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MEDICAL REHABILITATION AND OCCUPATIONAL THERAPY IN PATIENTS WITH LESION OF PLEXUS BRACHIALIS

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Summary. Causes for plexus brachialis damage are versatile, and in some cases remain unknown, but mostly result from degenerative and inflammatory processes. Treatment of brachial plexus dysfunction is often conservative and is subject to a team of specialists – neurologists, traumatologists, rehabilitation physicians, kinesitherapists and occupational therapists. The objective of the research is to report the recovery of patients with lesion of plexus brachialis after a complex physiotherapy and rehabilitation treatment program that includes electrostimulation, remedial massage, kinesitherapy, electrotherapy and occupational therapy. A total of 159 patients, treated at the Clinic of Physical Therapy, University Hospital of Pleven, were included in the study. Improvement of measured indexes: pain assessment, centimetry, assessment of upper limb muscle weakness, dynamometry and functional test of activities of daily living, was registered in all patients under observation. In order to achieve good results in the rehabilitation of patients with injured plexus brachialis, timely diagnosis, good medication therapy and early start of complex physiotherapy and rehabilitation are of crucial importance, so that performance of daily living activities improves. The good results come slowly and with difficulties, but the quality of life of patients and the quality of labor performed by them, improves significantly.

Key words: *plexus brachialis, rehabilitation, occupational therapy*

INTRODUCTION

Plexus brachialis is a net of somatic nerve fibers, extending from the four lower front roots of the spinal column cervical part, and from the first chest nerve (C5-C8 and T1) (fig. 1). Plexus brachialis is responsible for upper limb muscles motor innervations [1].

Causes for plexus brachialis damage are versatile, and in some cases remain unknown, but mostly result from degenerative and inflammatory processes. Very often the nerve roots are being pressed due to aggravated cervicoarthrosis or hernia discalis cervicalis, but may be inflamed after infectious disease, intoxication, immunization and others. Pressing mechanically the plexus or a single nerve (cervical rib, tumor process) may also cause neuritis and pare-

sis [2]. Direct trauma and overstretched nerve fibers are frequent cause for acute damage of plexus brachialis [3].

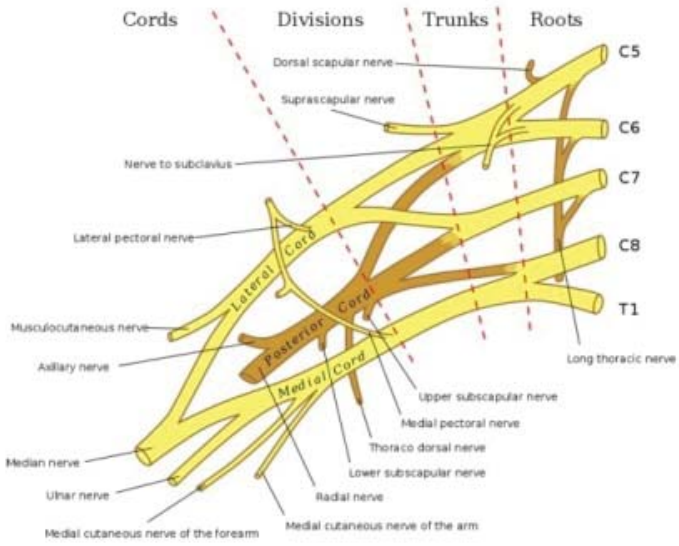

Fig. 1. Topography of the plexus brachialis [1]

A leading symptom in the clinical picture of brachial plexus neuritis is the intensive, burning pain in the shoulder joint area, irradiating to the fingers of the hand and increasing when the head and the upper limbs move. It represents peripheral atrophic torpid paresis or paralysis of the upper limb, depending on the severity and the level of damage [4]. Two major types of upper limb dysfunction are distinguished – upper type (Duchen – Erb) and lower type (Dejerin – Klumpke). The pain and the peripheral paresis cause complete or partial immobility of the limb. The patients are not fit for work and meet significant difficulties in performing activities of daily living (ADL).

The disease is diagnosed mainly through anamnesis and physical examination. Electromyography (EMG), MRI and CT scan should be performed in order to to establish the injury and the level of damage and to exclude a systemic disease or possible spinal pathology [5].

