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PREVENTIVE DETECTION OF NEUROLOGICAL DISORDERS IN PREMATURE NEWBORNS: CLINICAL-DIAGNOSTIC AND EVALUATION CRITERIA

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Abstract: Premature birth remains one of the leading problems of modern perinatology, accounting for 5-18% of all births in various countries of the world. Premature newborns represent a high risk group for neurological disorders, the frequency of which is inversely proportional to gestational age and birth weight. The immaturity of the central nervous system in premature infants causes their increased vulnerability to various pathological influences during the perinatal period. Hypoxic-ischemic brain lesions, intraventricular hemorrhages, periventricular leukomalacia, infectious complications, and metabolic disorders can lead to the formation of persistent neurological deficits, including cerebral palsy, epilepsy, visual and auditory impairments, and cognitive impairments.

Key words: premature newborns, neurological disorders, intraventricular hemorrhages, neurological scales, electroencephalography

Introduction. The problem of cerebral disorders In newborns and premature babies, according to researchers, cerebral disorders have been observed over the past decades, which are considered socially significant in pediatric neurology. Thus, according to foreign studies, lesions of the central nervous system occupy a leading position in disability among premature newborns, especially children with extremely low and very low birth weight. Despite the introduction of modern care technologies and intensive therapy, the frequency of cerebral injuries in this category of patients remains consistently high, and their long-term consequences often determine the formation of motor, cognitive, and behavioral disorders in childhood. In world literature, significant attention is paid to the study of the pathogenetic mechanisms of cerebral disorders in premature newborns, including hypoxic-ischemic damage, intraventricular and periventricular hemorrhages, cerebral hemodynamic disturbances, inflammatory and metabolic factors. A number of authors have shown that the immaturity of the vascular bed and the white matter of the brain in premature infants causes a high sensitivity to perinatal damaging effects and the formation of diffuse and focal cerebral changes in the early neonatal period. At the same time, it is emphasized that the clinical manifestations of cerebral disorders are often blurred and polymorphic, which complicates their timely diagnosis and early correction. There are works by authors identifying the high prevalence of cerebral disorders in premature newborns and their significant role in the formation of an unfavorable neurological prognosis. Research emphasizes the importance of a comprehensive clinical and diagnostic approach using neurosonography, Doppler assessment of cerebral blood flow, and dynamic clinical and neurological monitoring for early verification of central nervous system damage. However, despite the accumulated experience, the issues of systematizing clinical and diagnostic data and in-depth analysis

of the pathogenetic mechanisms of cerebral disorders in premature newborns remain insufficiently developed.

In our country, the problem of cerebral disorders in premature newborns is becoming particularly relevant due to the persisting proportion of premature births and the need to improve early diagnosis and prevention of neurological complications. Domestic studies are mainly devoted to the clinical aspects of perinatal CNS damage, while a comprehensive assessment of the clinical, diagnostic, and pathogenetic characteristics of cerebral disorders in premature newborns is presented in fragments and requires further in-depth study. Consequently, the high prevalence of cerebral disorders in newborns and premature infants, their complex and multifactorial pathogenesis, the polymorphism of clinical manifestations, and insufficient systematization of clinical, diagnostic, and pathogenetic data in domestic and regional literature determine the relevance of this study.

The aim of the study is to study the clinical, diagnostic, and pathogenetic features of cerebral disorders in newborns and premature infants for the early verification of central nervous system damage in the early neonatal period.

Research material and methods. The study included patients with clinical manifestations of cerebral disorders who had a history of premature birth and low birth weight, who were observed in outpatient and inpatient settings at the Multidisciplinary Clinic of Samarkand State Medical University (birth complex, neonatal pathology department, pediatric neurology department). The total number of examined children was n=52 between the ages of 0 and 1 year. The study group included patients of both sexes: boys - 28 (53.8%), girls - 24 (46.2%).

