

Abstract

O. I. Kolenko,

¹⁾I. O. Chemerys,

I. V. Chernetskyi,

*Sumy State University, 2, Rymko-
ho-Korsakova str., Sumy, Ukraine,
40007;*

¹⁾*Communal Institution of Sumy
City Council "City Clinical Hospi-
tal No.4", 3, Pratsi str., Sumy,
Ukraine, 40000*

EFFECTIVENESS OF EARLY REHABILITATION
IN PATIENTS WITH ACUTE ISCHEMIC STROKE
IN NEUROLOGY UNIT

Introduction. The theoretical grounding and solution of the scientific problem, which consist in the study of factors that contribute to the improvement of patients with ischemic brain stroke rehabilitation, are presented in this paper; it is a study of modern methods of rehabilitation and their effectiveness. The objective of the study was to find out reasons why the conducted research shows the significant importance of the use of kinesitherapy, transcutaneous electrical nerve stimulation, and psychotherapy in the system of early rehabilitation of patients.

Based on the study, we established that lateralization of brain lesions is an important factor that affects the rehabilitation potential of patients.

The signs of motor impairment and cognitive deterioration in patients with ischemic stroke requires the development of individual and intensive rehabilitation measures in order to restore brain function, and adequate treatment of all possible manifestations that impair the effectiveness of rehabilitation and the quality of patients' life after ischemic stroke. In addition, our task was to study the incidence of post-stroke depressive disorders and their relationship with psychosocial factors.

Material and methods. The empirical part was performed by collecting information about 60 patients who were treated and had initial rehabilitation in the early recovery period in the stroke unit. Patients were divided into 2 groups according to the timing of recovery to assess the likelihood of post-stroke depression and recovery against time. The analysis of data obtained after processing of materials was carried out using Microsoft Excel'16 program. Statistical processing of the results was carried out by the method of variational statistics using the Student's test. The data were collected from patients with cerebral circulation disorders of Communal Institution in neurology unit of Sumy City Council "City Clinical Hospital No.4".

Study results: It was established that gender is not a determining factor in the recovery of patients after ischemic stroke and does not significantly impact the rehabilitation prognosis. The most effective factors in recovering lost functions and skills after an ischemic stroke were complexity, phasing, and early start of rehabilitation measures.

Post-stroke depression is a common consequence of ischemic stroke

and 54 (90 %) patients ($p < 0.05$) have it. The characteristic feature of depression in post-stroke patients was the persistence of symptoms, mild and moderate degree of severity, criticism of their condition, etc. Depressive disorders were complex, polymorphic, and included signs of both organic depression and personal response to the development of a brain damage. The relationship of depression with the severity of neurological deficits, localization of the focus, as well as with psychosocial factors such as lonely living, loss of work, high social and professional status were shown. Further study of cognitive impairment and the role of specialists in solving the problem of their correction are required. Thus, a complete clinical-neurological and rehabilitation characteristic of patients with different baseline data and conditions is given, based on the results of our own research.

Keywords: stroke, ischemic stroke, rehabilitation, depression, transcutaneous electrical nerve stimulation, TENS.

Corresponding author: o.kolenko@med.sumdu.edu.ua

Резюме

О. І. Коленко,

¹⁾І. О. Чемерис,

І. В. Чернецький,

Сумський державний університет, вул. Римського-Корсакова, 2, Суми, Україна, 40007;

¹⁾КНП «Клінічна лікарня №4», Сумської міської ради, вул. Праці, 3, Суми, 40000

ЕФЕКТИВНІСТЬ РАННЬОЇ РЕАБІЛІТАЦІЇ У ХВОРИХ З ГОСТРИМ ІШЕМІЧНИМ ІНСУЛЬТОМ В УМОВАХ НЕВРОЛОГІЧНОГО ВІДДІЛЕННЯ

Вступ. Наявність ознак рухових та когнітивних порушень у пацієнтів з ішемічним інсультом (ІІ) вимагає розробки програми індивідуальних та інтенсивних реабілітаційних заходів з метою відновлення функцій мозку, та адекватного лікування всіх можливих проявів, які погіршують відновлення. Встановлено, що стать не є визначальним фактором відновлення хворих після ішемічного інсульту і суттєво не впливає на прогноз реабілітації. Комплексність, етапність, ранній початок реабілітаційних заходів – найбільш ефективний фактор відновлення втрачених функцій та навичок після ІІ.

