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Содержание

МЕДИЦИНА И ЗДРАВООХРАНЕНИЕ

СЕЛЬСКОЕ И ЛЕСНОЕ ХОЗЯЙСТВО

МЕДИЦИНА И ЗДРАВООХРАНЕНИЕ

NEUROREHABILITATION ALGORITHMS IN POST-STROKE PATIENTS WITH HEMIPARETIC SHOULDER

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НЕЙРОРЕАБИЛИТАЦИОННЫЕ АЛГОРИТМЫ ДЛЯ ИНСУЛЬТНЫХ ПАЦИЕНТОВ С ГЕМИПАРЕТИЧЕСКИМ ПЛЕЧОМ

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ABSTRACT

The goal was to evaluate the efficacy of neurorehabilitation (NR) in post-stroke patients with hemiparetic shoulder.

We observed a total of 118 post-stroke patients with humero-scapular subluxation.

Patients were controlled using a battery of tests and scales for motor deficiency, functional grasp, pain and goniometry of shoulder joint.

We effectuate clinical approbation of complex NR algorithms.

The comparative analysis of results shows significant reduction of pain, improvement of functional capacity (Brunnstrom, Barthel); increase of the range of motion of the humero-scapular joint (goniometry).

АННОТАЦИЯ

Цель настоящего сообщения: является оценка эффективности нейрореабилитации у пациентов после мозгового инсульта с гемипаретическим плечом.

Мы наблюдали 118 пост-инсультных пациентов с хумеро-скапулярной сублуксацией.

Пациенты были контролированы при помощи тестов и скал моторного дефицита, функционального хвата, боли и гониометрии плечевого сустава.

Мы осуществили клиническую апробацию комплексных нейро-реабилитационных алгоритмов.

Сравнительный анализ результатов указал значительную редукцию боли, улучшение функциональной производительности (Brunnstrom, Barthel); увеличение объёма движений гумероскапулярного сустава (гониометрия).

Keywords: Shoulder joint, hemiparetic shoulder, hemiparesis, neurological rehabilitation, cryotherapy, physiotherapy, magnetic field, interferential currents, electrostimulation

Ключевые слова: Плечевой сустав, инсульт, гемипарез, нейрологическая реабилитация, алгоритм, криотерапия, кинезитерапия, магнитное поле, интерферентные токи, электрическая стимуляция

INTRODUCTION

Persistent shoulder pain is a frequent phenomenon in stroke survivors with hemiparesis [4, 11, 12]. According some authors it occurs in 80-85 % of patients with spastic hemiplegia [1, 4, 8, 12].

A lot of etiologic factors are discussed, but without an established cause-and-effect relationship: gleno-humeral subluxation, contractures, complex regional pain syndrome (CRPS), rotator cuff injury, and spastic muscle imbalance of the shoulder [1, 5, 8, 9, 11,.12, 14].

Adequate shoulder function is a pre-requisite for functional recovery of the hand function (the grasp), and for autonomy in every-day life [1, 2].

Contemporaneous rehabilitation protocols for these patients are principally oriented to kinesiotherapy or physiotherapy [4, 5, 9, 10, 13]. But some Physical and Rehabilitation Medicine (PRM) schools (Bulgarian, Russian, etc.) traditionally apply a complex rehabilitation program with combination of different physical modalities, not only movement therapy [1, 2].

Reorganization of the human motor cortex can be induced by specific patterns of peripheral afferent stimulation [7]. The complex neurorehabilitation stimulates the neuroplasticity and the reorganization of the motor cortex, and enhances the functional recovery and the autonomy of patients with post-stroke hemiparesis [6].

GOAL

The objective of the current article is to evaluate qualitatively and quantitatively the efficiency of application of different PRM modalities and neurorehabilitation (NR) methods on independence in activities of daily living (ADL) in patients with post-stroke hemiparesis and hemiparetic shoulder; with estimation of the impact of different elements of the rehabilitation protocol: active kinesiotherapy (proprioceptive neuromuscular facilitation /PNF/ techniques. range of motion and strengthening exercises), cryotherapy (ice massage), occupational therapy, and pre-formed physical modalities (electrostimulations, phonophoresis, magnetic field).