Treatment of brachial plexopathy is often conservative and is subject to a team of specialists. In severe traumatic conditions, with complete nerve interruption (neurotmesis), urgent operative intervention with stitching (neuroraphia) or plastica is a must [6]. Along with symptomatic medication treatment (analgetics, nonsteroidal anti-inflammatory drugs, anticonvulsants, myorelaxants, nivalin, vitamins from the B group) [7], it is very important that the injured limb is placed in a suitable orthosis. Major part of treatment of this type, is appointed to the rehabilitation physician, and during various periods and stages of the program the means are versatile and individually précised and dosed [8].

MATERIALS AND METHODS

The objective of the research is to report the recovery of patients with lesion of plexus brachialis after a complex physiotherapy and rehabilitation treatment program.

A total of 159 patients (86 men and 73 women), aged between 29 and 78 years, with injured plexus brachialis, who have sought physiotherapy and rehabilitation treatment at the

Clinic of Physical Therapy, University Hospital of Pleven, for the period January 2012 – June 2013, were included in the study.

All patients have been diagnosed, have been given prescribed medication therapy and have been directed for physiotherapy by neurologist. Some of the patients have been admitted for hospital rehabilitation, and others have received ambulatory treatment. From all 159 patients, 53 had damage after a trauma, 71 – root injury due to cervicoarthrosis or hernia discalis cervicalis, 17 had complications after infectious diseases, and the rest 18 patients were cases of unclear etiology.

Depending on the cause, severity of the injury and the period of recovery, the patients received a series of remedial courses of complex physiotherapy and rehabilitation that included:

• *Electrostimulation* – impulse frequency less than 1 Hz, duration 300-500 ms and pause 3-4 times higher than the impulse, the current is exponential [8];

• *Remedial massage* for maintaining paretic muscle and muscle group trophy; at start, the remedial process is light and gentle, and when the recovery progresses, it gets more energetic and stimulating [9];

• *Kinesiotherapy*, aiming to maintain the muscle trophy, to prevent subsequent contractures, to support and stimulate weak and hypotonic muscles and muscle groups [10];

• *Treatment with pre-formed physical factors* – EF with nivalin (+), 10-15 min, 6-10 mA to assist nerve regeneration; interference current for pain relief, current frequency 90-100 Hz for 5 min and switching to 1-100 Hz frequency for 10 min; magnet therapy, that improves the trophy, metabolism, tissue regeneration and has anti-inflammatory effect – transverse methodic, 15 min, impulse mode, 200 Oe; phonophoresis – applied locally, with nonsteroidal anti-inflammatory means – unstable methodic in the lesion area, 10 min, impulse mode, 800 KHz 0,4-0,6 W/cm^2 [8];

• *Ergotherapy* – under the form of guidelines facilitating the ADL, that include a set of practices for maintaining personal hygiene, dressing up and putting shoes on, preparation of food and having meal, various daily and labor activities [11].

All patients had 4-5 physiotherapy and rehabilitation remedial courses, the duration of which was between 3-4 months and 6 months, and in most severe cases the treatment continued up to 2 years.

The methods and tests used in the research are: pain assessment – *VAS; centimetry; MMT* – assessment of upper limb muscle weakness, Vladimir Yanda; *dynamometry* of fist grip; functional test of upper limb – *ADL*.

This test was created by H. Rusk at the Centre of Medical Rehabilitation – New York [12]. Four stages were included in it: personal grooming and hygiene; putting on shoes and dressing; food preparation and feeding; different social and labor activities. The assessment is 6-graded (from 0 to 5), and the patients assessed themselves following basic activities no matter a dominant or not dominant limb was injured.

During pain assessment patients used points from 0 to 20: no pain – 20 points; strong, drug-uncontrollable pain - 0 points. The centimetry of armpit, forearm and through the palm is measured in cm, with linear centimeter tape, and displays presence of edema (marked with ”+” sign) or hypertrophy of injured limb (marked with “–“ sign), in comparison to the healthy limb. The dynamometry is conducted using a standard dynamometer, completing three trials and registering the best result in kg. This test displays the condition of the forearm muscles and fingers that take part in hand grip. All measurements and tests are performed at the beginning of the recovery process, after each rehabilitation course, and at the end of the recovery period; the results are entered in a separate file-card for each patient.

