence. BADL with a score of 60 or more is self-care. Patients in both groups were treated for four weeks after their condition was stable for 48 hours. We score according to the above two scoring standards.

Treatment methods

Both the exercise group and the control group were treated with conventional neurology drugs in the acute phase. Among them, the exercise group started one-to-one rehabilitation training 48-72h after the onset of the disease. One time a day, 30-45min each time, 4-6 times a week. At the same time, explain to patients and their families the importance of rehabilitation and actively cooperate with rehabilitation. In this way, the concept of rehabilitation runs through the 24h daily management and rehabilitation lifestyle. [5] The training method is based on the basic theory of exercise therapy for stroke hemiplegia. We formulate different treatment plans based on the initial evaluation of each patient. Specifically, it mainly includes: (1) Maintaining each joint's normal range of motion to avoid the limitation of joint motion caused by joint braking, adopting a passive motion of the whole joint, and assisting active motion. Joint movement is mostly in the contralateral or prone position. It usually starts from the proximal joint in sequence. (2) Good limb placement is used in anti-spasm mode. (3) Promote the recovery of the motor function of the affected limb through techniques such as functional electrical stimulation and acupuncture. (4) Trunk muscle training: a. Upper trunk flexion and rotation training. The patient lies on the contralateral side, and the therapist stands on the affected side. The therapist puts one hand on the affected side of the thorax and the other on the affected side of the scapula and induces flexion and rotation of the upper trunk. b. Lower trunk flexion and rotation training. The patient is lying on the contralateral side. The therapist stands on the affected side. The hand or forearm is placed on the affected pelvis to induce flexion and rotation of the lower trunk. c. Exercise recovery in bed. Turnover, sit up, transfer, pelvic 6-position training, etc. (5) Seat balance training: a. The patient takes a seat and shifts the center of gravity to the affected and healthy sides. b. Cross the legs with the diseased leg up and shift the center of gravity to the healthy side. (6) Standing balance training: a. Standing pelvic tilting forward and backward training. b. Support the sick leg, and perform abduction training with the healthy leg adducted. c. Support the sick leg and step on the steps for a healthy leg. (7) Preparation training before walking: a. The support phase stimulates the hip extensors; b. The swing phase stimulates the hip flexors. (8) Walking training: a. Promote hip joint extension and center of gravity shift. b. Instruct the torso to rotate and promote walking. c. Knee joint control training. d. Walk sideways, walk backward, and train up and downstairs. (9) ADL training.

Establishment of stroke model

The stroke model constructs the energy function of each pixel in the image. The algorithm uses the minimization of the energy function to achieve the optimal segmentation.[6] The target area segmentation can be achieved by minimizing the target function. The objective function is:

$$\begin{cases} \Psi(\varphi,u_1,u_2,\sigma_1^2,\sigma_2^2)=[E^{lf}(\varphi,u_1,u_2,\sigma_1^2,\sigma_2^2)+\upsilon L(\varphi)+\mu R(\varphi)] \\ E^{lf}-\int_{\Omega}E_x^{lf}dx=\int_{\Omega}\left\{\left[\sum_{i=1}^{N}\int_{\Omega_i}-\omega(x-y)\log p_{i,x}I(y)\right]dy\right\}dx \\ L(\varphi)=\int_{\Omega}|\nabla H(\varphi)|\,dx \\ R(\varphi)=\int_{\Omega}\frac{1}{2}(|\nabla\varphi|-1)^2dx \end{cases} \quad (1)$$

$x\in\Omega$ is the pixel of the image. y is the pixel information in its neighborhood O_x. E^{lf} is the applicable energy term of the global Gaussian distribution. E_x^{lf} is the fitting energy of the local Gaussian distribution. φ is the level set function. u_i, σ_i is the mean and standard deviation of the local grayscale, respectively. $R(\varphi)$ is a regularization term used to penalize the deviation between the level set function and the direction distance function. $L(\varphi)$ is used to punish the curve length.[7] $u.\upsilon$ is a weighting constant. ∇ is the gradient operator. $\omega(\cdot)$ is the Gaussian truncation function, as shown in equation (2).

$$\omega(d)=\begin{cases}\frac{1}{a}\exp\left(-\frac{d^2}{2\sigma^2}\right) & |d|\le r \\ 0 & |d|>r\end{cases} \quad (2)$$

r is the neighborhood radius of the pixel. The value of a must satisfy $\int_{\Omega}\omega(e)d_e=1$. In practical applications, we usually use the smoothing function H_ε instead of the heaviside function:

$$H_\varepsilon(x)=\frac{1}{2}\left[1+\frac{1}{\pi}\arctan\left(\frac{x}{\varepsilon}\right)\right] \quad (3)$$

Statistical processing

Data are all processed by the SPSS11.5 statistical software package. All measurement data are represented by $\bar{x}\pm s$. The t-test was used for comparison between groups. X^2 is used for counting data. The inspection level is α=0.05.