DESIGN OF THE STUDY (MATERIAL AND METHIODS)

The current controlled prospective randomized investigation was carried out during the period 2004-2016 on a total of 118 post stroke inpatients with hemiparetic shoulder, divided into 6 groups, treated in Physical and Rehabilitation Medicine (PRM) departments & clinics in Sofia and Pleven:

All patients were transferred from a Clinic of Neurology, with a neurological examination and diagnostic. The clinical diagnosis of our patients was post stroke hemiparesis with humero-scapular subluxation, proved clinically and radiologically. Our intervention began during the first three months after the patient leaves from the Neurological Clinic / Department (1 to 3 months). The drug therapy wasn't changed minimum 3 weeks before and during the neurorehabilitation.

Patients were controlled before, during and at the end of the PRM course and one month after its end - using a battery of methods: tests and scales for motor deficiency, balance and coordination; tests of spasticity, functional grip of the upper limb, gait and independent motion; goniometry of shoulder joint; complex functional scales for autonomy and capacity for activities (self service, family life, social); scales for depression; evaluation of the intensity of pain /visual analogue scale VAS 0-20/; goniometrical testing of the range of motion of the humero-scapular joint.

We effectuate clinical approbation of complex NR algorithms. In each group we applied a different PRM programme, composed of synergic combination of natural and pre-formed physical modalities (of electrotherapy, cryotherapy, kinesitherapy, occupational therapy).

All patients received a complex PRM program consisting of approximately three weeks (20 days).

All patients were investigated according to an examination Protocol - before (B.Th.), during (Day 8 and Day 15) and after (A.Th.) therapy (Day 20), and one month after the end of the rehabilitation (1 month later).

Our investigation was conducted with consideration for the protection of the patient, as outlined in the Declaration of Helsinki, and was approved by the appropriate institutional review boards and ethic commissions. All patients gave written informed consent before undergoing any examination or study procedure.

The distribution of patients by group was casual (patient /p/ № 1 for group /gr/ № 1, p № 2 – for gr 2, p № 3 for gr 3, etc.).

All patients had spastic hemiparesis, consequence of a supra-tentorial cerebral stroke (54 of them with intracerebral hemorrhage, 64 – with cerebral infarctus); mean age of patients - 56 years (SD 16,8), in a period of 3 to 18 months after the stroke; evaluation of the motor functions – levels III and IV according the scale of Sarah Brunnstrom; evaluation of the functional capacity 15 / 20 points of the scale of Barthel; with clinically and radiologically proved diagnosis gleno-humeral subluxation of the paretic upper limb (right – in 69 patients and left – in 49 patients).

Functional assessment methods

The evaluation protocol consists of history of the disease and its complications, neuro-imagery and neuro-functional investigations, clinical patterns, and functional assessment – before, during and after the rehabilitation [1, 2, 3].

For the functional evaluation we used some typical tests and scales, e.g. evaluation of the central hemiparesis and of the spasticity (0-3); visual analogue scale of pain /VAS 0-20/; scales of Brunnstrom, Barthel, E. Michels; range of motion (ROM) of the shoulder joint (goniometry); evaluation of the functional grasp and of autonomy in daily activities; psychological battery.

Treatment methods

The rehabilitation program was focused on following tasks: functional recovery, restoration of the knee kinetic and kinematic; reduction of pain and oedema; gait training; prevention of complications due to reduced mobility (e.g. myo-hypotrophy).

Patients were randomized into six treatment groups (20 patients per group, exception - the first group with 18 patients).

The complex NR (20 days) includes: position treatment (slings); proprioceptive neuro-muscular facilitation (PNF) techniques, analytic exercises; soft tissue techniques (and massages); cryotherapy (ice-massage).

