Evaluation of a Home-Based Physical Therapy Program in Ischemic Stroke Patients

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Abstract

*Introduction.*The rehabilitation therapy should begin in the acute-care hospital as soon as possible after the stroke and continued after discharging patients from the hospital to their home environment. The purpose of this study was to evaluate the efficiency of a home-based physical therapy program in the improvement of motor function, balance and activities of daily living. *Material and methods.* Fourteen ischemic first stroke patients (8 women and 6 men), aged from 49 to 84 (mean 69) were recruited from the Neurology Department of the Emergency County Hospital Timişoara. After hospital discharge, they were assigned to a 12-week home physical therapy program in order to improve motor function, balance and activities of daily living (ADL). All patients were assessed before and after the training program with the following tests: (1) Barthel index; (2) Berg Balance Scale; (3) Motricity index; (4) Functional Independence Measure. *Results.* After 12 weeks of physical therapy, the motricity index showed a significant improvement in the study group which means a better motor outcome ($p= 0,08$). The mean score of the Barthel index was significantly increased ($p=0.02$), showing improvement in ADL ability. There was a benefit in reducing disability suggesting a better functional capacity and a higher level of independence ($p= 0.03$). Finally, our results showed that hemiplegic patients presented a better balance function after completing the rehabilitation program ($p= 0,05$).
*Conclusions.*The intervention of a 12-week home physical therapy program in stroke survivors provided significantly better outcomes in motor function, balance function and activities of daily living.

Key words: home physical therapy program, stroke, motor function, balance, activities of daily living

Rezumat

Introducere. Recuperarea neurologică trebuie începută în spital, încă din faza acută, cât mai curând posibil după accidentul vascular cerebral şi continuată după externarea pacientului la domiciliu acestuia. Scopul acestei lucrări este de a evalua eficienţa unui program de recuperare neurologică la domiciliu în ameliorarea funcţiei motorii, echilibrului şi activităţilor zilnice (ADL). *Material şi metode.* Am luat în studiu 14 pacienţi cu un prim AVC ischemic (8 femei şi 6 bărbaţi) cu vârste cuprinse între 49 şi 84 de ani (media 69 de ani) internaţi pe secţia de neurologie a Spitalului Clinic Judeţean de Urgenţă Timişoara. După externarea din spital, pacienţii au fost supuşi unui program de recuperare neurologică la domiciliu timp de 12 săptămâni urmărindu-se îmbunătăţirea funcţiei motorii, echilibrului şi a executării activităţilor zilnice (ADL). Toţi pacienţii au fost evaluaţi înainte şi după aplicarea acestui program cu ajutorul următoarelor teste: (1) indicele Barthel; (2) scala echilibrului Berg; (3)

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indicele motor; (4) indicele de independenţă funcţională. *Rezultate.* În urma celor 12 săptămâni de terapie fizicală, pacienţii luaţi în studiu au înregistrat o îmbunătăţire semnificativă a indicelui motor ceea ce semnifică ameliorarea funcţiei motorii (p = 0,08).Valoarea medie a indicelui Barthel a crescut semnificativ (p = 0,02), pacienţii fiind mai abili în realizarea ADL-urilor. S-a obţinut reducerea disabilităţii, îmbunătăţirea capacităţii funcţionale şi creşterea nivelului de independenţă (p = 0,03). De asemenea, pacienţii hemiplegici luaţi în studiu au prezentat un echilibru mai bun după finalizarea programului de recuperare (p= 0,05). *Concluzii.* Aplicarea unui program de recuperare neurologică la domiciliu timp de 12 săptămâni pacienţilor post-AVC determină rezultate semnificativ mai bune in imbunatatirea functiei motorii, echilibrului şi activităţilor zilnice (ADL).

Cuvinte cheie: *program de recuperare la domiciliu, accident vascular cerebral, funcţie motorie, echilibru, activităţi ale vieţii zilnice.*

Introduction

The cerebrovascular accident (CVA) or stroke represents nowadays the third cause of death after cardiac disease and cancer. It is the main cause of neurological disability, especially among the elderly patients.

Stroke incidence remains high in most industrialized countries, increases with age and is more common in males than in females (incidence ratio 1.3/1).

In our days, Romania has an estimated 800.000 patients suffering from cerebrovascular diseases. Moreover, the frequency of occurrence of new cases has increased to 240 cases/year/100.000 inhabitants.

