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## Rehabilitation of patients with paraplegia - a review of the diversity of forms

Natalia Krakowska<sup>1</sup>, Benjamin Szmelcer<sup>1</sup>, Daria Zaborna<sup>1</sup>,  
Aleksandra Fortuna<sup>1</sup>, Patrycja Wszelaki<sup>1</sup>, Aleksander Florczak<sup>1</sup>,  
Michał Wilczyński<sup>1</sup>, Justyna Ciepluch<sup>1</sup>, Natalia Skierkowska<sup>1</sup>,  
Mateusz Porada<sup>1</sup>, Mariusz Wąsicki<sup>1</sup>, Mateusz Modrzejewski<sup>1</sup>,  
Kornelia Kędziora-Kornatowska<sup>1</sup>

<sup>1</sup>Faculty of Health Sciences, Department and Clinic of Geriatrics, Nicolaus Copernicus University

### Abstract:

**Background:** Damage to the spinal cord most often occurs as a result of spine injury, often causing the disability. In every patient with paraplegia, complications may occur in the form of: sensory disorders, bedsores, contractures, urinary and stool incontinence, paresis or limb paralysis, as well as sexual problems.

**Material and methods:** Analysis of available literature, articles in the Google Scholar and PubMed database using keywords: Rehabilitation, Paraplegia, Neurology

**Results:** Losing the function of locomotion and self-care in everyday activities is a great psychological burden, both for the sick person and his family. Rehabilitation proceeding should include physical, psychological and social aspects. For paraplegics, the introduction of early and appropriately targeted treatment may reduce the risk of onerous complications and allow for maximum self-empowerment in basic activities. For a person with disability, it is a chance to achieve self-acceptance and return to a dignified life in society.

**Conclusions:** Problems of patients with paraplegia, despite the fact that they were described in many books and articles, should still be considered in studies that would use the latest news from the world of science. Patients struggling with this problem still expect further measures to improve their quality of life.

**Key words:** Rehabilitation, Paraplegia, Neurology

## 1. Introduction

Paraplegia is a disorder or loss of sensory functions, most often of lower limbs, while maintaining the function of upper limbs. Otherwise, it is called hemiplegia. It can occur as a result of an injury to the thoracic, lumbar or sacral spinal cord. [1,2]

In patients after URK, it is very important to undertake as early as possible and multi-faceted rehabilitation. The progress of the treatment is influenced by such factors as: location, level of damage, degree of paresis and onerous complications (sensory disturbances, periarticular ossifications, limb deformities, decubitus ulcers, disturbances of micturition and defecation) as well as coexisting diseases, age and physical fitness of the patient from before injury. Properly directed, comprehensive and continuous therapy is a chance to minimize the occurrence of the above-mentioned complications. [3,4]

The main goals of rehabilitation in paraplegics is to achieve optimal independence in everyday activities. Leading to the state in which the patient reaches the ability to move independently in a wheelchair is a great success for both the disabled and the entire medical team. [4,5]

### Rehabilitation - Bedside rehabilitation

In the acute period, covering the first 3 months after the occurrence of the injury, in addition to surgical and pharmacological treatment, prophylactic activity is also very important, reducing the risk of secondary changes in the body. Rehabilitation proceeding mainly involves bedside kinesitherapy: breathing exercises, passive exercises of affected limbs, and active or passive exercises of uninjured limbs. The main goal of the exercise is anti-decubitus and antithrombotic prophylaxis and as soon as possible to start the patient. [6,7]

In paraplegic rehabilitation, it is important to conduct breathing exercises, aimed at increasing chest mobility, improving the respiratory muscles, improving the efficiency of the entire respiratory system and preparing the patient for further rehabilitation. In patients with respiratory complications, rehabilitation includes appropriate preventive measures. Such methods include, for example: regular patting, allowing the support of expectoration of retained secretions, as well as the use of inhalation and the training of effective cough. Frequent changes in the patient's position, using appropriate drainage positions (in combination with patting), help patients to breathe. [5,6]

Rehabilitation in the acute period in people after URK begins with conducting passive exercise of affected limbs. One should remember about a large number of repetitions of movements within the physiological range. The purpose of doing exercises is to prevent the formation of contractures and muscles. Conducting passive exercises positively influences the work of the cardiovascular system, by facilitating the outflow of venous blood towards the heart, preventing the formation of swelling and improving skin trophics. Under the influence of exercises in the body paraplegics, there is an increase in the activity of physiological stimuli, reaching a given segment of the spinal cord and intervening in the change of the reflex response. [1, 8]

During exercise, remember about the muscle's flaccidity and the patient's lack of pain (do not move, over the physiological range). It is also important to have an acute bladder during the acute period. Therefore, it is necessary to use auxiliary means such as: sanitary pads, diapers, diaper pants and internal or external catheters. [4,6]