Patients of the first group (gr 1) received only this PRM treatment, in group 2 we applied too occupational therapy; and in groups 3-6 a preformed physical modality was added:

- gr 3 - low frequency low intensity magnetic field [204 Oe, 10 minutes, 15 procedures],
- gr 4 - interferential currents [first 3 procedures - 100 Hz, from the forth procedure - 90-100 Hz, 10 min., 15 procedures],
- gr 5 – ultra-phonophoresis with non-steroidal anti-inflammatory drug [0,4-0,8 W/cm2, 5-10 min., 10 procedures],
- gr 6 - electrostimulations of musculus deltoideus [low frequency electric currents, tetanic pulses, 10-15 min., 15 procedures].

Statistical methods

Statistical analysis was performed with SPSS electronic package, version 17. We applied options for two samples comparison with parametrical analysis of variances ANOVA and non-parametrical distribution and correlation analysis: t-test (t-criterium, p value), Signed test, Signed rank test, Kolmogorov – Smirnov test, Mann – Whitney (Wilcoxon) W test (W медиана).

The treatment difference was considered to be statistically significant if the p value was < 0.05. In some cases we received lower results of the p-value ($p<0.01$ and even $p<0.001$).

RESULTS AND ANALYSIS

The detailed qualitative and quantitative evaluation proved the efficacy of application of different PRM programmes – on different types and levels of motor and functional deficiency of patients with post-stroke hemiparesis and hemiparetic shoulder.

Concretely, the comparative analysis of results shows a significant reduction of pain, improvement of functional capacity (Brunnstrom, Barthel); increase of the range of motion of the humero-scapular joint (goniometry).

Pain relief

The comparative analysis of the results shows a significant improvement of the symptoms of the patients, concerning pain relief (visualized by the analysis of results of Visual analogue scale VAS 0-20, fig.1). The clinical investigation and pain evaluation

marks a reduction of pain in all patients, but the comparative analysis between treatment groups demonstrates an important statistical significance for groups 3 to 6 and specially for group 3 ($p<0.01$). We obtain visualization of the efficiency of magnetic field).

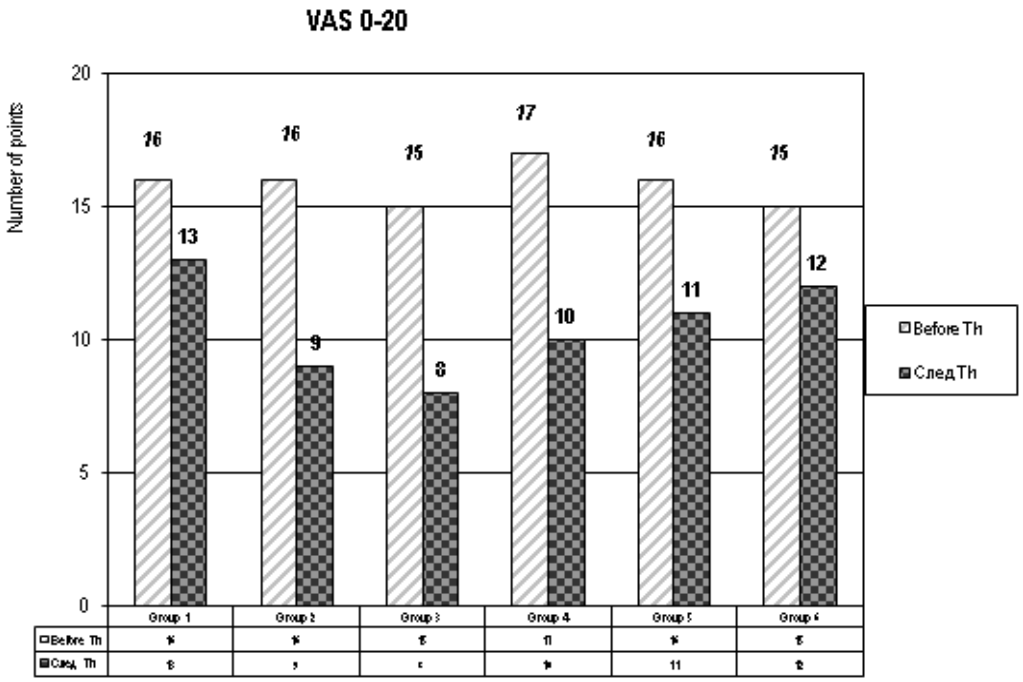

Fig.1. Efficacy on the pain (Visual Analogue Scale (0-20)

The median values for pain are: before NR - 15,83 (SD 0,75); after neurorehabilitation - 10,5 (SD 1,87).