The expansion of cerebrovascular disease morbidity to younger than 40 years old is the most worrying phenomenon today. One can notice a real "mutation" concerning the onset age of an ischemic stroke. [1, 2]

According to several studies, the rehabilitation program must obligatory be included in the management program of any stroke patient, it must be started early and continued daily with follow-ups at variable periods from months to years (3, 4).

The stroke recovery is influenced by patient's age, cause, size of injury, location of lesion and the extent of damage. Another important factor is the establishment of a rehabilitation program as early as possible. [5-7]

Most return of function is seen in the first 6 months of rehabilitation treatment. After this period there is a little chance of further improvement. However, patients have been known to continue to improve for years, regaining and strengthening their residual disabilities. Daily rehabilitation exercises should continue to be part of the stroke patient's routine. [8-10]

Ideally, the rehabilitation therapy should begin in the acute-care hospital after the stroke patient's condition is stable. During their hospitalization patients will benefit from a comprehensive rehabilitation program and should be able to return to their home environment following discharge.

More recently it has been noted that the length of stay in the neurorehabilitation unit decreases and the recovery is often incomplete at discharge. Once patients return home, the motor and functional performances they have gained in the hospital are not reinforced and most of stroke survivors did not receive any physical intervention or functional training.

The **purpose** of this study was to demonstrate the role of a home-based physical therapy program in the improvement of motor function, balance and activities of daily living.

Material and methods

Fourteen patients (8 women and 6 men), aged from 49 to 84 (mean 69), with a first acute ischemic stroke involving the middle cerebral artery (MCA) territory were recruited from the Neurology Department of the Emergency County Hospital Timisoara.

Patients included in this protocol fulfilled the following criteria: (1) computerized tomography (CT) or magnetic resonance imaging showing a single ischemic monohemispheric lesion; (2) first stroke due to MCA; (3) physiotherapeutic treatment performed daily during hospitalization; (4) age between 49 and 84 years. They were excluded if CT scan demonstrated primary cerebral hemorrhage or a lacunar infarct or if the patient was comatose, in terminal phase, or unable to understand simple orders.

All subjects received a complex recovery program during their stay in the neuro-rehabilitation unit. After hospital discharge, they were assigned to receive a 12-week home-based physical therapy program in order to improve motor function, balance and activities of daily living (ADL). The program included 2 visits a week for 8 weeks, and the patients were instructed to continue the exercise program on their own for another 4 additional weeks.

The objectives of the rehabilitation program were individualized based on: age, type of stroke, associated diseases, complications, degree of motor deficit and form.

The physical program, being preceded by a 10-min warm up session, was divided in 3 steps. First we recommended active and resistive exercises which had to occur in spiral-diagonal pattern and the difficulty was adapted to each patient. Afterwards, depending on patient's functional capacity, the resistance of exercises was increased progressively.

In the second step we encouraged the patients to perform balances exercises and the difficulty was increased either by changing the base support, balancing on a single leg or closing the eyes.

Finally, subjects were asked to perform routine tasks such as dressing, eating, ambulating, toileting and personal hygiene etc. Overall, each session lasted 80 minutes.

All patients were assessed before and after the training program with the following tests:

(1) Barthel index; (2) Berg Balance Scale; (3) Motricity index; (4) Functional Independence Measure.

Two evaluation of the muscle power in the affected upper limb were performed during the study using the "motricity index". [11] Power was assessed for pinch grip, elbow flexion and shoulder abduction while patient was sitting. This provided a weighted score ranging from 0 (no muscle power) to 100 (normal muscle power).

The Berg Balance scale comprises a set of 14 simple balance related tasks, ranging from standing up from a sitting position, to standing on one foot. The degree of success in achieving each task is given a score of zero (unable) to four (independent) and the final measure is the sum of all the scores. The maximum score on the Berg Balance Scale is 56 points.

Barthel Index (BI) was used to determine the degree of disability. It assesses 10 different aspects of activities of daily living. Each of these items was graded on four levels (level 1, independent; level 2, independent with assistive device; level 3, requires assistance from another person; and level 4, completely dependent on another person). Points are awarded for different levels of achievement in each category and can be added together to provide a total score ranging from 0 to 100.

Functional Independence Measure (FIM) was used to assess patient's dependence, whether or not they

require assistance. This scale includes 18 items, of which 13 items are physical domains based on the Barthel index and 5 items are cognition items. Each item is scored from 1 to 7 based on the level of independence,where 1 represents total dependence and 7 indicates complete independence.

