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Diagnosis of early spasticity in children with diseases of the peripheral nervous system.

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Abstract. Recent years are characterized by an increase in the representation of motor disorders in the general structure of lesions of the nervous system in childhood. One of the most common causes of severe damage to the motor system in children is polyneuritis..

Purpose of the study. To assess the possibility of early diagnosis of spasticity in children with diseases of the peripheral nervous system.

Materials and methods of research. Under observation were 109 children with diseases of peripheral nerves (89 with polyneuritis and 20 with plexalgia of various etiologies) aged 3 to 16 years, 50 girls and 59 boys, who made up the first group consisted of 22 children (11 boys and 11 girls) with HMSN type I; mean age - 12.3 ± 4.2 years.

Clinical research methods included the study of anamnesis, assessment of neurological, orthopedic, somatic statuses, ophthalmological, speech therapy, psychological and other special examinations. Standard laboratory, neuroimaging (CT and MRI) and neurophysiological examinations, accepted in a neurological clinic (ECHO-encephalography, EEG, etc.), were carried out.

Instrumental research methods included MRI-study and neurophysiological techniques - TMS and ENMG. MRI was performed on Broker Tomikon or Pinker tomographs. In all cases, the brain and, if indicated, the spinal cord were examined.

Research results. When conducting CT and MRI studies in children with PNS diseases, the following changes were found: 1) expansion of the ventricular system and subarachnoid spaces, as a rule, asymmetric - 49.5%; 2) local changes in the form of hemispheric cysts - 15.6%; 3) change in the density of the medulla in the periventricular region - 71.6%; 4) anomalies in the development of the brain in the form of micro- and pachygyria, hypoplasia and flattening of the corpus callosum, anomalies of Arnold-Chiari and Dandy-Walker, vascular malformations - 21.1%. When conducting TMS in patients with PNS diseases, the most striking changes were a decrease in the amplitude of the HME, a change in its shape, and, sometimes, an increase in its duration (Fig. 1). An increase in CMCT was also found, which was especially significant in children with PNS diseases. CMCT in the study of leg muscles exceeded the normative data by more than 3 standard deviations in 67% of patients in almost all age groups, which indicates a violation of the conduction along the cortico-spinal tract.

Conclusions: The registration of the ipsilateral response in patients with PNS diseases (in 58.3% in children with polyneuritis and in 70% with plexitis) is combined with the presence of severe paresis and the appearance of plus-symptoms

in the neurological status in the form of mirror movements in the unaffected limb and/or synergistic friendly movements on the side of hemiparesis.

Keywords: synergists; diseases of the peripheral nervous system; hemiparesis; equinus deformities; children

Relevance. Recent years are characterized by an increase in the representation of motor disorders in the general structure of lesions of the nervous system in childhood. One of the most common causes of severe damage to the motor system in children is polyneuritis.

Despite the large number of works devoted to the clinical, psychological, biochemical, morphological, neurophysiological and biomechanical aspects of the pathogenesis of this disease, the issues of accurate assessment of the motor abilities of children with lesions of the peripheral nervous system and their dynamics during treatment remain the most relevant, since movement disorders not only determine the clinical picture, but also significantly affect all areas of child development.

The most common articular manifestations are equinus deformities. Despite intensive conservative treatment, it is often necessary to resort to orthopedic-surgical correction.

However, dynamic monitoring of these patients shows that the fate of the operated children is relapses of equinovarus and even more severe deformities are formed. In this situation, the question arises, to what extent the aggravation of foot deformities is determined by the severity of spasticity and the violation of intermuscular interactions of certain muscle groups, or are other mechanisms included in the pathogenesis of the formation of foot deformities? In the literature there are only a few indications of the possibility of a combination of central suprasegmental influences - damage to the upper motor neurons (neuron-motor cortex or their axons) and peripheral segmental influences - damage to the lower motor neurons (neurons of the anterior horns of the spinal cord) disorders in diseases of the peripheral nervous system.

Purpose of the study. To assess the possibility of early diagnosis of spasticity in children with diseases of the peripheral nervous system.

Materials and methods of research.

Under observation were 109 children with diseases of peripheral nerves (89 with polyneuritis and 20 with plexalgia of various etiologies) aged 3 to 16 years, 50 girls and 59 boys, who made up the first group consisted of 22 children (11 boys and 11 girls) with HMSN type I; mean age - 12.3 ± 4.2 years.

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Statistical processing of materials was carried out using parametric and non-parametric research methods. Under observation were 109 children with diseases of peripheral nerves (89 with polyneuritis and 20 with plexalgia of various etiologies) aged 3 to 16 years, 50 girls and 59 boys, who made up the first group consisted of 22 children (11 boys and 11 girls) with HMSN type I; mean age - 12.3 ± 4.2 years.

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Research results.

When conducting CT and MRI studies in children with PNS diseases, the following changes were found: 1) expansion of the ventricular system and subarachnoid spaces, as a rule, asymmetric - 49.5%; 2) local changes in the form of hemispheric cysts - 15.6%; 3) change in the density of the medulla in the periventricular region - 71.6%; 4) anomalies in the development of the brain in the form of micro- and pachygyria, hypoplasia and flattening of the corpus callosum, Arnold-Chiari and Dandy-Walker anomalies, vascular malformations - 21.1%.