Statistically significant pain reduction was observed in groups 2 – 6 (t-criterion 6,47; p=0,00007 so $p < 0.05$, even $p << 0.01$), the effectiveness is very important in the group 3 (low frequency magnetic field).

Goniometry of the gleno-humeral joint

Goniometric results for the shoulder movements are presented in figures 2, 3 and 4.

The goniometric evaluation demonstrates a significant increase of the range of motion in the hemiparetic shoulder ($p<0,05$), significant for the ante-flexion, the internal rotation and the abduction of the shoulder joint, most important concerning the abduction and the internal rotation, and specially in group 6 (electrostimulations). The increase of the internal rotation is most significant in group 6 (electro-stimulations), and in group 5 (ultra-sound)

During the analysis of differences in goniometric values of samples (comparison after NR versus before rehabilitation), we received a mean value (sample mean) = 54,33; sample median = 57,5.

During the analysis with the t-test we consider that in the case of the hypothesis Zero the mean value is = 0; in the opposite case (alternating hypothesis) – the mean value is not zero. During our analysis we received t=6,70, p=0,0011, and we reject the Zero hypothesis ($p<0,05$), respectively the level of significance is over 95 %.

The Zero hypothesis is rejected too in case of analysis with the Sign test p=0,041 ($p<0,05$).

If we apply the Signed rank test, we received p value = 0,0360 ($p<0,05$).

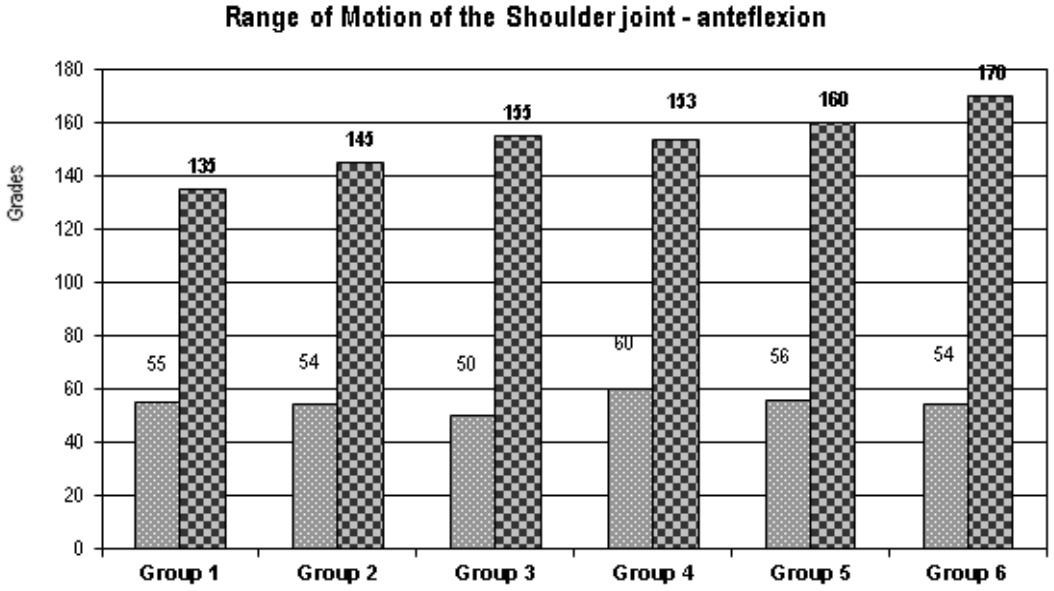

Fig. 2. Goniometry for the shoulder joint – anteflexion (before and after therapy – B.Th., A.Th.)