The statistical analysis was performed by using Microsoft Office Excel 2007. The independent *t* test (two-tailed) was used to compare two means and in particular when those means come from different groups of subjects. Student's *t* test for paired data (two-tailed) was used for the comparison of the mean values in each group of patients. A *p* value less than 0.05 was considered statistical significant.

Results

Data of subjects included in this study are shown in Table I.

In our study the patient's age ranged from 49 to 84 (mean 69) and 57% were women. We observed a

predominance of stroke in people aged over 65 years. As mentioned before the incidence of stroke increases with age and therefore it is considered a negative prognostic factor in stroke rehabilitation. Five patients had a left-sided lesion and nine a right-sided injury.

The site of the lesion was corticosubcortical in 6 cases, capsular in 5 cases and global in 3 cases.

The most common clinical manifestations were dysarthria (26%), left (29%) or right (16%) hemiplegia, hemineglect (16%), aphasia (7%) and ataxia (6%).

All patients received a 12-week home-based physical therapy program. The program was divided in 3 steps and we followed the improvement of motor function, balance and activities of daily living (ADL). Evaluations were performed before the physical therapy intervention and after 12 weeks of therapy.

Table I. Clinical and radiological characteristics of 14 stroke patients (L= left, R = right, MCA= middle cerebral artery

Patient	Age	Sex	Side	Topography of lesion	Clinical picture
A.R	79	F	L	L capsular	Dysarthria,R hemiplegia
H.F	80	F	R	R corticosubcortical frontal	Dysarthria,L hemiplegia, L hemineglect
M.C	74	M	R	R corticosubcortical parietal	L hemiplegia, L hemineglect, ataxia
D. W.	72	M	L	L corticosubcortical fronto-parietal	R hemiparesis,aphasia
C.X.	60	M	R	R MCA global	L hemiplegia, L hemineglect, aphasia
S.A	57	F	L	L MCA global	Dysarthria,R hemiplegia
R.C	66	M	L	L global	R hemiplegia
G.G	77	M	L	R corticosubcortical parietal	Dysarthria,R hemiplegia,ataxia
G.M	57	F	R	R capsular	Dysarthria,L hemiplegia
M.N	49	F	R	R capsular	Dysarthria, L hemiplegia
D.L	63	F	R	R capsular	L hemiplegia
G.I	84	F	R	R corticosubcortical parietal	L hemiplegia, L hemineglect, dysarthria
B.S	69	M	R	R capsular	L hemiplegia
J.M	80	F	R	R corticosubcortical parietal	L hemiplegia, dysarthria, L hemineglect

Table II. Evaluations of motor function, balance and activities of daily living

| Parameters	Baseline*	12 weeks follow-up	p value
Motricity index	42.40±34.8	60.1±32.4	0,08
Barthel index	42±34.65	51±37.25	0.02
FIM	63.4±33.75	73.8±39	0.03
Berg Balance	28.3±18	44.5±17	0.05

*Data are presented as the mean±S.D. (FIM= Functional Independence Measure)

At the end of the observed period we noticed that all patients registered better stroke outcomes (*p*<0.05) (Table II).

