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CEREBRAL PALSY: MEDICAL TECHNOLOGIES ARE IMPROVING, BUT THE PROBLEM REMAINS RELEVANT

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ABSTRACT. Despite the achievements of modern medicine, infantile cerebral palsy (ICP) currently remains one of the most pressing problems of both domestic and world health care, dominating in the structure of neurological disorders, leading to severe pathology of the movement system and disability. Often cerebral palsy is combined with other serious disorders of neurological and/or psychiatric nature, causing pronounced persistent limitations of physical abilities and a significant reduction in the quality of life of patients in all aspects. The purpose of this scientific review was to attract the attention of specialists in various areas of health care to the problem of cerebral palsy, as well as to substantiate the earliest necessary medication measures of therapeutic, rehabilitative and preventive profile. Provision of maximum possible, continuous medical care to such children will contribute to the reduction of disability, pronounced functional disorders, and prevent the development of serious complications. The result of early diagnosis and effective treatment can be considered the achievement of individually possible recovery or compensation of impaired functions with the prospect of integration into the surrounding society.

KEYWORDS: *cerebral palsy, etiopathogenesis, diagnosis, treatment, rehabilitation, prevention*

ДЕТСКИЙ ЦЕРЕБРАЛЬНЫЙ ПАРАЛИЧ: МЕДИЦИНСКИЕ ТЕХНОЛОГИИ СОВЕРШЕНСТВУЮТСЯ, АКТУАЛЬНОСТЬ ПРОБЛЕМЫ ОСТАЕТСЯ

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РЕЗЮМЕ. Несмотря на достижения современной медицины, детский церебральный паралич (ДЦП) в настоящее время остается по-прежнему одной из наиболее актуальных проблем как отечественного, так и мирового здравоохранения, доминируя в структуре неврологических нарушений, приводящих к тяжелой патологии системы движения и инвалидизации. Нередко ДЦП сочетается с другими серьезными расстройствами неврологического и/или психиатрического характера, обусловливает выраженные стойкие ограничения физических возможностей и значительное снижение качества жизни пациентов во всех аспектах. Целью настоящего научного обзора послужило привлечение внимания специалистов различных направлений здравоохранения к проблеме ДЦП, а также обоснование наиболее ранних необходимых медикаментозных мероприятий лечебного, реабилитационного и профилактического профиля. Оказание максимально возможной, непрерывной медицинской помощи таким детям будет способствовать снижению инвалидизации, выраженных функциональных нарушений, профилактировать развитие серьезных осложнений. Результатом ранней диагностики и эффективного лечения можно считать достижение индивидуально возможного восстановления или компенсации нарушенных функций с перспективой интеграции в окружающий социум.

КЛЮЧЕВЫЕ СЛОВА: *детский церебральный паралич, этиопатогенез, диагностика, лечение, реабилитация, профилактика*

Nowadays, cerebral palsy in children is a certain group of persistent neurological disorders that develop in the ante-, intra- or postnatal periods and are characterized by organic damage to the brain, in some cases combined with developmental anomalies of the brain. This subsequently leads, to gross defects and serious motor disorders if there is no timely and adequate treatment and rehabilitation.

Despite the fact that this pathology is considered non-progressive, specialists register a strong discrepancy between the constantly increasing demands of the environment on the motor activity of a sick growing child with significantly different parameters of psychomotor and physical development from healthy peers. Ultimately, as a result of irreversible functional and morphological changes in some patients, this ends with the inevitable formation of persistent and pronounced deviations from the norm in neurological profile with the registration of disability in childhood.

In some cases cerebral palsy is combined with severe diseases of the organs of vision and hearing, speech disorders, and is accompanied by decreased intelligence of varying degrees of severity, epilepsy, and other pathologies. These significantly worsens the condition and determines an unfavorable prognosis for health, acquisition of everyday skills, and, in the future, inclusion in educational and work processes, and communication in general.

