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Peripheral nerves electrostimulators. Technical Specifications

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Abstract

Admission The first successful attempt to use stimulants neuro modulation properties date back to the first half of the twentieth century. Due to the high technological limitations, the use of peripheral nerve electrostimulators the early eighties

XX century was relatively small and involved few patients treated primarily due to neuropathic pain and patients psychosurgical.

The development of modern batteries in the eighties of the twentieth century, standardization and implementation process to achieve consensus on the guidelines for operations in the field of functional neurosurgery, they contributed to intensified "Renaissance" functional neurosurgery.

Material and methods Articles in the EBSCO database were analyzed using the keywords: peripheral nerves, stimulation, electrostimulation, neurosurgery. Furthermore, neural searched betting sites in terms of the technical aspects of this equipment. Available literature was subjectively selected. Then searched the latest version of each article.

Results Offered different tools offered technical specifications. Technological developments have allowed the convenience to use devices, min. by increasing control by the user or representative of the operation of the pacemaker.

Conclusions The development of technology and neuroscience neurostymulatorów resulted in the development of many available on the market. However, more research is needed to determine the exact parameters of stimulation, which would get the largest size stimulation effect while minimizing adverse effects.

Key words: electrostimulation, physical medicine, neurostimulation

Admission

1.1 Historical conditions techniques used in neurosurgery

The first successful attempt to use stimulants neuromodulation properties date back to the first half of the twentieth century. Due to the high technological limitations, the use of peripheral nerve stimulators to the beginning of the eighties of the twentieth century was relatively small and involved few patients treated primarily because of neuropathic pain and psychosurgical patients [1].

The biggest drawback of that period used stimulants were their large size and the need for frequent battery changes and the resulting burden on the patient. There are no indications of standardization and protocol prevented the implantation procedure itself sufficiently rapid development of this method [2]. The development of modern batteries in the eighties of the twentieth century, standardization and implementation process to achieve consensus on the guidelines for operations in the field of functional neurosurgery, contributed to intensified "renaissance" of functional neurosurgery in the past two decades, both in Poland How in the world. The risk of irreversible side effects that may occur after ablative procedures especially made on both sides, It prevented the treatment of movement disorders or pallidotomy methods bilateral thalamotomy. Making ablative treatments stages only slightly reduced the risk of developing serious complications.

Hemibalizm risk or other movement disorders after subthalamotomy caused not using the subthalamic nucleus in the treatment of Parkinson's disease. Implementation stimulators deep structures allowed relatively safe bilateral operations. The same happened with the objectives previously regarded as unattainable for ablative methods, due to the relatively high risk of complications. Only after the introduction of pacemakers became available for the treatment of neurosurgical [3].

1.2 Peripheral nerves

Electrostimulation of peripheral nerves

The mechanism of functioning of the nervous system uses nerve impulses to transmit information suggests the possibility of using electricity derived from outside the body to modify the data transported through the neurons. Such intervention would enable the achievement of a number of positive effects, greatly facilitate the treatment of the patient, as the effects of rehabilitation or leading to pain [4].

The aforementioned thesis became even more credible when in 1965 Melzack and Wall published the theory gates of pain, according to which electric pulses of higher frequency are able to block the transmission of pain information, without damaging the neurons. This discovery marked the beginning of the process of using electrical stimulation at relieving pain and led to the launch of many studies over the other positive effects of shock on the body [5].

In the currently used electrostimulators utilizes the fact that the signals coming from said device transmitted by the nerve fibers of type C, which transmit information faster than the fiber-type [6]. With this impetus coming from the pacemaker reaches faster to the centers located in the central nervous system, such as the hypothalamus in the case of pain impulses, while blocking signals coming from the body. This results in inhibition of the transmission of information, which are undesirable in the treatment of a patient, making it easier to carry out [4].

Material and methods

Articles in the EBSCO database have been Analyzed using keywords: peripheral nerves, stimulation, electrostimulation. Neurosurgery. Moreover, the company neuro devices of sites were searched in terms of technical aspects of equipment described. The available literature was subjectively selected. Then, the newest version of every paper you searched for.