After 12 weeks of physical therapy, the "motricity index" showed a significant improvement in the study group which means a better motor outcome (p= 0,08) (Fig. 1). The mean score of the BI was significantly increased (p=0.02), showing improvement in ADL skill level (Fig. 3). There was a benefit in reducing disability suggesting a better functional capacity and a higher level of independence (p= 0.03) (Fig. 4).
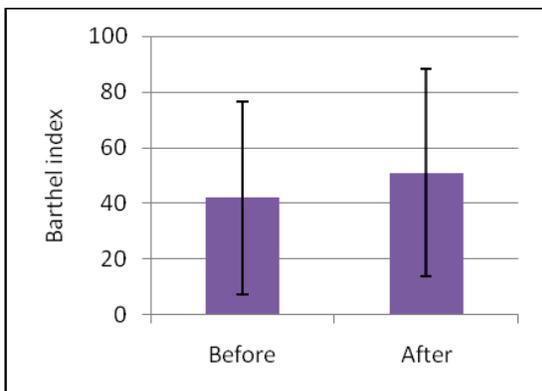
Moreover, our results showed that balance training was effective in the hemiplegic patients after completing the rehabilitation program (p=0,05) (Fig. 2). We did not notice any limitation in the capacity to shift weight and to load the hemiplegic leg during walking.
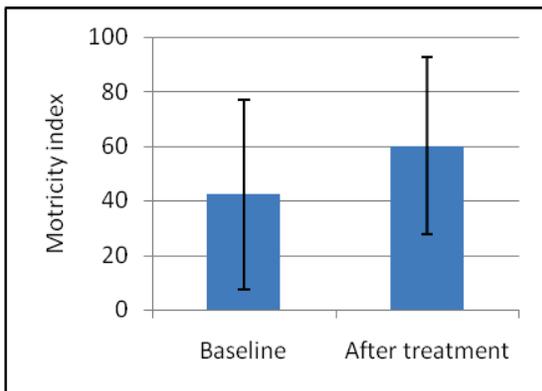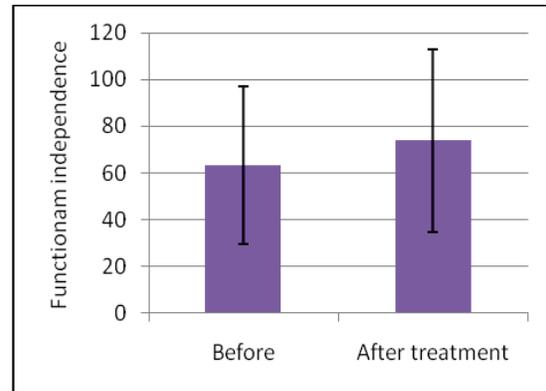

Figure 1. Evaluation of motricity index
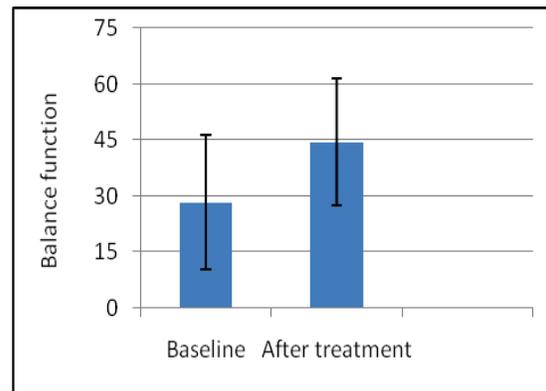
Figure3. Evaluation of Barthel index

Figure 2. Evaluation of balance function

Figure 4. Evaluation of Functional independence

Discussions

In recent years, home rehabilitation in stroke patients has been increasingly used in order to improve the ability to perform activities of daily living and to prevent the loss of motor and functional performance gained as an in-hospital patient. It has been suggested that patients are more motivated to be independent in their own home environment. The goal for the hemiplegic patient is the ability to perform functional activities such as walking and self-care.

Our study provides important information about the effectiveness of an early home rehabilitation intervention in a homogenous group of first stroke patients. Similar to other studies, our patients obtained better outcomes in motor function, balance and activities of daily living. [12, 13]

After completing the physical therapy program, all patients were able to perform routine tasks and to be more autonomy in the context of their own living environment. Motor performance, transfer time, static and dynamic balance were improved. The same result was obtained in a recent investigation of a 12-week, twice-per-week, progressive resistance-training program on muscle strength, gait, and balance in stroke subjects. [14]

Our study has some limitations. The number of patients was limited, caused by very strict inclusion criteria. Therefore, a larger study group is needed to confirm the benefit of this method.

Also, we didn't realize a follow-up study at 6 months after this therapy program since a later evaluation could give us a view of improvement witch can continue for up 6 months and sometimes for up to 1 year.

It would be interesting to study which factors influence motor or functional recovery in ischemic stroke patients. Thus, we didn't evaluate the influence of hemispheric lateralization or the type of lesion among patients enrolled in our study. Previous studies demonstrated that subjects with embolic stroke presented a better recovery of the affected arm than patients with thrombotic stroke. [15, 16] In addition, the localization of stroke is one of the best predictor for stroke rehabilitation. [17] However, the most important predictive factor for limb recovery is the early rehabilitation intervention after the onset of stroke. Several authors demonstrated the role of delay of therapy on rehabilitation outcomes. They demonstrated that there is time-dependent rehabilitation-induced map reorganization after stroke, with the remaining preserved cortical areas being most responsive to rehabilitation training in the early phase of stroke recovery. [18]

Conclusion

The intervention of a 12-week home-based physical therapy program in stroke survivors provided significantly better outcomes in improving motor function, reducing disability and increasing balance function.

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