The search for the most advanced treatment and rehabilitation measures dictates a detailed study of modern views on the etiology and pathogenesis, diagnosis and clinical picture of cerebral palsy [1–5]. The prevalence of cerebral palsy in modern world tends to increase, as evidenced by data from researchers in different countries studying this problem, amounting to 1.5 to 4 and higher per 1000 newborns. There is a direct relationship between the detection of the disease and weight of newborn children: 59.5 per 1000 children with a birth weight of less than 1500 g; 6.2 per 1000 children born with weight of 1500–2499 g; for newborns with weight of 2500 g and above, this value is 1.1 per 1000 children [6].

Perinatal pathology in the Russian Federation is diagnosed in approximately a quarter of the entire child population, while in the structure of neurological pathology leading to disability, cerebral palsy still leads, the prevalence of which is 2–2.5 cases per 1000 children; among all patients with cerebral palsy, about half are premature newborns [7].

According to domestic authors, the following prevalence rates of cerebral palsy are typical for Russia depending on the maturity and birth weight of a child:

- 1.6–6.0 per 1000 full-term newborns;
- 9.0–24.0 per 1000 premature newborns born with a birth weight of 1000–2500 g;
- 18.0–40.0 per 1000 newborns with very low birth weight (less than 1000 g) [8].

Thus, on the one hand, modern high technologies of nursing have increased the survival rate of extremely premature low birth weight babies, and on the other hand, such children have an increased risk of perinatal pathology with the subsequent development of cerebral palsy. So, the shorter the gestational age and the birth weight of the child, the more often cerebral palsy is diagnosed later. In particular, when a child is born before 28 weeks of gestation, the risk of developing cerebral palsy increases by 50 times, while in newborns born at 37–41 weeks, the risk of the disease is 10 times lower [6, 7].

The etiology and pathogenesis of cerebral palsy are currently being comprehensively studied. At the same time, researchers note the primary importance in the genesis of this disease of an unfavorable obstetric and gynecological history and brain damage to a newborn child in the coming months after birth.

When analyzing the age of mothers who gave birth, whose child was subsequently diagnosed with cerebral palsy, the following results were obtained: the majority of women were aged 19 to 30 years — 60.8%; 30 to 39 years — 29.2%; over 40 years — 3.1%; in the younger age group under 18 years of age there were 6.9% of expectant mothers [6].

In literary sources there are some researches on correlation between the birth of a child with cerebral palsy and multiple pregnancy. It was shown that when a pregnant women carrying four fetuses, cerebral palsy occurs in 43% of cases, and if there are triplets and twins — in 8 and 1.5%, respectively, while a singleton pregnancy was associated with a minimal risk of cerebral palsy — 0.2% [6].

The search for key links in the etiology and pathogenesis of cerebral palsy has substantiated the

consideration of causally significant factors depending on their presence in the early periods of a child's development.

Thus, among the causes of antenatal problems (37–60% of cases) as risks of developing motor disorders in the structure of cerebral palsy, maternal diseases of somatic and gynecological genesis, as well as stress and bad habits that complicate the course of pregnancy, are distinguished. Incompatibility of mother and child by blood group or Rh factor may be accompanied by fetal bilirubin encephalopathy with subsequent manifestation of hyperkinetic or dyskinetic syndromes.

Also, factors of damage to the central nervous system (CNS) of the fetus of various origins should be noted. For example, intrauterine infections, intoxications, hypoxic and metabolic disorders, which lead, depending on the timing and degree of exposure, to disturbances in the formation and development of the central nervous system organs, organic brain damage. The problem is especially aggravated by presence of combined genetic pathology [6–12].

In particular, it has been shown that when a pregnant woman becomes ill with a TORCH infection (toxoplasmosis, rubella, cytomegalovirus infection, and herpes infection), the potential risk of cerebral palsy in the child increases.

Such pathologies as neoplasms, uterine scars, morphological and functional disorders of the placenta, including premature placental abruption, chorioamnionitis, are potentially dangerous for the normal neurological development of the fetus.

The presence of antithyroid or antiphospholipid antibodies in a pregnant woman represents severe intoxication for the neurons of the fetus and can cause serious CNS disorders in the future.

