

Rehabilitation examination of patients with compression-ischemic neuropathy of the upper limb

Olena Bismak

National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine

Compression-ischemic neuropathy of the upper limb is a common disease of the peripheral nervous system, accompanied by impaired motor, sensory spheres and a decrease in the quality of life in people of working age.

Purpose: *to reveal the structure of rehabilitation examination in people with compression-ischemic neuropathy of the upper limb.*

Material & Methods: *analysis and synthesis of data from scientific and methodological literature and the Internet information network; interrogation, history taking, palpation, tests, mathematical methods. The study was conducted on the basis of the neurological departments No. 1 and No. 2 of the Kiev City Clinical Hospital No. 4, Kiev, from 2017 to 2019. The examination involved 48 patients with compression-ischemic neuropathy of the upper limb.*

Results: *a scheme (algorithm) of rehabilitation examination was proposed, which included: a survey, history taking, determining the level of damage, the degree of neurological deficit, motor and sensory disturbances, muscle hypotrophy and atrophy, joint and muscle contracture. During the initial examination of patients with compression-ischemic neuropathy of the upper limb, the predominance of male patients was revealed, namely 89.6%. Damage to the peripheral nerves of the upper limb was more often observed in patients of able-bodied young and middle age – 77,1%. The vast majority were patients with radiation injuries – 52,1% and ulnar nerves – 35,4%. In 60,4% of individuals, pains of moderate intensity were observed (4–6 points on a 10-point visual-analogue scale for assessing pain intensity (VAS)).*

Conclusions: *an initial examination was carried out indicating the presence of disorders of the motor and sensory function of the affected limb in individuals with this pathology. To restore the functional state and preserve the function of the affected limb, it is necessary to comply with the developed scheme (algorithm) of the rehabilitation examination, and will contribute to the development of an effective physical therapy program.*

Keywords: *rehabilitation examination, compression-ischemic neuropathy, patients, physical therapy, motor, sensory disturbances.*

Introduction

Today in Ukraine, as in other countries of the world, there is a tendency to increase neurological diseases. Diseases of the peripheral nervous system is currently a socially significant problem [2]. Compression ischemic (tunnel) neuropathies are quite common in clinical practice [12]. Tunnel neuropathies account for 1/3 of diseases of the peripheral nervous system. The literature describes more than 30 forms of tunnel neuropathies [5].

The reason for the development of compression-ischemic neuropathy is a short, moderate or prolonged slight compression (compression) of the nerve, which is accompanied by a violation of the internal neural circulation, leads to the development of ischemia of nerve fibers. It was found that even short-term, but strong compression of the nerve leads to blockage of neural conduction mainly in motor fibers due to local demyelination at the site of compression and degeneration of part of the nerve fibers, followed by progressive distal atrophy of the nerve. Ischemic damage to nerve fibers leads to their Waller degeneration [4; 17].

Acute (develop within a few days to 4 weeks), subacute (develop within a few weeks) and chronic, including recurrent (develop within a few months or years), tunnel neuropathies are distinguished by the timing of development. [6].

The full clinical picture of tunnel syndrome includes sensory (pain, paresthesia, numbness), motor (decreased function, weakness, atrophy) and trophic disorders. There are various options for the clinical course. More often – a debut from pain or other sensitive disorders. Less commonly, the onset is with motor impairment. Trophic changes, as a rule, are expressed slightly and only in advanced cases. The characteristic syndrome of tunnel syndrome is pain. Usually the pain appears during movement (load), then it occurs at rest. Sometimes the pain wakes up the patient at night, which drains the patient and makes him see a doctor [16].

Motor disturbances occur as a result of damage to the motor branches of the nerve and manifest as a decrease in strength, rapid fatigue. In some cases, the progression of the disease leads to atrophy, the development of contractures ("clawed paw", "monkey paw") [1; 15].

The treatment of tunnel syndromes is based on conservative therapy aimed at decompression of the nerve trunk and restoration of its functions. Medications and non-medications are used, among which an important role is given to physical therapy, since with this pathology, disorders of the motor function of the upper limb are observed [11].