The research data have been entered in WIN Excel spreadsheet, and arithmetic mean of all examined patients results from the beginning and from the end of the monitored period have

been processed. A value of $p < 0.05$ denoted statistically significant results that allow to make meaningful conclusions.

RESULTS

Fig. 2 represents in graphics the improvement of the tested muscles, innervated by the nerves extended from the brachial plexus, at the start of physiotherapy and rehabilitation treatment and at the end of the recovery period.

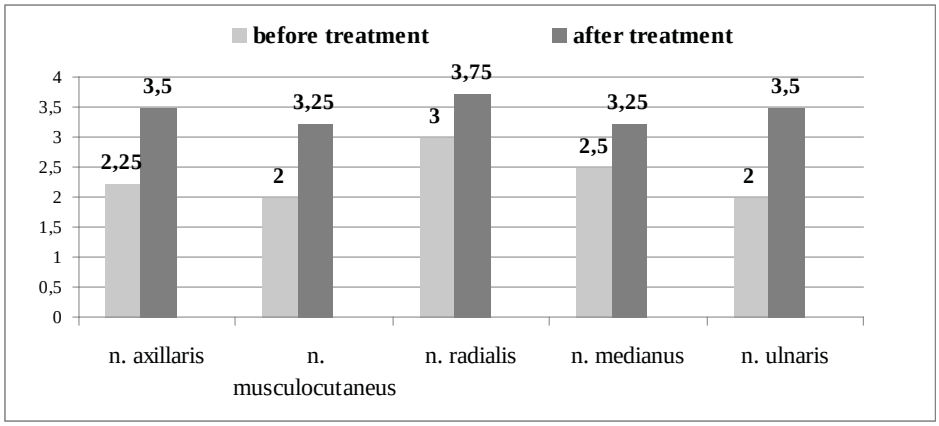

Fig. 2. Results from the assessment of upper limb muscle weakness (manual muscle strength testing, MMT) – muscles innervated by nerves of plexus brachialis at the beginning and at the end of the recovery process

The VAS pain results, centimetry and dynammetry results are shown in Table 1; column 1 contains data from the beginning of rehabilitation, and column 2 – data from the end of the rehabilitation period; column 3 presents the improvement.

Table 1. Results from arithmetic averages of VAS for the pain, centimeters and dynamometers at the beginning and at the end of the recovery process in patients with disability of plexus brachialis, grouped depending on the reason of the lesion

Patient group	Patients with traumatic lesion			Patients with roots dysfunction			Patients with infectious disability			Patients with inflammatory disabilility		
Research	1	2	3	1	2	3	1	2	3	1	2	3
VAS for pain	7.9	15.6	7.7	11.7	17.2	5.5	13.4	17.5	4.1	12.3	17.9	5.6
Centim. of the brachii	-2.3	-0.8	1.5	-1.7	-0.8	0.9	-1.9	-0.7	1.2	-1.2	-0.4	0.8
Centim. of the anthebr.	-1.4	-0.5	0.9	-1.1	-0.5	0.6	-1.1	-0.5	0.6	-0.9	-0.4	0.5
Centim. of the palm	+1.9	+0.5	1.4	+1.1	+0.5	0.6	+0.8	+0.3	0.5	+0.9	+0.3	0.6
Dinamom. in men	9.7	15.6	5.9	11.7	18.4	6.7	12.3	19.6	7.3	10.8	18.7	7.9
Dinamom. in women	2.6	6.8	4.2	5.7	9.8	4.1	6.9	10.2	3.3	6.2	9.6	3.3

Figure 3 shows the test results of ADL assessment at the beginning and at the end of treatment. At the end of the rehabilitation course the Wilcoxon curves were dislocated to the right, which means that improvement in the independence of the patients and in their quality of life and work was achieved, regardless of which limb, the dominant or the non-dominant one, was injured.