Exposure of a pregnant woman to physical trauma can be combined with direct trauma to the fetus and also disrupt the delivery of oxygen and nutrients to the developing organism in utero [7].

Structures of the child's central nervous system, which is formed in utero, are very vulnerable, and throughout the entire pregnancy there is a risk for the formation of various pathologies, characterized by both morphologically diagnosed structural defects and disorders of the conduction system of CNS. Pathologies of structure and disturbances in conduction along the cortex may correspond to both hereditary and sporadic variants of formation.

In addition, fetal stroke of both hemorrhagic and ischemic origin deserves the attention of specialists. It is noted that pregnant women and fetuses have significantly more frequent occurrences of various types of coagulopathies responsible for the risk of hyper- or hypocoagulation during pregnancy [7].

The causes (27–40% of cases) that have a negative impact on the health of the fetus during the intranatal period are considered separately. The risk of developing cerebral palsy increases in cases of premature birth, fetal asphyxia during childbirth caused by the umbilical cord being wrapped around the neck, prolapse of the umbilical cord, amniotic fluid entering the fetus's respiratory tract, bleeding and other complications caused by premature placental abruption or placenta previa. The consequences of birth trauma and cerebral hemorrhages, including those resulting from the use of obstetric forceps and vacuum extractors, are extremely negative, as are the unfavorable consequences of infection directly during childbirth, which can subsequently lead to severe disturbances in the movement system [6–8].

Postnatal risks (3–25% of cases) are primarily represented by head injuries, various infectious diseases and intoxications, as well as oxygen deficiency.

Meningitis and encephalitis, neonatal seizures can result in persistent irreversible brain damage with severe neurological deficit and mental disorders [7, 8].

According to the majority of authors, the clinical manifestation of cerebral palsy usually requires the combined adverse effects of several pathological factors acting in different initial periods of the child's development [6].

Diagnosis of cerebral palsy still presents certain difficulties due to the variability of clinical manifestations and the gradual appearance of characteristic symptoms. However, early diagnosis and timely treatment and rehabilitation measures can significantly improve the health of patients. This is achieved as a result of partial restoration or compensation of impaired motor functions, which, as far as possible in each particular case, optimizes the further prognosis. Researchers emphasize that as a result of adequate, time- and volume-based, comprehensive rehabilitation, pathological

changes can undergo partial or even complete reversal. Specifically, infancy is the most promising period for rehabilitation measures for cerebral palsy, because there is a decrease in in the rehabilitation potential of an elder sick child with a noticeable decrease in the response to treatment, so it is very important not to miss the earliest time for treatment and rehabilitation programs [7].

For the diagnosis of cerebral palsy, it is important to correctly assess clinical symptoms in combination with available modern instrumental methods, using various tests to assess the motor sphere and cognitive functions [13–15].

An important role is played by a comprehensive assessment of health status based on the ICF (International Classification of Functioning) [16, 17].

The basis for the earliest assessment of the health status of children at risk of developing cerebral palsy are the doctor's knowledges of the characteristics of normal neuropsychic development in children of the first year of life.

It is customary to distinguish the following degrees of delay in the level of motor and psychomotor development in cerebral palsy: up to 3 months — mild degree, 3–6 months — moderate degree, over 6 months — severe degree [8].

Considering that about half of children with cerebral palsy are born prematurely, it is fair to introduce correction factors: up to 1 year of life, the period of prematurity in months is added; from 1 year to 2 years of life, it is recommended to add half the period of prematurity in months.

As is known, a clear sequence is typical for the development of the movement system of a healthy child: the extinction of unconditioned reflexes, formation of corrective (straightening) reflexes and improvement of balance reactions.

Researchers emphasize that an early manifestation of cerebral palsy is a violation of the timely reduction (at 2 months in full-term children, at 3–4 months in premature children) of unconditioned reflexes and postural reactions [8].

In addition, in patients with cerebral palsy, tonic reflexes may be present throughout life, which disrupts the development of corrective reflexes, voluntary movements, interferes with normal balance and ultimately results in a pathological postural stereotype in children. Changes in normal muscle tone are typical for such children, which should also alert doctors in terms of the development of cerebral palsy.