Мета роботи. Надати теоретичне обґрунтування та розв'язання наукової задачі, яка полягає у вивченні факторів, що сприяють покращенню реабілітації хворих з ІІ; вивчити сучасні методи відновлення функцій та їх ефективність. Проведене дослідження показує суттєву значимість застосування кінезітерапії, черезшкірної електростимуляції (ЧЕНС) та психотерапії у системі ранньої реабілітації хворих.

Матеріали та методи. Було обстежено 60 хворих, які лікувалися та проходили початковий реабілітаційний курс у ранньому відновному періоді в умовах неврологічного відділення для хворих з порушеннями мозкового кровообігу КУ СМР «Міська клінічна лікарня №4». Пацієнти були розділені на 2 групи залежно від термінів відновлення з метою оцінки ймовірності розвитку післяінсультного депресивного стану та динаміки відновного лікування. Аналіз даних, отриманих після обстеження, проводився за допомогою програм "Microsoft Excel'16". Статистичну обробку результатів здійснювали методом варіативної статистики за критерієм Стьюдента.

Результати. На основі дослідження встановлено, що латералізація ураження при ішемічному інсульті являється важливим фактором, який впливає на реабілітаційний потенціал хворих. Депресія є частим наслідком ішемічного інсульту і через 6 місяців відмічається у 54 (90 %) хворих ($p < 0,05$). Її характерними рисами у постінсульт-

них хворих були стійкість симптомів, легкий та помірний їх ступінь, перевага соматовегетативної симптоматики, збереження критики до свого стану та інші. Депресивні розлади мали складний, поліморфний характер і включали ознаки як органічної депресії, так і особистісну реакцію на розвиток мозкової катастрофи.

Ключові слова: інсульт, реабілітація, депресія, черешкірна електронейростимуляція, ЧЕНС.

Автор, відповідальний за листування: o.kolenko@med.sumdu.edu.ua

Introduction

For over 15 years, staff and young scientists from the Department of Neurosurgery and Neurology have been studying the epidemiology of stroke in the region. In addition, the complex of studies must include monitoring the correctness of care for patients with cerebrovascular disease, the effectiveness of preventive measures, as well as the problem of reducing disablement and restoration of functions, which is not only a medical but also an economic problem.

Brain stroke usually leaves behind a specific neurological deficit. At this particular time, the question of correct, or rather, effective, organization of rehabilitation activities arises before the neurologists [1, 2, 5, 6]. We were confronted with a question to study and analyze the degree of functional failure after stroke, to evaluate the current system of rehabilitation methods that are currently available in the inpatient unit, to determine ways to improve this area of medical care. About 80 % of survivors of ischemic stroke (IS) become disabled, some of them require permanent care. The result is economic losses. By the end of the acute stroke period, hemiparesis was observed in 81.2 % of patients who survived, including hemiplegia – 11.2 %, severe and rough hemiparesis – 11.1 %, mild and moderate hemiparesis – 58.9 %. The indicators do not differ from data of other studies [3, 4, 7, 9].

In recent years, there has been evidence of impact of cognitive impairment on the effectiveness of rehabilitation in post-stroke patients. Depression is another factor that has a negative effect on the recovery process and increases the risk of mortality. Recently, this problem has become an issue in many countries around the world. However, the interval of time and the category of patients affected by cognitive disorders are not yet determined.

Increased number of strokes, insufficient study of the recovery capabilities, lack of a clear recovery program, absence of staff of rehabilitation therapist encourage a well-founded study of this

problem, because rehabilitation is most effective in the first weeks [8, 10].