Results

PERIPHERAL Nerve stimulators

Peripheral nerve stimulators (ang. Peripheral nerve stimulator, PNS) have become indispensable in modern medical practice, and are widely used for the treatment of chronic pain. The process of stimulation involves placing a small electric appliance in the vicinity of one of the peripheral nerves (the nerves located outside the brain and spinal cord) [7]. The electrode provides fast electrical impulses that are felt as mild tingling. During the trial period, the electrode is connected to an external device, and if the attempt is successful then the patient's body can be implanted permanently small stimulator. As in the case of

pacemakers, electricity is supplied from the pacemaker to the optic nerve or using one or more electrodes.

EXAMPLES peripheral nerve stimulators

- **STIMUPLEX HNS 12**

STIMUPLEX HNS 12 is a device used to stimulate peripheral nerves, which is equipped with:

- neurostimulator,
- 9V battery,
- cable set,
- the tester proper functioning of the device.

The most important advantages of this simulator are:

- the ergonomic shape of the pacemaker,
- the menu in Polish,
- keyboard function,
- precise digital current adjustment knob,
- large flat LCD screen,
- no slipping of the place of stimulation,

- Keyboard quick selection.

Ranges pacemaker settings:

- current amplitude (intensity) 0.00 - 1.00 mA or 5.00 mA 0,00- depending on the setting,

- the supply of a sequence of stimuli of varying duration for easier location of the nerve/plexus nerve (SENS),

- stimulus duration of 0.05 ms, 0.10 ms; 0.30 ms; 0.50 ms, 1.00 ms,

- frequency stimulus 1,2 or 3 Hz,

- automatic shutdown if not used [10].

Fig. 1. View of peripheral nerve stimulator STIMUPLEX HNS 12 B. Braun

- **Plexygon company VYGON**

This type of pacemaker and peripheral nerve plexus has been designed for ease of use, performance, and security. With it is possible to easily and quickly identify the nerves.

Pulse generator:

- 0 to 6 mA for 50 ms pulse,
- 0 to 5 mA with a pulse of 100 ms.
- 0 to 4 mA for a pulse of 300 ms.

This device has an adjustable pulse frequency (1, 2 and 4 Hz) and their duration (300 ms, 100 ms or 50 ms) [11].

Fig. 2. View of peripheral nerve stimulator Plexygon company VYGON

- **MultiStim ECO company PAJUNK**

MultiStim ECO is a device manufactured by PAJUNK, which was reinforced with a wide range of equipment for nerve stimulation. It is simple to operate and suitable for the combination, as well as for self-stimulation techniques. It is characterized mainly by the following properties:

- the device has no additional cabling during use by the patient is minimized and therefore the risk of malfunction of the system.
- It is small and compact, and therefore fully meets the requirements of combined procedures,

- simple operation - manual settings were limited to basic settings [12].

Fig. 3. View of peripheral nerve stimulator MultiStim ECO company PAJUNK

- **MTR + Vertriebs MyoBravo**

MyoBravo Stimulator has more than thirty programs, the use of which enables the stimulation of peripheral nerves, and muscle stimulation and regeneration of the body through relaxation, cleansing and active rehabilitation.

MyoBravo has the ability to configure any of the three programs for individual needs and preferences, allowing users, doctors and physiotherapists, but the athletes and correlate muscle stimulation program [13].

Fig. 4. View of peripheral nerve stimulator MTR + Vertriebs MyoBravo

Discussion

With the development of modern technologies, such as reducing the required size of the instruments or increasing battery capacity and progress related to physical medicine and neurosurgery, which flourished in the years eighties of the twentieth century, electrical stimulators of peripheral nerves become one of the cornerstones of treating patients with the broadest possible dysfunctions neurological and musculoskeletal system. This made it

possible to drastically reduce complications such as treatment also significantly improved the quality of life of patients. [14,15]

The very process of locating and neurosurgical future use by the patient electrostimulator peripheral nerve underwent significant ease. Currently, this process begins by placing a test device and its positive results, implantation of small, proper pacemaker. The patient alone changes the setting at its discretion. [16]

Recently appeared on the market a huge amount electrostimulators peripheral nerves, which differ in specification, the number of programs, or ease of use. It is very important that both medical personnel and patients themselves thoroughly acquainted with all the data and capabilities of the device prior to its use so as to fully customize and use the full performance of the device. [17]

Despite the many devices available, there is still a great need for further research on the use of elektrostymulatorów. All the time there are large deficits over the full use of the performance which gives us modern technology, not only the problems of the peripheral nerves but other disabilities. [18]

Conclusions

The history dates back to electrostymulators nerves early twentieth century. The following ever since technological progress has allowed improving the quality of their performance and convenience of use. From the beginning of the big, heavy, impractical for the patient, requiring frequent battery changes stimulators used rarely, small appliances replaced with modern rechargeable batteries, which can control the operation of the patient. Introduced were also indications standards and procedures for implementation. Currently, there are several types of nerve stimulators.