The presence of hypertonicity of muscles in children over 4 months in combination with an asymmetrical posture can lead to the development of spastic forms of cerebral palsy, while the frog pose observed with diffuse muscle hypotonia in premature babies may indicate the formation of an atonic-astatic form of cerebral palsy in the future [8].

Thus, the authors identify the following early manifestations of cerebral palsy in children: delayed psychomotor development, absence or delayed reduction of congenital reflexes and tonic reflexes against the background of delayed or absent formation of righting reflexes, which is accompanied by pathology of muscle tone and increased tendon reflexes, the emergence of pathological synkinesis and patological attitudes (flexion and pronation of the arms, adduction of the hip, etc.) [8].

Taking into account the above, it is fair to emphasize that nowadays there is no universal diagnostic algorithm for the early diagnosis of cerebral palsy. At the same time, a number of symptoms can and should attract the attention of doctors immediately after the birth in terms of alertness to the development of this serious disease: a low score on the Apgar scoring system, abnormal muscle tone and movements. Later, as the sick child grows and develops, the pathology of the motor sphere, compared to healthy peers, does not raise doubts among doctors [6].

Among the methods of paraclinical diagnostics, preference is currently given to magnetic resonance imaging of the brain, which is characterized by higher sensitivity compared to computed tomography of the brain and is capable of detecting brain damage at the earliest stages, namely: perinatal hypoxia, cerebrospinal fluid dynamics disorders, and anomalies of intrauterine brain development [6].

Magnetic resonance neuroimaging diagnoses periventricular leukomalacia, ventriculomegaly, areas of cerebral ischemia and hemorrhage [7].

Along with routine electroencephalography (EEG), specialists choose EEG video monitoring of night sleep, which allows for the most detailed assessment of the

Table 1. Medical and psychological diagnostics in cerebral palsy

Таблица 1. Медико-психологическая диагностика при детском церебральном параличе

Медико-психологическая диагностика при детском церебральном параличе / Medical and psychological diagnostics for cerebral palsy				**Иные методы исследования / Other research methods**
Медицинская диагностика / Medical diagnostics			Психологическая диагностика / Psychological diagnostics	Логопедическая диагностика / Speech therapy diagnostics
Осмотр врачами-специалистами / Examination by medical specialists	Лабораторная диагностика / Laboratory diagnostics	Инструментальная диагностика / Instrumental diagnostics	Осмотр медицинским психологом / Examination by a medical psychologist	Осмотр логопедом / Examination by a speech therapist
Педиатр / Pediatrician	Клинический анализ крови / Clinical blood test	Ультразвуковое исследование органов брюшной полости / Ultrasound of abdominal organs	Консультация / Consultation	Консультация / Consultation
Невролог / Neurologist	Биохимический анализ крови / Biochemical blood test	Ультразвуковая денситометрия / Ultrasound densitometry	Тестирование / Testing	Медико-логопедическое исследование при дисфагии / Medical and speech therapy examination for dysphagia
Травматолог-ортопед / Traumatologist-orthopedist	Общий анализ мочи / General urine analysis	Нейросонография / Neurosonography		Медико-логопедическое исследование при дизартрии / Medical and speech therapy examination for dysarthria
Офтальмолог / Ophthalmologist		Магнитно-резонансная томография головного мозга / Magnetic resonance imaging of the brain		
Врач по лечебной физической культуре / Physiotherapy doctor		Компьютерная томография головы / Computer tomography scan of the head		
Физиотерапевт / Physiotherapist		Электроэнцефалография: • с нагрузочными пробами; • с видеомониторингом / Electroencephalography: • with load tests; • with video monitoring		
		Электромиография: • игольчатая; • накожная одной анатомической зоны / Electromyography: • needle-like; • cutaneous of one anatomical zone		

Ending of the Table 1 / Окончание табл. 1

Медико-психологическая диагностика при детском церебральном параличе / Medical and psychological diagnostics for cerebral palsy				Иные методы исследования / Other research methods
		Электроэнцефалография / Electroencephalography		
		Стабиллометрия / Stabilometry		
		Рентгенография: • позвоночника; • головки и шейки бедренной кости / Radiography: • spine; • head and neck of the femur		

functional activity of the brain and identification of focal symptoms.