### **Postural therapy**

Between the exercises, it is important to take care of the patient's positioning positions and to change them every 2-3 hours during the day. The purpose of the position changes is to prevent the occurrence of troublesome in the treatment of pressure ulcers. In order to minimize the risk of articular contractures, appropriate physiological limb positions should be considered in all joints. It is advisable to use shapes, pillows and orthoses, most often worn overnight. [4,7]

## **Rehabilitation - early period - General improvement exercises**

The early period of rehabilitation covers the first year of spinal cord injury. This is the period of continuation of the ongoing kinesitherapy, with the inclusion of additional self-service exercises and general improvement exercises. Thanks to regular and appropriately directed rehabilitation of upper limbs in people with paraplegia, the chance for faster self-service in moving around on a wheelchair or with the use of other orthopedic equipment increases. The most important goal of rehabilitation is to improve the patient as soon as possible, in order to achieve this, the scope and difficulty of the exercises should be gradually increased. During this period, the purpose of rehabilitation is to achieve active verticalization of the patient (using a parapodium), learning to drive in a wheelchair and in the case of people with such opportunities - learning to walk. [9,10]

Self-assisted exercises used in patients with muscle strength according to the Lovett 0-2 scale, enable the patient to feel the movement. With the occurrence of trace muscle contraction, isometric exercises are carried out for the rehabilitation of paraplegics. The purpose of these exercises is to accelerate the strengthening of muscle strength, prevention of muscle wasting and muscle mass gain (in the case of the resulting disappearances). Conducting stretching exercises is aimed at maintaining muscle flexibility. With muscular strength above 3 degrees on the Lovett scale for active exercises, a gradual resistance is introduced. It is important to adjust the proper support as well as the muscle load. Exercises with resistance are very important in order to prepare the patient for later active uprightness. Examples of the resistance used, for example, may be the therapist's hand or the use of springs or weights. [10]

## **Verticalization and gait re-education**

One of the most important elements of rehabilitation in people with spinal cord injury is early verticalization, which has a positive effect on the course of treatment. By contacting the feet with the substrate, the patient's body is subject to axial loading of joint surfaces and long bones of the lower limbs and stimulation of the spinal cord. [10]

Conducting passive standing begins with the use of the patient's bed. The inclination of the head and chest gradually increases, going to a flat seat, and then to a flat sit with legs suspended off the bed. Vertical positioning is also used in verticalization. The ability to monitor heart rate and blood pressure during upright positioning is very helpful in controlling the therapy. In the case of orthostatic hypotension (sudden drop in blood pressure), it is

recommended to introduce pharmacological treatment and the use of compression stockings, placed on the lower limbs (improving blood circulation). [4]

Methods of supporting patient uprightization include the orthotic supply. The main objectives of the use of sourcing are to enable a safe position of sponging, preventing deformation of inactive limbs and enabling gait reeducation. The type of supply used depends on the level of spinal cord injury. In patients after trauma at the thoracic level, low-back strollers are most often used. However, in the case of people who have a lesion in the lumbar region of the core, it is possible to conduct learning in the so-called kangaroo walk. [11]

Among the orthotic equipment, passive and active supply is distinguished. Depending on the level of spinal cord injury, among the passive supplies, you can mention, for example: orthopedic footwear, ortosis stabilizing the limb in the hip, knee and ankle joints and paraplegia. However, the use of functional electrical stimulation and orthotic devices with an electric, hydraulic or pneumatic drive - so-called exoskeleton structures, is included in the group of active supply. [11]

In rehabilitation for passive and partially active upright positioning, a parapodium is used. It is a structure that stabilizes the lower limbs and torso, enabling to achieve and maintain a biased posture and moving in a limited space. Static and dynamic parapodium stand out. The first of them ensures stability of the torso during uprightization, by fitting special belts at the knee, pelvis and chest level of the patient. The wide base of the parapodium facilitates balance and a sense of security. [11,12]

The dynamic parapodium is equipped with additional wrist grips and a head stabilizing handle as well as wheels enabling movement in space (at the second person's belaying). The introduction of a dynamic parapodium for patient therapy is associated with many advantages. Enabling an upright position reduces the risk of contracture and spasticity, accelerates the healing of pressure ulcers, enables physiological loading of the bone and joint system, improves the physiological function of the digestive, excretory, cardiovascular and respiratory systems. The possibility of adopting a po- posed position can raise the patient's psychological state by providing energy and motivation for active participation in further rehabilitation. [11]

Before starting to learn to walk, it is very important to strengthen the patient overall. Great attention should be paid to the proper preparation of the muscles of the upper limbs and the shoulder girdle. The possibility of learning functional gait with appropriate orthopedic

equipment depends primarily on the amount of spinal cord injury. In the case of an injury below the Th6 segment, the patient, after having mastered the movement in a wheelchair - is completely independent. The people with spinal cord injury below Th12 level have greater chances of better movement with orthotic support. [11,12]

### **Neurogenic bladder therapy**

Among the methods of stimulating the provocation of automatic bladder emptying reflex, there are among others: upper thigh massage, irritation of the rectum, tapping of the suprapubic area and tightening of the abdominal muscles, carried out together with breathing exercises. It is important to introduce the science of self-curing into rehabilitation.