STIMUPLEX HNS 12 stimulator allows precise adjustment of the desired parameters. It is possible to determine the current amplitude, a sequence of stimuli of different duration, the duration of the stimulus, its frequency. It also has an automatic power off when not in use.

The company Vygon, out of concern about the ease of use, performance, and security nerve stimulator and weaves launched Plexygon device. It allows quick and easy recognition of the nerves.

Also, a simple-to-use device is MultiStim Eco. Set in it only the basic parameters, small size, no additional cables ensure the proper functioning of the pacemaker.

MTR + Vertebris MyoBravo gives wide opportunities as stimulation of peripheral nerves, muscle regeneration. These effects are achieved through programs introduced. There is also the possibility of introducing their own programs.

For patients use devices are available tailored to different needs. They are easy to use, minimize the risk of error on the part of the user, others allow themselves to determine the desired parameters, and even create their own programs nerve stimulation, nerve plexus, muscles, and even regeneration.

Bibliography

[1] Mandat T., Neurostymulacja w leczeniu neuropatycznych zespołów bólowych i chorób pozapiramidowych z wykorzystaniem stymulatorów struktur głębokich mózgu, stymulatorów kory ruchowej mózgu oraz stymulatorów rdzenia kręgowego, Centrum Onkologii- Instytut im. Marii Skłodowskiej-Curie w Warszawie, Warszawa 2010.

[2] Hausmanowa-Petrusewicz I., Jędrzejowska H., Haftek J., Choroby nerwów obwodowych, Państwowy Zakład Wydawnictw Lekarskich, Warszawa 1972.

[3] A Neurological Journal – Brain, Aids to the examination of the peripheral nervous system, Elsevier Urban & Partner, Cop 2008.

[4] Doucet B. M., Lam A., Griffin L. (2012). Neuromuscular electrical stimulation for skeletal muscle function. Yale Journal of Biology and Medicine, 85(2), 201-215.

[5] Mendell L. M. (2014). Constructing and deconstructing the gate theory of pain. Pain, 155(2), 210-216.

[6] Li C. L., Bak A. (1976). Excitability characteristics of the A- and C-fibers in a peripheral nerve. Experimental Neurology, 50(1), 67-79.

[7] Tulchinsky A., Weller RS., Rosenblum N., Gross JB., Nerve stimulator polarity and brachial plexus block, Anesth Analg 1993; 77 (1):100-3.

[8] Loth E., Nauka o nerwach obwodowych, Państwowy Zakład Wydawnictw Lekarskich, 1960.
[9] Zyss T., Zięba A., Dudek D., Najnowsze techniki neuromodulacyjne: w terapii zaburzeń depresyjnych, Komitet Redakcyjno-Wydawniczy Polskiego Towarzystwa Psychiatrycznego, 2009.
[10] Bathram CN, Nerve stimulators for nerve localization – are they All the same?, Anaaesthesia 1997; 52;761-764.
[11] Pither CE, Raj PP, Ford DJ, The use of peripheral nerve stimulators for regional anesthesia: a review of experimental characteristics, technique and clinical applications, Reg Anesth 1985; 10:49-58.
[12] Gołembiowska K., Neurotransmisja i neuromodulacja purynergiczna, Instytut Farmakologii PAN, 2005.
[13] Herman E., Diagnostyka chorób układu nerwowego, Państwowy Zakład Wydawnictw Lekarskich, Warszawa 1982.
[14] Mika T. Fizykoterapia. PZWL, Warszawa 2001, 151–253.
[15] Straburzyński G., Straburzyńska-Lupa A. Medycyna fizykalna. PZWL, Warszawa 2000, 295–346.
[16] Demczyszak I., Wrzosek Z. Współczesne metody elektroterapii bólu ze szczególnym uwzględnieniem przezskórnej elektroneurostymulacji TENS. Fizjoterapia 2001.
[17] Łazowski J. Podstawy fizykoterapii. Wydawnictwo AWF, Wrocław 2009.
[18] Kwasucki J., Talar J. Ocena efektu przeciwbólowego elektrostymulacji przezskórnej nerwów u chorych z rwą kuszową. Postępy Rehabillitacji 1994.