Depending on the concomitant pathology, children with cerebral palsy are prescribed consultations with specialists: a neurologist, surgeon, orthopedist, ophthalmologist, etc. [6].

Other neurophysiological studies: ultrasound diagnostics, electromyography, recording of evoked potentials in combination with laboratory paraclinical analyses, including biochemical analyses and genetic tests, and consultations with the necessary specialists help to promptly detect concomitant pathology, in particular, optic nerve atrophy, hearing loss and others, as well as diagnose genetic syndromes with manifestation in the first months of a child's life [7].

The scope of medical and psychological diagnostics for cerebral palsy depends on the specific clinical situation (Table 1) [3, 6].

In the structure of concomitant neurological pathology, more than a third of patients are diagnosed with convulsive syndrome, which is more often recorded in the hemiparetic form of cerebral palsy.

Psychiatric disorders are caused by cognitive impairments of various mental functions and occur in over 80% of patients with cerebral palsy. The authors note mental retardation, mental deficiency and speech disorders of varying severity. Only a third of children have normal intelligence. Sensory pathology is observed in approximately 2/3 of clinical cases [8].

According to researchers, concomitant diseases of the sensory organs, cognitive impairment, speech disorders and convulsive syndrome significantly complicate the course of cerebral palsy and seriously affect the quality of life of such children [7].

Thus, the earliest possible diagnosis of cerebral palsy during the first months of life, as well as the identification of concomitant pathology, are important for timely treatment and rehabilitation measures and the most favorable prognosis [8].

Due to the fact that the motor sphere is the central link in the pathology under consideration, the existing classifications of cerebral palsy, as a rule, reflect the characteristic motor disorders in this disease.

In scientific literature, classifications are presented with the allocation of both three and four variants of motor disorders. In the case of three categories, the following forms of cerebral palsy are noted:

- spastic – increased muscle tone and tendon reflexes (upper or lower paraparesis, tetraparesis, unilateral or bilateral hemiplegia);
- dyskinetic – impaired coordination and adequacy of muscle tone regulation (athetoid or hyperkinetic form);
- ataxic – with impaired coordination of voluntary movements (atonic-astatic or mixed forms of cerebral palsy) [7].

According to the classification of four forms, the authors describe: spastic, athetoid, ataxic and mixed variants of cerebral palsy.

However, in practice, specialists more often note spasticity as the dominant symptom, occurring in more than 80% of clinical cases and manifested by

increased muscle tone and tendon reflexes. Less frequently, a decrease in muscle tone with impaired coordination (ataxic form of cerebral palsy) is recorded, as well as instability of muscle tone (dyskinetic form of cerebral palsy). Nevertheless, all forms of cerebral palsy can be accompanied by pathological tonic reflexes, most pronounced when changing body position. In addition, attention is drawn to increased general reflex excitability, pathological synkinetic activity during voluntary movements, as well as pathological variants of coordinating interactions of synergist and antagonist muscles [7, 8].

Currently, according to the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10), it is customary to distinguish the following forms of cerebral palsy:

- G80.0 — Spastic cerebral palsy.
- G80.1 — Spastic diplegia.
- G80.2 — Infantile hemiplegia.
- G80.3 — Dyskinetic cerebral palsy.
- G80.4 — Ataxic cerebral palsy.
- G80.8 — Other cerebral palsy.
- G80.9 — Unspecified cerebral palsy.

Based on the Surveillance of Cerebral Palsy in Europe (SCEREBRAL PALSYE, 2000), the following forms of the disease are diagnosed:

- spastic paralysis — unilateral (hemiplegia), bilateral (diplegia, quadriplegia);
- dyskinetic — dystonic, choreoathetotic;
- ataxic.

In Russia, the classifications proposed by K.A. Semenova (1972) and L.O. Badalyan et al. (1988) are generally recognized among specialists.