The components of the clinical activity of a physical therapist are examination; assessment; diagnosis of violations; forecasting; interventions [3]. However, the analysis of literature and Internet sources indicates that little attention is paid to the problem of conducting a rehabilitation examination in compression-ischemic neuropathy. Therefore, the study of the structure and content of rehabilitation examination in compression-ischemic neuropathy is an urgent problem.

Purpose of the study: to reveal the structure of rehabilitation examination in people with compression-ischemic neuropathy of the upper limb.

Material and Methods of the research

Research methods: analysis and synthesis of data from scientific and methodological literature and the Internet information network; interrogation, history taking, palpation, mathematical methods.

The study was conducted on the basis of the neurological departments No. 1 and No. 2 of the Kiev City Clinical Hospital No. 4, Kiev, from 2017 to 2018. The examination involved 48 patients with compression-ischemic neuropathy of the upper limb.

Results of the research

It is known that one of the areas of work of a physical therapist is a comprehensive examination of patients with the aim of establishing a rehabilitation diagnosis and planning an intervention program.

To determine motor disorders, we developed a *rehabilitation examination* scheme (algorithm), which included: a survey, medical history, determination of the level of damage, the degree of neurological deficit, motor and sensory disturbances, muscle hypotrophy and atrophy, joint and muscle contractures. The survey results were recorded in a specially designed rehabilitation examination card.

Surveys included patient complaints, both basic and additional, information about the features of professional activity, since one of the reasons for the development of neuropathy of the upper limb, in particular carpal tunnel syndrome, is compression of the median nerve during the performance of work functions [11]. It is important to pay attention to the age of the person, the date of diagnosis and the period of manifestation of the disease, which will analyze the rate of progression of neuropathy.

The survey made it possible to find out the priority tasks of

rehabilitation interventions and the needs of the patient.

When collecting an anamnesis, it was found out the presence of trauma in the past (traffic accidents, falls, fractures, stab wounds, gunshot wounds, etc.), provoking factors (profession, occupation), the time of manifestation of symptoms was specified, a history of concomitant diseases and previous ones was collected surgical interventions. Palpation was determined by the presence of soreness, hypertrophic altered tissues, joint deformities.

When conducting a rehabilitation examination, it is necessary to know what motor and sensory disturbances occur when a particular nerve of the upper limb is affected. In addition, the symptoms of neuropathy are largely determined by the location of the compression of the nerve.

So, with neuropathy of the radial nerve, the motor function is primarily disturbed: the patient cannot squeeze his hand tightly, not only delicate work (writing, knitting) is difficult, but also rough. In addition, the clinical picture includes specific manifestations, namely: a symptom of a "mounted brush", limitation or absence of amplitude of movements (extension of the forearm, hand, fingers in the metacarpophalangeal joints, extension of the I finger) difficulty supination of the forearm, hand; retraction of I, IV, V fingers from the III finger, and finger from II, retraction and adduction of the hand. There is a decrease or complete lack of sensitivity in the area from the shoulder to the back surface of the III-V fingers. As a rule, sensitivity is disturbed in the area of the "anatomical snuffbox" on the hand [8; 10].

With incomplete damage to the ulnar nerve, weakness of the muscles of the hand, hypotrophy of the muscles in the region of the first interdigital spaces, decreased sensitivity in the region of the fifth finger, pain, tingling along the ulnar nerve are noted. For complete damage to the ulnar nerve, anesthesia of the skin of the fifth finger, half of the fourth finger, the ulnar edge of the palm, paralysis of the muscles that move the finger, and the flexor muscles of this finger are characteristic. A person is disturbed by a constant feeling of tightness, soreness, burning in the region of IV-V fingers. The formation of the so-called "clawed paw" of paresis and atrophy of the own muscles of the hand [8].

When the median nerve is damaged, the muscles of the hand are affected (most often it is carpal tunnel syndrome), which are responsible for flexion, atrophy of the muscles of the palm occurs and it becomes impossible to bend I-II fingers, it is difficult for the patient to hold small objects. Patients have a typical "monkey" brush; it is impossible to bend the terminal phalanges of I-II fingers with the palm firmly lying on the table ("scratches"), it is impossible to hold a sheet of paper between the I and II fingers (and the finger is straightened). The defeat of the median nerve is accompanied by sensitivity disorders, trophic and vasomotor disorders (increased sweating of the skin of the palmar surface) [7; 9; 13].