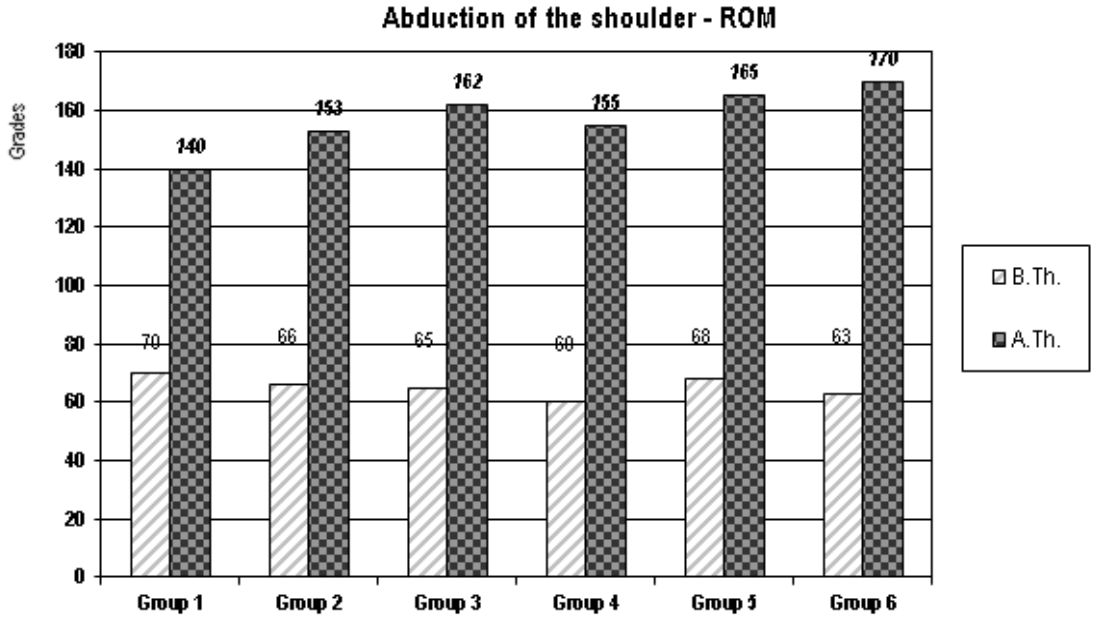

Fig. 3. Goniometry for the shoulder joint – abduction (before and after therapy – B.Th., A.Th.)