The clinical classification of K.A. Semenova provides for the following forms of cerebral palsy: double hemiplegia, spastic diplegia, hemiparetic form, hyperkinetic form, atonic-astatic form, mixed forms.

It has been found that spastic forms of cerebral palsy account for about 90% of all clinical forms, and the percentage ratio of different variants of the disease deserves attention:

- spastic diplegia — 69.3%;
- hemiparetic form — 16.3%;
- atonic-astatic form — 9.2%;
- hyperkinetic form — 3.3%;
- bilateral hemiplegia — 1.9% [6].

According to the domestic classification of L.O. Badalyan et al., cerebral palsy variants are distributed by age periods as follows.

1. Early age corresponds to spastic forms (hemiplegia, diplegia, bilateral hemiplegia), dystonic form, hypotonic form.

2. Older age is characterized by spastic forms (hemiplegia, diplegia, bilateral hemiplegia), hyperkinetic form, ataxic form, atonic-astatic form, mixed forms (spastic-ataxic, spastic-hyperkinetic, ataxic-hyperkinetic) [6].

In addition, the authors defined the stages of development of cerebral palsy: the early stage lasts up to 45 months; the initial residual stage lasts from 6 months to 3 years; the late residual stage is observed in children over 3 years of age.

In scientific literature there is also a classification of cerebral palsy depending on the severity:

- mild — independent movement and mastering of self-care skills is possible;
- moderate — help is needed to move the sick child and to take care of himself;
- severe- the patient is completely dependent on the help of people around him.

Currently, various scales have been developed and are used in practice to objectively assess motor functions in patients with cerebral palsy.

The Gross Motor Function Measure (GMFM) was proposed in 1989 by D. Russell et al. Motor testing is performed from various starting positions: a) lying down and turning; b) sitting; c) crawling on knees; d) standing; e) while walking, running and jumping. Depending on the version, the scale is presented with 88 or 66 tests that can be independently completed by a healthy child aged 5 years. Testing time is from 45 to 60 minutes.

The Gross Motor Function Classification System (GMFCS) is a functional classification of cerebral palsy proposed in 1997 by R. Palisano et al. In this case, the level of motor development and limitations of motor activity in everyday life are taken into account, the functional capabilities of patients, and the need for special devices to perform movements are assessed. The classification includes 5 levels for 4 groups of children of different ages: up to 2 years; 2 to 4 years; 4 to 6 years; 6 to 12 years [6, 8].

The GMFCS-E&R classification was developed in 2007, adding an adolescent group from 12 to 18 years

old, taking into account the anatomical and physiological characteristics of this age period. It has been shown that after 12 years, a decrease in children's motor activity is recorded, which is due to intensive growth, active formation of contractures and significant inhibition of the development of new motor functions.

According to this classification, the following levels are provided:

- Level 1 — the child is able to move without restrictions and assistance;
- Level 2 — movement with restrictions, the child does not go outside the premises;
- Level 3 — the child moves using devices and assistive devices (walkers, sticks, crutches, orthoses);
- Level 4 — motorized means are needed for movement, since independent movement is sharply limited;
- Level 5 — the child's movements are completely dependent on others, transportation is carried out in a stroller or wheelchair [6, 8].

International criteria for assessing the functional state of children with cerebral palsy also include the Barthel index, modified for children under 4 years of age, the functional independence scale, modified Wee Fim for children over 4 years of age, the Manual Ability Classification System, and the Ashworth spasticity assessment scale.

Thus, the main clinical symptoms of cerebral palsy are disorders leading to pathology of motor function and coordination: paresis, spasticity, fine motor disorders, dystonic attacks, hyperkinesis. With prolonged illness and pronounced morphofunctional changes, serious complications develop, which include dislocations and subluxations of joints (in 2/3 of patients), foot deformities in over 80% of patients, contractures, pathological postural settings, deformities of joints and limbs, for the correction of which the surgical intervention may be used [7].

Drug treatment of cerebral palsy is exclusively symptomatic and is aimed at correcting a specific symptom or complication of the disease. The tasks of drug therapy include correcting muscle tone, preventing cicatrix and commissures, and improving the psychoemotional background [7].