During the initial examination, we found a predominance of

male patients, namely 89,6% (women – 10,4%), which is obviously connected with the lifestyle and habits (driving a motorcycle, scooter) and the features of work in the so-called "male" professions. Among the males, working professions predominated, women worked as accountants, cashiers and conveyor workers.

According to the new WHO classification of 2015, patients are divided into age groups according to young age (25–44 years), middle (45–59 years), elderly (60–74 years) and senile (>75 years). The age of patients ranged from 19 to 78 years. As can be seen from the Table 1, injuries of the peripheral nerves of the upper limb were more often observed in patients of precisely working age – 77,1%. The greatest number of peripheral neuropathies among the examined patients was found in young people (25–44 years old) – 43,8%.

Table 1
Distribution of patients by age (n=48)

Age of patients	Number of patients	
	abs.	%
under 25 years old	2	4,1
25–44 years old	21	43,8
44–60 years old	16	33,3
60–75 years old	8	16,7
>75 years old	1	2,1

The distribution of patients according to the clinical syndromes of nerve damage is presented in Table 2: the vast majority of observations were made by patients with injuries of the radial nerve – 52,1% and the ulnar nerve – 35,4%.

Pain is assessed using a ten-point visual-analogue scale for assessing pain intensity (VAS) (Table 3).

The muscle strength of the affected upper limb, we plan to evaluate by manual muscle test (MMT) [14]. The test results showed that in all patients there was a decrease in muscle strength of the affected limb.

Table 2
Distribution of patients according to clinical syndromes (n=48)

Clinical Syndromes	Number of patients	
	abs.	%
Injuries of the ulnar nerve	17	35,4
Injuries to the radial nerve	25	52,1
Injuries to the median nerve (carpal tunnel syndrome)	4	8,3
Combined injuries to the median and ulnar nerves	2	4,2

Table 3
Severity of pain in the examined patients (n=48)

Manifestations of pain	Number of patients	
	abs.	%
Moderate pain (4-6 points)	29	60,4%
Intense, unbearable pain (7-9 points)	19	39,6%

Conclusions / Discussion

The initial examination showed the presence of disorders of the motor and sensory function of the affected limb in individuals with this pathology. To restore the functional state and preserve the function of the affected limb, it is necessary to comply with the developed scheme (algorithm) of the rehabilitation examination, and will contribute to the development of an effective physical therapy program.

Our results of the initial examination of persons with compression-ischemic neuropathy of the upper limb confirm the results of studies by scientists E. V. Bakhterev, Yu. V. Tsimbalyuk and others.

Prospects for further research are to justify the means of physical therapy for this pathology.

Conflict of interests. The author declares that no conflict of interest.

Financing sources. This article didn't get the financial support from the state, public or commercial organization.

References

1. Bakhtereva, E.V. (2017), *Kompressionnye perifericheskie nevropatii verkhnikh konechnostey: rol' proizvodstvennykh faktorov, rannaya diagnostika i lechenie: avtoref. dis. d-ra med. nauk* [Compression peripheral neuropathies of the upper extremities: the role of production factors, early diagnosis and treatment: abstract of the dissertation of the medical sciences doctor], Ekaterinburg, 44 p. (in Russ.)
2. Bismak, O.V. (2019), "Peripheral neuropathy of the upper limb as a medical and social problem", *Scientific journal of the National Pedagogical University named after MP Drahomanov Series No. 15. Scientific and pedagogical problems of physical culture (physical culture and sports)*, No. 7 (115), pp. 12-16. (in Ukr.)
3. Bismak, O.V. (2019), "The role of physical therapist in rehabilitation of carpal tunnel syndrome patients", *Materials of the international scientific and practical conference "Traditions and innovations in the training of specialists in physical education and physical rehabilitation"*, pp. 53-58. (in Ukr.)
4. Golubev, V.L., Merkulova, D.M. & Orlova, O.R. (2017), "Tunnel hand syndromes", *Russian Medical Journal*, No.2. (in Russ.)
5. Levin, O.S. (2005), *Polyneuropathies*, Moscow. (in Russ.)
6. Merkulova, D.M., Merkulov, Yu.A. & Nikitin, C.C. (2012), "Tunnel neuropathies. Diagnosis and principles of pathogenetic therapy", *Consilium Med.*, No. 2, pp. 1-2. (in Russ.)
7. Nikitin, S.S., Maslak, A.A., Kurenkov, A.L., Savitskaya, N.G. & Pripisnova, S.G. (2013), "Features of the diagnosis of carpal tunnel syndrome using electromyography and ultrasound", *Annals of Clinical and Experimental Neurology*, Volume 7, No. 4, pp. 20-26. (in Russ.)
8. Pizova, N.V. (2017), "Clinic, Diagnosis and Therapy of Some Tunnel Syndromes of the Upper Limbs", *Russian Medical Journal*, No. 21, pp. 1548-1552. (in Russ.)