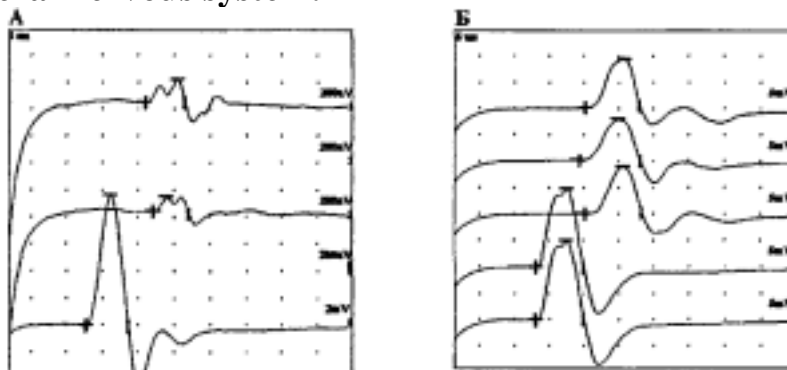
Table 1. The frequency of occurrence of the main symptoms in patients with lesions of the peripheral nervous system.

| Symptom | Number of patients | % |
|------------------------|--------------------|------|
| dysarthria | 47 | 52,8 |
| labyrinth tonic reflex | 49 | 55,1 |

| | | |
|---|----|------|
| Symmetric neck tonic reflex | 17 | 19,1 |
| The strength of individual muscles in the legs is less than 3 points | 49 | 55,1 |
| Coordinating Disorders | 43 | 48,3 |
| Pathological hand and foot signs | 79 | 88,7 |
| Pathological synergies (bright tibial synkenesis and global extensor synergy) | 46 | 51,7 |
| A sharp increase in muscle tone | 54 | 60,6 |
| independent walking | 48 | 53,9 |
| Walking with extra support | 31 | 34,8 |
| Equinovarus foot deformity | 43 | 48,3 |

When conducting TMS in patients with PNS diseases, the most striking changes were a decrease in the amplitude of the HME, a change in its shape, and, sometimes, an increase in its duration (Fig. 1). An increase in CMCT was also found, which was especially significant in children with PNS diseases. CMCT in the study of leg muscles exceeded the normative data by more than 3 standard deviations in 67% of patients in almost all age groups, which indicates a violation of the conduction along the cortico-spinal tract.

Rice. 1. WMO m. Abductor pollicis brevis in TMS and stimulation of the spinal cord roots at the C-VII level in a 15-year-old child with lesions of the peripheral nervous system.



When conducting TMS in children with polyneuritis, a decrease in the level of excitability of cortical motor neurons was revealed. The registration thresholds for WMO were significantly increased up to +10% ($p < 0.05$) when testing m. abductor

pollicis brevis and +19% ($p < 0.001$) when registering a response with m. abductor hallucis.

Thus, in patients with polyneuritis, changes in the projection of the muscles of the lower extremities predominated.

In the study of patients with plexitis, a relatively similar increase in the MRT thresholds was observed when testing the muscles of the arms (up to + 22%) and legs (up to + 25%). An increase in the threshold for registration of WMO was noted not only in children with plexitis, but also in patients with polyneuritis, which indicates damage to the spinal cord in both groups of patients with PNS diseases.

Activation of the collateral pathways was characteristic of the majority of patients with PNS and manifested itself in a sharp accentuation of the ipsilateral response, which was not observed in healthy children older than 10 years.

In children with polyneuritis, when testing the arm muscles, ipsilateral WMO was recorded in 58.3%. Moreover, its representation on the clinically worst side was always higher.

In children with plexitis on the affected side, ipsilateral WMO was obtained in 70% of cases, while on the unaffected side it was detected only in 15%.

All children with a clear ipsilateral WMO on the affected arm tended to have severe hemiparesis. The presence of an ipsilateral response in patients with PNS was usually combined with neurological plus symptoms in the form of mirror movements in the unaffected limb and/or synergistic friendly movements on the side of hemiparesis. Thus, the analysis of the parameters of the ipsilateral response makes it possible to interpret the fact of its registration as a criterion for an unfavorable prognosis for the compensation of movement disorders.

During TMS, a violation of the mechanisms of interhemispheric interaction was also revealed, which was found in the absence of transcallosal inhibition in 65% of patients with PNS diseases. In those cases (35%) where this physiological phenomenon was registered, a sharp shortening of the duration of the period of transcallosal inhibition was noted.

Conclusions. Registration of the ipsilateral response in patients with PNS diseases (in 58.3% in children with polyneuritis and in 70% with plexitis) is combined with the presence of severe paresis and the appearance of plus-symptoms in the neurological status in the form of mirror movements in the unaffected limb and / or synergistic friendly movements on the side of hemiparesis. The presence of an ipsilateral response is a criterion for an unfavorable prognosis of compensation for motor disorders.