The inclusion criteria in the study were: premature birth (gestational age less than 37 weeks), low birth weight, the presence of clinical and neurological signs of central nervous system damage in the early neonatal and postneonatal periods, as well as established diagnoses according to ICD-10: P91.0-P91.9 (other disorders of cerebral status in newborns), P52 (intraventricular hemorrhages), P57 (nuclear jaundice), G93.4 (encephalopathy unspecified). The exclusion criteria were: congenital malformations of the central nervous system, chromosomal syndromes, hereditary neurometabolic diseases, severe congenital infections (TORCH), as well as parents' refusal to participate in the study.

Depending on the severity of the central nervous system damage, patients were divided into groups: mild degree of cerebral disorders - 18 children (34.6%), moderate degree in 20 children (38.5%), severe degree was noted in 14 children (26.9%).

The control group consisted of 25 relatively healthy children of comparable age who underwent preventive examination in outpatient settings; participation was carried out with the written informed consent of parents.

Additionally, children in the main group were distributed according to the degree of prematurity: moderate prematurity was detected in 22 children (42.3%), deep prematurity in 18 cases (34.6%), and extreme prematurity in 12 children (23.1%). Based on the level of birth weight, the following subgroups were identified: low birth weight (1500-2499 g) 24 (46.2%), very low birth weight (1000-1499 g) 18 (34.6%), and extremely low birth weight (<1000 g) 10 (19.2%).

Taking into account the etiological factors of premature birth, it was established that the most frequent causes were: intrauterine hypoxia and placental insufficiency in 21 cases (40.4%), maternal infectious and inflammatory diseases in 14 examined women (26.9%), extragenital pathology (anemia, diseases of the cardiovascular and endocrine systems) in 10 cases (19.2%), multiple pregnancy and obstetric complications in 7 cases (13.5%).

The Apgar score at the 1st minute of life was: 4-5 points in 16 examined children (30.8%), 6-7 points in 22 cases (42.3%), 8 points and higher in 14 (26.9%), which reflected the varying severity of perinatal adaptation and the risk of developing cerebral disorders.

The study was conducted using a comprehensive clinical, instrumental, and functional approach, with a focus on the early detection and stratification of cerebral disorders in newborns and premature

infants. All patients in the main and control groups underwent a comprehensive clinical and neurological examination, assessing their general somatic condition, level of consciousness, the nature of spontaneous motor activity, muscle tone, impaired activity, and autonomic reactions. The clinical features of central nervous system damage were analyzed differentially depending on the severity of cerebral disorders (mild, moderate, and severe forms), with subsequent comparison of the obtained indicators with the data of the control group.

Particular attention was paid to the analysis of the reflex sphere, including the assessment of innate (primitive) reflexes: searching, sucking, proboscis, palm-mouth, Moro, support and automatic walking, crawling, Robinson grasping reflex, as well as protective and tonic reflexes. The timing of the appearance, symmetry, degree of severity, exhaustion, and timeliness of the extinguishing of reflexes were assessed. The established reflex characteristics were compared with the level of gestational immaturity, birth weight, and severity of cerebral disorders, which made it possible to identify early clinical markers of central nervous system dysfunction.

To standardize the quantitative assessment of neurological status, age-specific scales adapted for premature newborns and children of the first year of life were used: the Hammersmith Neonatal Neurological Examination (HNNE) scale, the General Movements Assessment (GMA) scale for the analysis of spontaneous motor skills, as well as the modified Dubowitz scale. In the postneonatal period, the elements of the INFANIB scale were additionally used to assess motor development and the risk of developing motor disorders. The results of the scaled examination were analyzed by groups and compared with clinical and instrumental data, with the indicators of the control group.