9. Suponeva, N.A., Piradov, M.A., Gnedovskaya, E.V., Belova, N.V., Yusupova, D.G., Vuytsik, N.B. & Lagoda, D.Yu. (2016), "Carpal tunnel syndrome: the main issues of diagnosis, treatment and rehabilitation (review)", *Ulyanovsk Medical and Biological Journal*, No. 2, pp. 91-97. (in Russ.)
10. Khalimova, A.A. (2013), "Wrist Tunnel Syndrome (Literature Review)", *Vestnik AGIUV*, pp. 94-101. (in Russ.)
11. Tsymbaliuk, Yu.V. (2014). *Vidnovne neirokhirurhichne likuvannia uskodzhen peryferychnykh nerviv iz zastosuvanniam dovhotryvaloi elektrostymuliatcii: avtoreferat dysertatsii doktora medychnykh nauk: 14.01.05* [Restorative neurosurgical treatment of peripheral nerves injuries with the use of long-term electrostimulation: the dissertation author's abstract of the doctor of medical sciences]. NAMN Ukrainy, In-t neirokhirurhii im. A.P. Romodanova, Kyiv, 40. (in Ukr.)
12. Assmus, H., Antoniadis, G. & Bischoff, C. (2015), "Carpal and cubital tunnel and other, rarer nerve compression syndromes", *Dtsch Arztebl Int.*, Vol. 112(1-2), pp. 14-25.
13. Dong-Wook, R., Sang Hee, I., Seong-Kyun, K. et al. (2011), "Median nerve conduction study through the carpal tunnel using segmental nerve length measured by ultrasonographic and conventional tape methods", *Phys. Med. Rehabilitation*, No. 92, pp. 1-2.
14. Hagert, E. & Hagert, C-G. (2008), "Manual Muscle Testing – A Clinical Examination Technique for Diagnosing Focal Neuropathies in the Upper Extremity" In book: *Upper Extremity Nerve Repair: Tips and Techniques*, Chapter: 36, *American Society for Surgery of the Hand, Editors: David Slutsky*, pp.451-466.
15. Jepsen, J.R., Laursen, L.H., Kreiner, S. & Larsen, A.I. (2009), "Neurological Examination of the Upper Limb: A Study of Construct Validity", *Open Neurol J.*, No. 3, pp. 54-63, doi: 10.2174/1874205X00903010054.
16. Jepsen, J.R. (2018), "Studies of upper limb pain in occupational medicine, in general practice, and among computer operators", *Dan Med J.*, No. 65(4).
17. Linda, D.D., Harish, S., Stewart, B.G., Finlay, K., Parasu, N., Rebello, R.P. (2010), "Multimodality imaging of peripheral neuropathies of the upper limb and brachial plexus", *Radiographics*, No. 30(5), pp. 1373-400, doi: 10.1148/rg.305095169.

Received: 20.05.2019.

Published: 30.06.2019.

Information about the Authors

Olena Bismak: *PhD (Physical Education and Sport), Associate Professor: National University of Ukraine on Physical Education and Sport: Fizkul'tury str. 1, Kyiv, 03150, Ukraine.*

ORCID.ORG/0000-0002-6495-6170

E-mail: ebismak@gmail.com