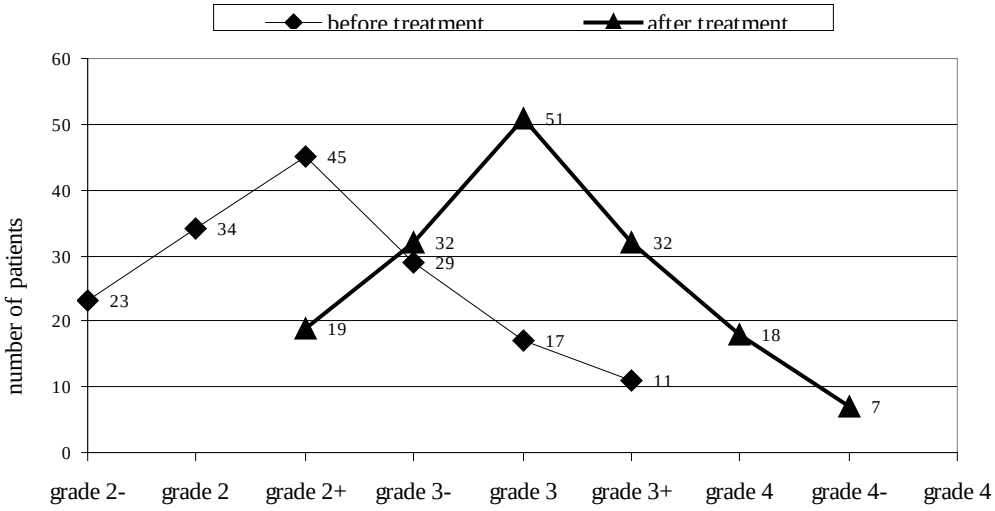

Fig. 3. The Wilcoxon test results for activities of daily living (ADL) at the beginning and at the end of treatment

DISCUSSION

The dynamic life of people, multiplied traumatism, unceasing industrial failures, natural calamities and military confrontations lead to increased sick rate of muscle and skeleton system diseases worldwide. We encounter more often problems of individuals in active age, with neuromuscular disabilities, that should be treated promptly.

A number of publications point out the frequency of plexus brachialis lesion, the affected separate plexus nerves, age limits and the sex ratio [13]. Our research confirmed a numerical superiority of men – 54% of all patients. The reason for injuries in younger age (under 50) is mostly traumatic [14], and in older patients (age over 60) is due to degenerative problems, infectious complications or intoxication [15]. In case of mechanically pressed plexus, surgery for decompression is required, followed by subsequent rehabilitation program [16].

The analysis of research derived results confirmed a need for a complex treatment that should include medication therapy, combined with systematic, continuous and adequate rehabilitation program. Neurological pain is a leading symptom, and a series of publications suggest therapy with analgetics and anti inflammatory drugs, in order to create optimal precondition in order to conduct adequate physiotherapy [2, 6]. Medical science is in a constant search for suitable drugs that shall stimulate regeneration of injured peripheral nerves [17], but so far, application of nivalin, which in severe cases is injected according to a scheme, along with vitamins from the B group and compulsory local application with the help of EE, is indispensable [7].

The prime importance of applied electrostimulation on injured muscles and muscle groups is indisputable, but often this is not possible due to lack of proper equipment and trained staff in most of the existing physiotherapy medical establishments in our country [18, 19]. In such cas-

es a reliable option is the professionally conducted systematic kinesitherapy that influences the reduced muscle power of the whole upper limb. A list of possible options would include analytic, passive, aided and active exercises for the upper limb joints; manual techniques and mobilization of periphery joints; special techniques from the proprioceptive neuromuscular facilitation of Kabat; suspension exercises for the muscles that move the shoulder joint within the front and sagittal plane; exercises with and on apparatuses for upper limbs, preventing contractures; pull therapy for strengthening weak and hypotrophic muscles, etc [9, 10].

Recognizing the functional recovery of the upper limb, improved self-service of patients, performance of various labor activities and return to independent, full-value life is the objective of the specialists that conduct the rehabilitation at first hand [20].

CONCLUSIONS

Improvement of measured indexes was registered in all patients under observation, and the duration of the treatment was dependent on the cause, severity and level of injury of plexus brachialis.

In order to achieve good results in the rehabilitation of patients with injured plexus brachialis, timely diagnosis, good medication therapy and early start of complex physiotherapy and rehabilitation program that includes electrotherapy, electrostimulation, kinesitherapy and ergotherapy, are of crucial importance, so that performance of daily living activities improves. The good results come slowly and with difficulties, but the quality of life of patients and the quality of labor performed by them, improves significantly.

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