Materials and methods of research

The current study was conducted in neurology unit for patients with cerebral circulation disorders of Communal Institution of Sumy City Council “City Clinical Hospital No. 4”. The diagnosis of cerebral ischemic stroke was based on American Stroke Association recommendations and defined as clinical evidence of cerebral, focal ischemic injury based on symptoms persisting > 24 hours and other etiologies excluded with mandatory neuroimaging verification. Patient status was assessed using the National Institutes of Health Stroke Scale (NIHSS) during hospitalization to determine the severity of the stroke, and the Barthel scale to determine the patient’s daily activity in the year since. The study of cognitive function was abandoned because of the inability to evaluate it adequately in patients with speech disorders. All patients underwent conventional basic therapy in accordance with current recommendations for the treatment of stroke against the background of monitoring critical indicators to vital functions, like respiratory rate and heart rate, body temperature, arterial pressure, electrocardiography. All patients were examined by a therapist, an ophthalmologist, and, if necessary, also a neurosurgeon, a cardiologist, a vascular surgeon. The obtained results were subjected to statistical processing with the calculation of arithmetic mean (M) and standard error of the mean (m). The significance of differences in the compared parameters was calculated using the Student’s rate. Differences were considered significant at $p < 0.05$. The calculation was made using Microsoft Excel’ 16.

Sixty patients who underwent an initial rehabilitation course in the early recovery period in the department were examined to resolve these tasks. Thirty-two of them were men and 28 were women. Patients were divided into 2 groups of 30 people each in our study. In the first group (A) active rehabilitation activities were carried out with some additional techniques at the request of

patients and relatives, including kinesitherapy (expanded complex of active gymnastics, breathing exercises and self-care training), transcutaneous electrical nerve stimulation (TENS), exercise therapy, massage. Patients who refused additional procedures or had contraindications were included in the second (B) group. They were conducted exercise therapy and massages. Working-age persons – 19, disabled – 41. The patients were divided into 2 groups of 30 people each. Among all men studied, 17 patients were 51 to 60 years old and 15 were older than 61 years. Women at the time of stroke predominated at the age of 60–70 years (16 people), 9 people at the age of 81 years and 3 women under 40 years.

Patients were also divided into groups for lateralization of lesions, lesions of the right hemisphere – 29 people (group R), left ones – 31 people (group L). An individual program was developed for each patient, according to his somatic condition, the severity of the IS, the degree of paresis, etc. All patients were examined by a staff speech therapist. Interviews with the purpose of psychological unloading of the patient and his relatives and educational work were conducted at the initiative of the researches.

Almost all patients were admitted to the neurology unit for patients with cerebrovascular diseases by ambulance crews, 68.9 % of them within 3-6 hours (within the «therapeutic window») from the moment of development of clinical manifestations of IS.

Research results

According to the NIHSS scale, the neurological deficit was moderate in both groups in most cases. For group A, the mean score was 24 ± 5.5 for group B it was 22 ± 5.3 . A mild degree of impairment was observed in 2 (3.3 %) patients (only group B). Severe neurological deficits were observed in 4 (6.6 %) cases in group B and in 3 (5 %) in group A. The most severe disorders were observed in 2 (3.3 %) patients, only in group A.

The proportion of the possible factors that caused the brain crash was: 26 % of patients with arterial hypertension, 12 % had arterial fibrillation, 15 % had diabetes mellitus, 3 % had mitral heart defects. Among other reasons, 18 % of patients (mostly men) had damage habits (alcohol, smoking), 16 % had psycho-emotional stress, 6 % had multifactorial causes, 4 % had no known cause.

The focus of the study was on evaluating the effectiveness of motor function recovery using a comprehensive approach. The Barthel index was determined among all patients, in group A it

corresponded to 87 ± 4.3 and in group B 75 ± 5.6 . In group A it was 16 ± 0.2 % higher than the control group. The obtained data indicate an unmistakable prediction ($p < 0.05$) that a comprehensive approach to rehabilitation with the use of TENS, psychotherapy, massage, exercise therapy positively effect on the recovery of motor function. The physiological order of recovery in all groups did not change. Initially, an arbitrary movement usually lost after acute brain ischemia, then hemiplegia becomes hemiparesis with a predominant distal limb disorder.

The process in the studied patients began with the leg, then the upper extremity of the hand joined, with the proximal extremities. A few days after the brain lesion, the muscle tone of the paralyzed limbs changed: there was an increase in flexor tone in the arm, and in the led the extensor leg.