However, in the rehabilitation of people who have symptoms of autonomic bladder, the urinary retention status should be checked regularly, as well as the use of self-counseling learning. It is advisable to introduce abdominal muscle exercises and learn how to empty the bladder by exercising the pelvic floor muscles (according to Kegel) and using the abdominal press. [6]

### **Locomotion in a wheelchair**

Learning how to properly and effectively use a wheelchair is very important in the process of improving people after a spinal cord injury. It is advisable to choose appropriate techniques when moving, enabling the consumption of smaller energy resources. In order to improve the overall performance of a disabled person for rehabilitation, a gradual increase in the level of difficulty of the exercise through the use of resistance is introduced [11, 13].

It is important to choose the right trolley for the patient's life needs. The basic factors in the selection are: rolling resistance and air resistance, body weight, ease of maneuvering and patient's comfort. The wheelchair should be light, stable and returnable at the same time, enabling recreational, sports and social activity. Learning a disabled person to deal with activities such as: moving from bed to stroller and vice versa, riding in different terrain conditions, dealing with lifting after falling or negotiating driveways is very useful in achieving greater independence. Developing the correct technique of getting in and out of the wheelchair for people with disabilities is essential in everyday functioning. [11, 13]

## **Rehabilitation - late period**

The chronic period of rehabilitation lasts until the end of the disabled person's life. For people with paraplegia it is very important to achieve independence in everyday activities and to gain full fitness in moving on a wheelchair, in various terrain conditions. The fulfillment of these conditions is connected with the possibility of accelerating the acceptance process of disability and is a chance for an active life. [14]

## **Rehabilitation in spasticity**

Conducting rehabilitation in patients with URK who have spasticity is a major disadvantage. Before beginning the therapy, an in-depth examination should be performed, which includes, among others, superficial and deep feeling sensation, sense of perception, higher central nervous system function and examination of muscle tone (Ashworth scale and / or Tardieu scale). A further rehabilitation depends on the exact assessment of the patient's condition.

The use of the Bobath method in the rehabilitation of spasticity is focused on the regulation of muscle tone, by reducing muscle tone and replacing the pathological movement patterns - normal. This method ensures work with the patient in every starting position. It is advisable to combine several different methods, e.g. PNF or soft tissue therapy or manual therapy, to increase the effectiveness of action. [15]

Among the methods of combating spasticity, pharmacological treatment is used, having both advantages and disadvantages. Pharmacology helps patients reduce excessive muscle tension, however, it also involves an increased risk of side effects. With the passage of time from the start of taking oral medications, the risk of immunizing the body increases. The doses used cease to bring the expected effects, and their increase is associated with deterioration of the general condition of the patient. [11]

The physiotherapeutic treatment of spasticity also applies to temperature, electrostimulation, autogenous training, stretching, biofeedback, cortezes and exercises with the combination of early patient verticalization. The main goals in using the above-mentioned methods is to prevent deepening contractures, increase mobility in joints and stretch contorted muscles.

The effect of temperature has a significant impact on changes in muscle tone. Heat causes lowering of physical activity and muscle relaxation, while under the influence of cold (about 20 ° C), the reaction to passive stretching is reduced (up to 24 hours). To reduce spasticity, local cooling of the spinal cord is also used. [11]

Among the treatments from the electrotherapy department, the most commonly used are: tonolysis, biostimulation laser, magnetotherapy (low frequency), sollux lamp (blue filter) and cryotherapy. In the reduction of excessive muscle tension, the use of underwater massage, two- and four-chamber baths and exercises in the aquatic environment is also of great use. [4]

Medicine over time, introduces newer methods of fighting spasticity. There is great hope in surgical treatment, which may be systemic or central, including the spinal cord, peripheral nervous system or tendon-muscular system. [11]

### **Psychological rehabilitation**

In people after URK, sudden loss of mobility of the musculoskeletal system, allowing the correct posture, its change and the possibility of locomotion, is associated with the occurrence of a great psychic shock. A disability experience for every person is a traumatic event. Often entering into new, difficult living conditions is associated with a significant decrease in self-esteem and social withdrawal. Therefore, in the rehabilitation of psychological care - it is necessary. [13,16]