Research results. The results of the analysis of the clinical and neurological status of newborns and premature infants in the main group showed that in the group of children with mild CNS damage, functional changes in the form of moderate muscle hypotonia or dystonia, unstable vegetative lability, and short-term sleep disturbances prevailed; these manifestations were registered in 66.7% of patients in this subgroup and were, as a rule, transient in nature. In the group with moderate cerebral disorders, depression syndrome, persistent muscle tone disorders, delayed postural reaction formation, and pronounced vegetative disorders were significantly more frequently detected, which was observed in 75.0% of the examined children. In patients with a severe degree of central nervous system damage, gross neurological syndromes dominated, including pronounced suppression of spontaneous motor activity, persistent pathology of primitive reflexes, convulsive readiness, and signs of stem structure dysfunction, which were registered in 85.7% of children in this group. Whereas, in the control (comparison) group, clinical and neurological indicators corresponded to age norms. Data on the control of the reflex sphere revealed that in children with mild cerebral disorders, a slight delay in the extinguishing of primitive reflexes was noted in 38.9% of patients, while with a moderate degree of damage, asymmetry and exhaustion of reflexes were registered in 60.0%, while in children with a severe degree, persistent preservation of pathological reflexes was noted and their dissociation was detected in 78.6%.

According to the HNNE scale, a significant decrease in the total score was established as the severity of cerebral disorders increased. At the same time, in children with a mild degree of damage, the average values corresponded to the lower limit of the age norm (28.4±2.1 points), with a moderate degree, a significant decrease was noted (23.7±2.8 points, $p<0.05$), while with a severe degree, the values were in the zone of pronounced neurological dysfunction (18.9±3.2 points, $p<0.01$). In the control group, the HNNE indicators were 31.6±1.9 points.

The GMA scale indicators showed that normal generalized movements predominated in 72.2% of children with mild degrees of the disease, while in moderate degrees, poor and monotonous movements were more frequently recorded (65.0%), and in severe cases, pathological patterns with no variability (78.6%) prevailed. In the control group, 92.0% of children's movements corresponded to physiological age characteristics.

Assessment according to the INFANIB scale in the postneonatal period revealed an increased risk of developing motor disorders in children with moderate and severe cerebral changes. The average values

of the scale in the main group were 64.3±6.1 points, while in children with severe damage, the risk of pathological motor development was noted in 71.4% of cases, while in the control group, the indicators were within the normal range (82.7±4.5 points).

Statistical analysis revealed and established significant relationships and strong negative correlations between HNNE scores and the severity of cerebral disorders ($r=-0.71$; $p<0.01$), as well as between the quality of generalized movements according to GMA and the severity of clinical syndromes ($r=-0.68$; $p<0.01$). Preservation of pathological primitive reflexes reliably correlated with low INFANIB values (V Kramer = 0.62; $p<0.05$).

Significant predictors of severe central nervous system damage were identified: extreme prematurity, low Apgar score at the 1st minute of life, pathological nature of generalized movements according to GMA, persistent disorders of the reflex sphere, and pronounced vegetative dysfunction. The combined assessment of these indicators allowed for the formation of an early prognostic profile of the risk of severe cerebral disorders in newborns and premature infants.

Conclusions

1. Cerebral disorders in newborns and premature infants are characterized by pronounced clinical and neurological polymorphism, the degree of which increases as the severity of the central nervous system damage increases and is due to gestational immaturity, low birth weight, and adverse perinatal factors.
2. It has been established that in mild cerebral disorders, functional and transient changes predominate, while in moderate and severe cases, persistent muscle tone disorders, pathological changes in the reflex sphere, suppression of spontaneous motor activity, and pronounced vegetative dysfunction predominate.
3. The use of age-specific scales (HNNE, GMA, INFANIB) allows for an objective assessment of the degree of central nervous system damage in premature newborns and the identification of early markers of an unfavorable neurological prognosis, inaccessible during a standard clinical examination.
4. A comprehensive clinical-scale approach with an integrative assessment of motor, reflex, and autonomic indicators has high diagnostic and prognostic significance, which determines its novelty and justifies the feasibility of introducing early diagnosis of cerebral disorders in newborns and premature infants into practice.

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