Regarding the lateralization of the lesion, the values obtained after Barthel evaluation were: group R – 75 ± 5.6 , and group L – 86 ± 4.4 . This may be due to the fact that the right hemisphere is responsible for features such as spatial orientation, music perception and sensitivity, and the center that is responsible for speech is located in the right hemisphere of the brain only in left-handed. Indicators of patients with the left hemispheric localization of the ischemia are higher on 15 ± 0.6 %. The unmistakable prediction is also 95.5 % ($p < 0.05$) due to left hemisphere localization.

Assessment of patients on the Barthel scale, by gender, revealed the following result: men had 80 ± 5.1 points, women – 79 ± 5.2 . No significant difference between the indicators was obtained, so it can be argued that the patient's gender may not be a factor affecting the rehabilitation potential of patients with ischemic stroke.

Post-stroke depression refers to organic depression indicated by F 06.32 in International Classification of Diseases-10. To assess the severity, we chose the well-known Hospital Anxiety and Depression Scale (HADS), which has been used repeatedly in stroke patients and there is strong evidence of its sensitivity.

Signs of clinically defined depression syndrome, defined on the HADS scale, were found in 76.6 % of patients, in 1-3 months after stroke, and in 90 % of patients in 3-6 months according to follow-up observations. In 1-3 months after stroke, the overall HADS score was 7 ± 1.45 points, that is corresponding to mild depression and in 3-6 months it was 9 ± 1.45 points, that is corresponding to moderate depression ($p < 0.05$). As a rule, the symptoms of depression were persistent. The severity of depression in the vast majority of patients was mild and moderate.

The analysis of the development of the depression, depending on the localization and severity of stroke was held. We did not find a clear dependence on the development of depression on the localization of stroke. It could only be noted that more pronounced depression was observed in patients with right-sided localization of the IS. In accordance with the results in group A, the proportion of patients with a mild form of depression was 76.6 %. In group B, the rate was 86.7 %, but it was mild and moderate depression.

Unfortunately, to date, rehabilitation activities in municipal hospitals have been constructed in such a way that the greatest attention is paid to motor rehabilitation. This can be explained by the considerable social importance of immobility, which requires the involvement of outside assistance, causes the disability and financial costs of society.

Conclusions

1. In the course of the work, the current state of providing rehabilitation assistance to patients in the conditions of further industry reform was studied and analyzed. The conducted research shows the significant importance of the use of kinesitherapy, TENS and psychotherapy in the system of early rehabilitation of patients. The fact that lateralization of lesions in IS is an important factor influencing the rehabilitation potential is confirmed. The presence of signs of movement and cognitive impairment in patients with brain ischemia requires the development of a program of individual and intensive rehabilitation measures to restore brain function and adequate treatment of all possible manifestations that impair the effectiveness of rehabilitation measures and impair the quality of life of patients after stroke. The most effective factors in recovering of lost functions and skills after an IS are complexity, phasing, early start of the rehabilitation.

It is established that gender is not a determining factor in the recovery of patients after IS and does not significantly affect the prognosis of rehabilitation.

2. Thus, the conducted comprehensive

Nevertheless, equally important is psychological and speech rehabilitation, because speech is a no less important tool for the work of a particular category of patients, and psychological correction in the presence of defects contributes to reducing the percentage of post-stroke depressive states. Swallowing disorders are also within the competence of the speech therapist. Productive rehabilitation has not yet been established with this category of patients. The primary method of correction of post-stroke speech disorders is to renew speech, reading, and writing sessions with a speech therapist- aphasiologist or neuropsychologist conducted on the background of receiving nootropics. However, not always the staff of the department has specialists at the appropriate level. However, this is a reason for further in-depth research.

epidemiological, clinical and neurological, the statistical study made it possible to assess the epidemiological situation in Sumy region and in the Sumy city, study the most common risk factors, determine the rehabilitation potential of patients and indicate that early approach, consistency and individuality contribute to effective recovery after stroke. The obtained results allow developing and proposing measures to improve the rehabilitation program aimed at increasing the daily activity of the patient's life with stroke.