Achieving adaptation to new physical conditions is a long and difficult process, not always fully achieved by the patient. The problem of the lack of acceptance of your disability very often, has a negative effect on the effects of rehabilitation. However, for many people, finding a positive aspect of life, despite all the limitations associated with disability - is possible. [17,18]

In connection with the shocking event, which is the loss of a given life function, the initial period of disability is associated with the occurrence of the so-called shock phase, manifested in great pain, fear, despair and denial of reality. After some time, the person goes into a phase of indifference, apathy and depression. During this period, suicidal thoughts may often occur in patients. The next stage is the emergence of a defensive attitude, sudden opposition to loss of fitness through full mobilization of forces to fight. Due to the high motivation to exercise, this is a period during which a significant progress of rehabilitation can take place. Over time, the disabled person adapts and accepts his disability, begins to take an

active part in life, looking for new social and professional roles. Unfortunately, very often there is a situation in which a man "stops" at some point and does not want to accept the loss of his earlier life. [19]

Unfortunately, in our environment, for disabled people there are a lot of architectural barriers that make it impossible to achieve greater independence. Overcoming such difficulties, such as lack of a lift and a wheelchair ramp, a narrow door, a bathroom with a bath instead of a shower, no proper access to the toilet and many more, is a huge challenge for people living with disabilities. [13,19]

### **Sports of disabled people**

In the therapy of people with spinal cord injury, the role of sport plays a large role. For everyone, practicing physical activity has a positive effect on well-being and the psyche. The opportunity to take an active part in sports is very rewarding. The choice of sport discipline is an individual matter and depends on the patient's functional status. Practicing sports by people with disabilities may enable improvement of integration with the society, rebuild self-esteem and achieve a higher level of life independence. Unfortunately, taking up sporting activity in disabled people involves the necessity to overcome numerous difficulties, such as architectural barriers, unavailability of people supporting sports, learning each movement from the beginning or mental blockage. However, after overcoming many limitations, people with disabilities can become mentally stronger and more confident. [20,21]

The rehabilitation role of sport continues throughout the period of improvement of the functional state of the disabled person. At the moment when the maximum level of functional fitness (appropriate to the type of disability) is reached, practicing sports usually takes the form of recreation or competition. [22]

Popular sports practiced by people with disabilities include, for example, strength training (strengthening the upper limbs), table tennis (improving the coordination of movement), swimming (enabling exercise in relieving and increasing the muscular strength of the upper limbs), basketball, rugby, archery, fencing (balance and concentration exercises) as well as wheelchair racing and winter sports. [6]

Due to the difficulty in accepting new living conditions, people with disabilities very often find peace of mind in practicing physical activity. Sport is becoming their new way of life. [13]

## **Active Rehabilitation Foundation**

Introduced in 1988 in Warsaw - the Active Rehabilitation Foundation is a developmental organization, professional and social activation of disabled people. The FAR program complements the basic rehabilitation of people with disabilities, which bridge the gap between hospital life and later life in society. The Foundation is addressed to people over 16 who are permanently dependent on a wheelchair, and mobility problems are the basic barrier for them in an attempt to undertake physical activity.

For many people, participation in the FAR camps is a great opportunity to achieve their sporting goals. The main idea of the foundation is to enable people with disabilities to lead a dignified and full life in society by striving for maximum self-empowerment in the performance of basic self-service and locomotion activities. [13]

FAR methods are based on sports training, including learning wheelchair techniques and practicing sports such as wheelchair racing, cycling, basketball, fencing, table tennis, swimming, archery, rugby, boccia and many more. Camps cyclically taking place in 16 regions in Poland. Instructors are people with disabilities who have gained the ability to efficiently move on wheelchairs and lead an active lifestyle. In this way, they show their pupils the opportunity to achieve independence by living with disabilities.

Thanks to the foundation, the wheelchair has become an active pram model, and the rapid development of wheelchair sports encourages an increasing number of people with disabilities to start physical activity. The existence of the FAR has led to the development and modernization of many sports facilities, and thus, it has made it possible to overcome earlier architectural barriers. [13,23]

## **Summary**

People with paraplegia have to overcome many difficulties every day. The feeling of doubt, anxiety and fear resulting from the necessity to enter into new living conditions is a frequent occurrence. Therefore, conducting comprehensive rehabilitation is very important. Loss of control over the function of the bladder, the efficiency of the limbs, sexual organs and others is associated with the need for help from the other person. Non-self-reliance in everyday activities becomes a big psychological burden.

The work of the whole medical team: doctor, nurses, physiotherapist and psychologist is very important in the progress of treatment. The effectiveness of rehabilitation is influenced by such factors as: type of damage and location, occurrence of complications, presence of comorbidities, condition of the organism from before the injury and the degree of motivation and willingness to cooperate in the therapy.

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