Among pharmaceutical preparations, the following groups can be noted: nootropic and neurotrophic agents; preparations that restore cerebral hemodynamics and microcirculation; normalize metabolic processes in the nervous system, and also have reparative and resolving properties; anticonvulsants; preparations that correct muscle tone; agents for the treatment of hyperkinesis; general tonic preparations, including vitamin and microelement complexes [8].

In order to correct local and segmental spasticity of the lower and upper extremities, intramuscular administration of botulinum toxin type A preparation is indicated, which can reduce spasticity for up to 3–5 months. In Russia, botulinum therapy has been included in the treatment standards for cerebral palsy since 2004. Two preparations of botulinum toxin type A are registered for use in children over 2 years of age: Dysport for focal spasticity of the lower extremities and Botox for focal spasticity associated with dynamic foot deformity of the equine foot type [18–24].

Orthopedic treatment includes orthopedic shoes and insoles, verticalizers, reclinators, functional splints, tutors, and layings. This treatment helps to prevent contractures and is aimed at restoring the correct position of the limb.

Orthotics are an important part of the multidisciplinary rehabilitation program for patients with cerebral palsy and are performed in the form of semi-soft splinting. The main goals of using orthoses are to increase function, prevent deformations, maintain the joint in a functional position, stabilize the trunk and limb, selectively facilitate movement control, reduce spasticity, and protect the limb in the postoperative period.

Fixed contractures that develop as a result of long-standing muscle spasticity may be considered from the point of view of the appropriateness of surgical intervention. The most frequently used operations for cerebral palsy are tenotomise. The purpose is to return the limb to its normal supporting position as much as possible. In cases of severe symmetrical spasticity that does not respond to medication, accompanied by pain syndrome or joint complications, neurosurgeons recommend spinal rhizotomy to interrupt the transmission of pathological impulses from the spinal cord to the affected muscle groups. Also among the indications for surgical treatment are severe manifestations of scoliosis, pathology of the joints and feet [25, 26].

Taking into account very serious prognosis for the health and life of children with cerebral palsy due to the presence of limited health capabilities and disabilities, inevitably facing psychological trauma and lack of tolerance in society, especially with intact intelligence, patients need comprehensive assistance and support at all levels of treatment and rehabilitation, educational and upbringing processes, inclusion in educational and industrial organizations, and obtaining a profession. For this reason, in addition to health care workers, the active participation of a clinical psychologist, speech therapist, defectologist, occupational therapist and social workers is required [27, 28].

Comprehensive rehabilitation of patients with cerebral palsy includes medical, psychological, social, educational, training (with the formation of everyday skills), educational and work components [29, 30].

The program of rehabilitation treatment for children with cerebral palsy depends on the nature, severity and predominant localization of the lesion, as well as the presence of concomitant pathology [30, 31].

Under the guidance of a physical and rehabilitation medicine physician, a multidisciplinary team actively selects the most effective interventions and routing plan for a specific patient [32–40].

The complex of treatment and rehabilitation measures, along with drug-based therapeutic and surgical interventions, according to indications, includes methods of physical rehabilitation (therapeutic exercise, massage, mechanotherapy, physiotherapy, manual therapy, reflexology), psychological, pedagogical and speech therapy correction, including high-tech speech therapy using computer-controlled communication tools for patients with severe speech problems; psychotherapy, occupational therapy with elements of career guidance [41–43].

Great importance is given to the social and environmental adaptation of patients and psychological assistance to the family. Hippotherapy, canine therapy and dolphin therapy can be recommended, which have a positive effect on the psycho-emotional background and motor sphere.

Thus, the tasks of specialists still include a high degree of alertness in terms of early diagnosis and timely adequate treatment of cerebral palsy.

Today, only early effective and prolonged necessary medical interventions can provide significant assistance to patients with cerebral palsy, reduce the percentage of disability and severe functional disorders.

Comprehensive treatment, rehabilitation and preventive measures should further become an integral and important part of the lives of patients suffering from cerebral palsy.

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

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Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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