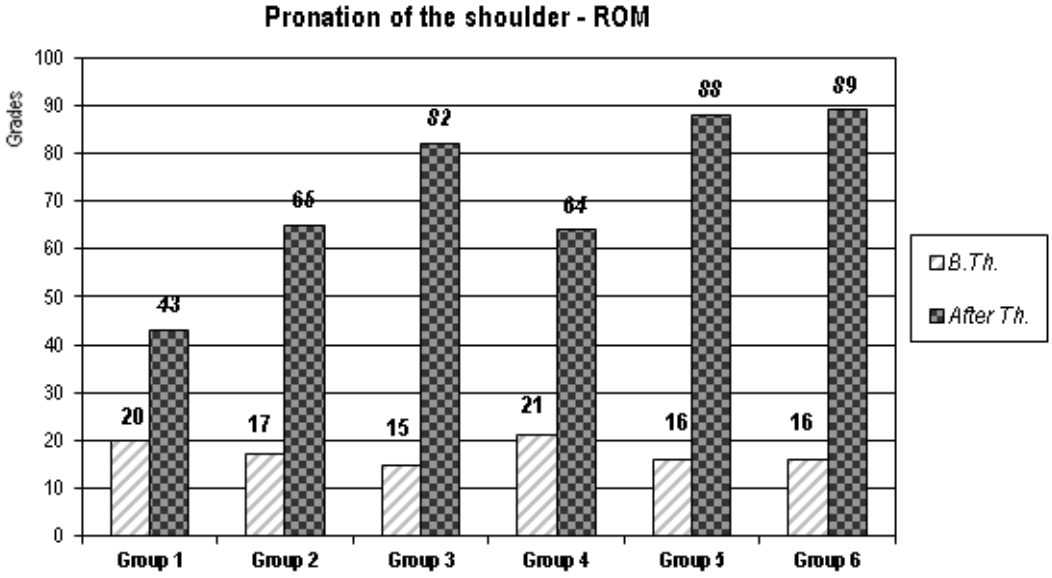

Fig. 4. Goniometry for the shoulder joint – pronation (before and after therapy – B.Th., A.Th.)

Functional evaluation (functional scales)

The Barthel index (fig.5) demonstrates favorable results (comparison after NR versus before NR).

Comparative evaluation by ANOVA Paired Test determines a mean value of the difference in the Barthel index after / before NR -54,33, standard deviation SD=19,85; t=-6,7; p=0.001, so we have statistical significance [p<0.01].

The application of the t-test shows a value of the t-criterion -9,8287, and a value of p=0,000185 – very important statistical significance [p<0.01].

The comparative analysis Paired Samples of the Signed Rank Test receives a coefficient Large Sample Test statistic = 2,10235 and p=0,035, so we have a statistical significance (rejection of the hypothesis Zero at p<0.05).

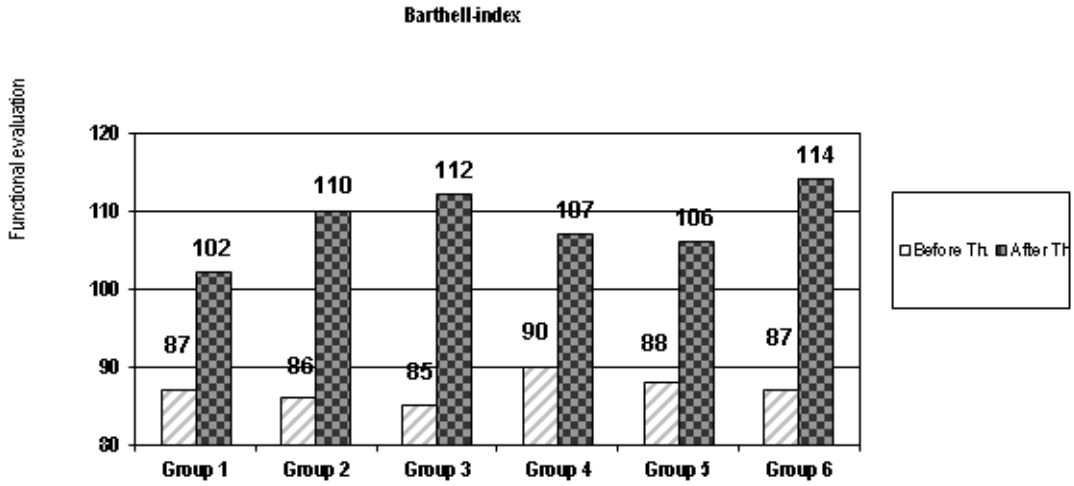

Fig. 5. Functional evaluation (Barthell-index)

During the analysis of the functional evaluation by the test of Brunnstrom (fig.6) we observed a dynamics in statistical Wilcoxon medians before / after neurorehabilitation. The curvature of distribution of patients (Gauss' bell) before NR is moved to the levels of mild alteration after NR.