RESULTS

There was no statistically significant difference in the treatment of stroke patients between the two groups. X^2 =2.7778, P=2.4198. The difference between cerebral infarction and cerebral hemorrhage was statistically significant (Table 1). X^2 =11.5783, P=0.0007.

There was statistical significance in the final stage, t=21.4659, P=0.0000. There was no significant difference in Barthel index score compared with the initial stage. t=1.8914, P=0.0604. The end-stage difference was statistically significant.[8] t=29.9816, P=0.0000 (Table 2).

DISCUSSION

Drug therapy is the first choice for the treatment of acute stroke. To maximize the functional recovery of stroke patients with hemiplegia, we must carry out rehabilitation training as soon as possible. The theory of stroke rehabilitation medicine believes that early scientific and reasonable rehabilitation treatment can improve the plasticity of the central nervous system, which can better tap the potential of damage repair and promote the regeneration of terminal protrusions.[9] Studies have shown that in early peripheral stimulation, restorative synapses are more obvious than reactive synaptic hyperplasia. It can restore function to the greatest extent and reduce the disability rate.

Table 1. Comparison of the treatment status of the two groups of patients.

Group	n	Gender		Paralyzed limbs		Lesions	
		Male	Female	Left	Right	Cerebral infarction	Cerebral hemorrhage
Exercise group	80	58	22	47	33	54	26
Control group	80	60	20	4+	34	55	25
x2 value		16.1059		2.7778		11.5783	
P value		0.0001		2.4198		0.0007	

Table 2. Comparison of FugL-Meyer and Barthel scores between the two groups.

Group		Rehabilitation group	Control group	t	P
n		82	82		
Age		61.89±2.56	62.04±3.12	0.3366	0.7369
FugL-Meyer score	Early	20.96±6.94	22.72±5.02	1.8607	0.0646
	Terminal	71.88±9.63	43.32±7.24	21.4659	0
Barthel Index score	Early	13.61±5.27	15.34±6.39	1.8914	0.0604
	Terminal	73.92±5.41	43.65±7.37	29.9816	0

Early rehabilitation training is convenient to mobilize the residual cells in the patient's brain tissue to play a compensatory role and promote the remodeling of the injured area and the regeneration of cells. This can effectively prevent brain nerve atrophy so that the patient's various functions can be restored and improved as soon as possible. At the same time, physical activity promotes the increase of cerebral blood flow in the corresponding cortex of the patient and can also greatly reduce muscle atrophy.[10] This can increase the range of motion of the joint and prevent the occurrence of atrophic deformities. Any medicine cannot replace this. The main purpose of stroke rehabilitation is to prevent and correct various dysfunctions, improve and strengthen body control functions, and improve and enhance daily living ability. Some data show that 60% of stroke patients can take care of themselves in their daily activities after regular systemic rehabilitation, 20% need help in complex activities, 15% need more help, and 5% need help completely. The main principle of rehabilitation medicine is to focus on the education and training of patients based on general and special therapies, to minimize brain dysfunction as much as possible. Stroke rehabilitation medicine includes rehabilitation of motor function, language function rehabilitation, intellectual and mental symptoms, and cognitive and sensory disorders.

Some scholars believe that only after stroke hemiplegia patients enter the recovery period can they undergo rehabilitation training to avoid the aggravation of the disease. But the author believes that through ultra-early rehabilitation training, the body is induced to reorganize brain cells around the lesion. Through learning-acquisition-re-learning, alternate training can achieve the purpose of a fixed training model. In this way, the plasticity of brain cells can be maximized to promote the recovery of limb function.[11] According to the evaluation results of each patient, the author conducts targeted rehabilitation therapy on the exercise group. The results showed that the exercise group's Fugl-Meyer score and Barthel index scores were significantly higher than those of the control group.

CONCLUSION

Super-early (48-72h after onset) scientific and reasonable rehabilitation treatment can promote the functional recovery of stroke patients with hemiplegia. This method can help patients improve their daily living ability and return them to family and society as soon as possible.

The author declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: The author made significant contributions to this manuscript. Jia Xu: writing and performing surgeries; data analysis and performing surgeries; article review and intellectual concept of the article

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