3. To increase the effectiveness of the rehabilitation period of patients with stroke and to improve the system of providing care assistance, the following measures should be followed: 1) to encourage patients to active rehabilitation activities and all necessary techniques to improve lost functions; 2) create conditions for the introduction of advances physical rehabilitation techniques, including the TENS and special exercises for the acquisition of self-care skills; 3) adhere to the principles of duration and complexity of rehabilitation; 4) actively involve patients' relatives, provide outreach and psychological support measures.

Prospects for future research

1. Define and expand the role of related specialists in the treatment of cognitive dysfunctions.
2. Particular attention should be given to the problem of speech rehabilitation and resumption of swallowing.
3. Expand the role of a speech therapist in the rehabilitation of verbal function.

Conflict of interest

The authors declare no conflict of interest.

Відомості про авторів

Коленко Оксана Іванівна, СумДУ, доцент кафедри нейрохірургії та неврології, e-mail: o.kolenko@med.sumdu.edu.ua, тел. +380954821636;

Чемерис Інна Олександрівна, лікар-невропатолог, магістр, КНП «Клінічна лікарня №4», Сумської міської ради, вул. Праці,3, Суми, 40000, e-mail: neiro@med.sumdu.edu.ua, тел. +380668536863;

Чернецький Ігор Володимирович, Сумський державний університет, студент, вул. Римського-Корсакова, 2, Суми, Україна, 40007, e-mail: neiro@med.sumdu.edu.ua, тел. +380542646444.

References

1. Bruni MF, Melegari C, De Cola MC, Bramanti A, Bramanti P, Calabrò RS. What does best evidence tell us about robotic gait rehabilitation in stroke patients: A systematic review and meta-analysis. *J Clin Neurosci.* 2018; Feb;48:11-17. doi: 10.1016/j.jocn.2017.10.048
2. Bindawas SM, Vennu V, Mawajdeh H, Alhaidary H. Functional outcomes by age after inpatient stroke rehabilitation in Saudi Arabia. *Clin Interv Aging.* 2017; Oct 24;12:1791-1797. doi: 10.2147/CIA.S145402
3. Maier M, Ballester BR, Verschure PFMJ. Principles of Neurorehabilitation After Stroke Based on Motor Learning and Brain Plasticity Mechanisms. *Front Syst Neurosci.* 2019; Dec 17;13:74. doi: 10.3389/fnsys.2019.00074
4. Mamin FA, Islam MS, Rumana FS, Faruqui F. Profile of stroke patients treated at a rehabilitation centre in Bangladesh. *BMC Res Notes.* 2017; Oct 27;10(1):520. doi: 10.1186/s13104-017-2844-x
5. Tararoschenko NV, Babkina NV, Aliynik DA, Kovalenko VM, Yangol VI. [Early rehabilitation of patients with stroke in neurological department]. *Ukrainian Neurological Journal.* 2015; 2: 77-81.
6. Vynchuk SM, Fartushna OYe. [Early rehabilitation after acute ischemic cerebrovascular events]. *International Neurological Journal.* 2016; 8(86): 34-39. doi: 10.22141/2224-0713.8.86.2016.90909
7. Wang XC, Liu T, Wang JH, Zhang JJ. Post-stroke hand spasm treated with penetrating acupuncture combined with kinesiotherapy: a randomized controlled trial. *Zhongguo Zhen Jiu.* 2020; Jan 12;40(1):21-5. doi: 10.13703/j.0255-2930.20190106-k0003
8. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, et al.; American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke.* 2016; Jun;47(6):e98-e169. doi: 10.1161/STR.0000000000000098
9. Zhang ZQ, Li KP, He J, Jiang LM, Wang W, Hu XS, Feng W. Acupuncture of fascia points to relieve hand spasm after stroke: a study protocol for a multicenter randomized controlled trial. *Trials.* 2020; Jan 10;21(1):69. doi: 10.1186/s13063-019-3999-7
10. Zirk M, Storm V. Subjective Stroke Impact and Depressive Symptoms: Indications for a Moderating Role of Health-Related Locus of Control. *Front Psychiatry.* 2019; Dec 19;10:918. doi: 10.3389/fpsy.2019.00918

(received 09.03.2020, published online 29.06.2020)

(одержано 09.03.2020, опубліковано 29.06.2020)