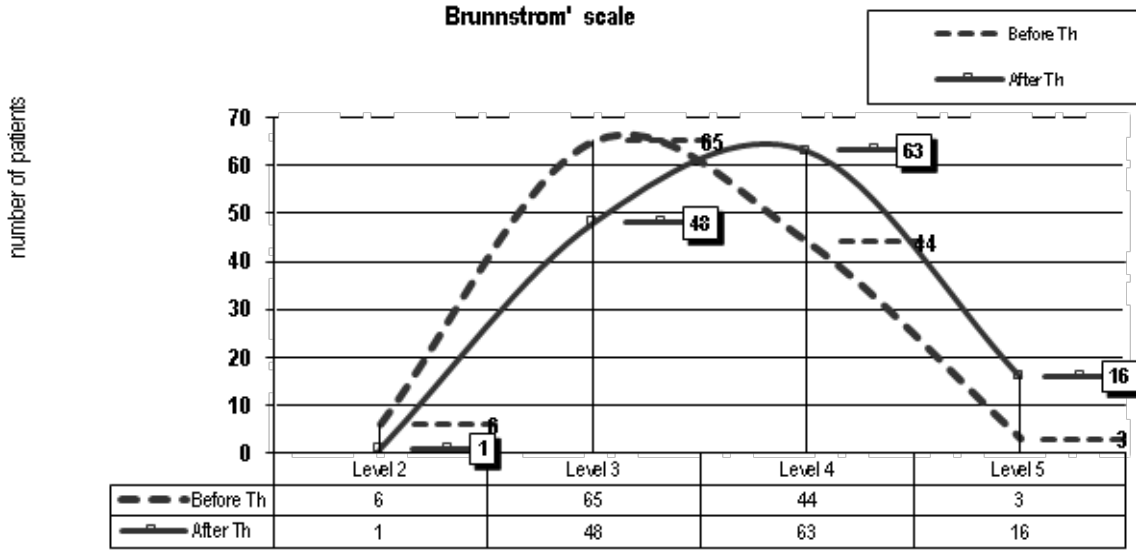

Fig.6. Functional evaluation (Brunnstrom-test)

DISCUSSION

The active kinesiotherapy is without discussion the most important element of the rehabilitation in the domain of neurology [1, 2, 4, 5]. We consider that in clinical practice it is important to add some other techniques – oriented to reduction of pain and spasticity (e.g. cryotherapy and pre-formed physical modalities), amelioration of range of motion of the shoulder joint, functional recovery and improvement of autonomy in activities of daily living (ADL).

We observed the significance of cryokinesitherapy and occupational therapy on the autonomy in ADL; the importance of electrostimulations on spasticity and on the range of motion of hemiparetic shoulder, the effect of magnetic field and lasertherapy on vegetotrophic disturbances in hemiparetic limbs, the role of interferential currents on the osteoporosis of caput humeri, the effect of ultrasound (phonophoresis with non-steroidal anti-inflammatory drug) on the humero-scapular periarthritis, etc [1, 2].

The favorable effect of kryokinesitherapy on the orthopedic dysfunction of humeral joint was discussed by several authors [4, 5, 6, 7, 10, 13]. Our investigation proved that the occupational therapy ameliorates the range of motion, and stimulates neuroplasticity and functional recovery of the paretic upper extremity.

We can formulate some recommendations and neurorehabilitation algorithms for these patients:

- In cases with intensive pain the low frequency low intensity magnetic field is indicated.
- In case of humero-scapular periarthritis – the ultrasound or ultraphonophoresis with a non-steroidal anti-inflammatory gel is favorable.
- In cases of throphic alterations (osteoporosis of caput humeri) – interferential currents are very helpful.
- Goniometrical indices (range of motion of the shoulder joint) are significantly increased by electrostimulations and occupational therapy.

The on-time neurorehabilitation prevents complications that occur often in hemiparetic patients with prolonged immobilization: muscle weakness, spasticity, tendency to develop muscular and joint contractures, pathological proprioceptive afferentation, pathological synergies, altered autonomy, and depression.

CONCLUSION

Our neurorehabilitation programmes influence the cause of the orthopedic dysfunction of the shoulder joint, and on its signs and symptoms, including joint dislocation, muscular hypotrophy, inflammatory response, local osteoporosis, pain, etc. By our opinion, the most important is the increase of the joint range of motion and the functional recovery of the patient with post stroke hemiparesis and hemiparetic shoulder.

We could recommend our complex neurorehabilitation algorithms. In conclusion, we must underline that the structured neurorehabilitation algorithms can be individualized in every case.

Our opinion is that the role of different elements of our complex neurorehabilitation programmes must be considered for the assurance of amelioration of the quality of care, and for improvement of everyday quality of life of patients with post stroke hemiparesis and hemiparetic shoulder.

СПИСОК ЛИТЕРАТУРОЙ / REFERENCES

1. Колева И. Комплексни неврорехабилитационни алгопитми за функционално възстановяване и подобряване самостоятелността в ежедневния живот при социално-значими инвалидизиращи неврологични заболявания. Автореферат на дисертационен труд, представен за присъждане на научна степен "Доктор на медицинските науки". Научна специалност „Физиотерапия и рехабилитация", Код 03.01.58. – София. ВАК, 2008. / Koleva IB. Complex neurorehabilitation algorithms for functional recovery and amelioration of independence in everyday life in socially important invalidating neurological diseases. Thesis for Doctor-es-Sciences in Physical & Rehabilitation Medicine, Sofia, High Attestation Commission, 2009. [In Bulgarian].

2. Колева И. Основи на физикалната медицина, физикалната терапия и рехабилитацията (вкл. ерготерапия и medical SPA). Второ допълнено и преработено издание. Том 1 и том 2. – София: СИМЕЛ, 2015, 659 с. / I. Koleva. Bases of Physical medicine, Physical therapy and Rehabilitation (incl. Ergotherapy and Medical SPA). Second Edition. Volumes 1 & 2. – Sofia: SIMEL, 2015, 659 p. [In Bulgarian]

3. Bethoux F, Calmels P. Guide de mesure et d'évaluation en médecine physique et de réadaptation. - Paris: Roche; 2003.

4. Forster A. painful hemiplegic shoulder: physiotherapy treatment. Rev Clin Gerontol, 1994, 4, 343-348.

5. Karaahmet OZ, Eksioglu E, Gurcay E et al. Hemiplegic shoulder pain: associated factors and rehabilitation outcomes of hemiplegic patients with and without shoulder pain. Top Stroke Rehabil, 21, 2014, 3, 237-245.

6. Koganemaru S, Mima T, Thabit MN et al. Recovery of upper-limb function due to enhanced use-dependent plasticity in chronic stroke patients. Brain, 133, 2010, 11, 3373-3384.

7. McDonnell MN, Hillier SL, Miles TS et al. Influence of Combined Afferent Stimulation and Task-Specific Training Following Stroke: A Pilot Randomized Controlled Trial. Neurorehabilitation and Neural Repair, 21, 2007, September, 435-443.

8. Najenson T, Yacubovich E, Pikielni SS. Rotator cuff injury in shoulder joints of hemiplegic patients. Scand J Rehabil Med, 3, 1971, 3, 131-137.

9. Poduri KR. Shoulder pain in stroke patients and its effect on rehabilitation. J Stroke Cerebrovascular Dis, 1993, 3, 261-266.

10. Principles of assessment and Outcome measurement for occupational therapists and physiotherapists. Theory, skills and application. AL Fawcett Editor. – Chichester: John Wiley & Sons Ltd, 2007.

11. Teasell RW. The painful hemiplegic shoulder. Physical Medicine and Rehabilitation: State of the Art Reviews, 12, 1998, 3, 489-500.

12. Van Ouwenaller C, Laplace PM, Chantraine A. Painful shoulder in hemiplegia. Arch Phys Med Rehabil, 67, 1986, 1, 23-26.

13. Verheyden G, Putman K, Bockx N et al. Prédire le score du Barthel Index et Nottingham Extended Activities of Daily Living six mois après un accident vasculaire cérébral: nouveaux résultats de l'étude européenne multicentrique CERISE. Annals of Physical and Rehabilitation Medicine, Volume 56, 2013, October, e176.

14. Yi Y, Lee KJ, Kim W et al. Biomechanical properties of the glenohumeral joint capsule in hemiplegic shoulder pain. Clin Biomech (Bristol, Avon), 28, 2013, 8, 873-878.

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