

INDICATORS OF COGNITIVE AND PSYCHOMOTOR DEVELOPMENT IN YOUNG CHILDREN WITH CONGENITAL HEART DEFECTS**S. B. Tairova, A. T. Djurabekova, L. A. Mukhamadieva**

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Ключевые слова: врожденные пороки сердца, дети раннего возраста, когнитивное развитие, нейрофизиология.**Tayanch soʻzlar:** tugʻma yurak nuqsonlari, yosh bolalar, kognitiv rivojlanish, neyrofiziologiya.**Key words:** congenital heart defects, young children, cognitive development, neurophysiology.

Congenital heart defects are a leading cause of congenital pathology in children and are a significant cause of morbidity, disability, and mortality in pediatric practice. In recent decades, advances in cardiac surgery have significantly improved the survival rate of children with congenital heart defects, leading to an increase in the number of patients with late neurological and cognitive impairments. Recent researches show that children with congenital heart defects often develop impairments in higher mental functions, including delayed cognitive and psychomotor development, speech disorders, attention deficit, and behavioral problems. The incidence of such impairments reaches 40–70%, making this problem extremely pressing.

TUGʻMA YURAK NUQSONLARI BOʻLGAN YOSH BOLALARDA KOGNITIV VA PSIXOMOTOR RIVOJLANISH KOʻRSATKICHLARI**S. B. Tairova, A. T. Djurabekova, L. A. Muxamadiyeva**

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Tugʻma yurak nuqsonlari bolalarda tugʻma patologiyalar tuzilishida yetakchi oʻrinlardan birini egallaydi va pediatriya amaliyotida kasallanish, nogironlik hamda oʻlimning muhim sabablaridan biri hisoblanadi. Soʻnggi oʻn yilliklarda kardioxirurgiya yutuqlari tufayli tugʻma yurak nuqsonlari boʻlgan bolalarning tirik qolish darajasi sezilarli darajada oshdi, bu esa uzoq muddatli nevrologik va kognitiv buzilishlarga ega bemorlar sonining koʻpayishiga olib keldi. Zamonaviy tadqiqotlar shuni koʻrsatmoqdaki, tugʻma yurak nuqsonlari bor bolalarda oliy psixik funksiyalar buzilishlari koʻp hollarda shakllanadi, jumladan kognitiv va psixomotor rivojlanishning kechikishi, nutq buzilishlari, diqqat yetishmovchiligi va xulq-atvor buzilishlari kuzatiladi. Bunday buzilishlar chastotasi 40–70% gacha yetadi, bu esa ushbu muammoni nihoyatda dolzarb qiladi.

ПОКАЗАТЕЛИ КОГНИТИВНОГО И ПСИХОМОТОРНОГО РАЗВИТИЯ У ДЕТЕЙ РАННЕГО ВОЗРАСТА С ВРОЖДЕННЫМИ ПОРОКАМИ СЕРДЦА**С. Б. Таирова, А. Т. Джурабекова, Л. А. Мухамадиева**

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Врожденные пороки сердца занимают одно из ведущих мест в структуре врожденной патологии у детей и являются значимой причиной заболеваемости, инвалидизации и смертности в педиатрической практике. В последние десятилетия благодаря достижениям кардиохирургии существенно повысилась выживаемость детей с ВПС, что привело к увеличению числа пациентов с отдалёнными неврологическими и когнитивными нарушениями. Современные исследования показывают, что у детей с врожденными пороками сердца часто формируются нарушения высших психических функций, включая задержку когнитивного и психомоторного развития, речевые расстройства, дефицит внимания и поведенческие нарушения. Частота таких нарушений достигает 40–70%, что делает данную проблему крайне актуальной.

Introduction. Congenital heart defects (CHD) are among the most common forms of congenital pathology in children and are associated with a high risk of developing neurological and cognitive impairments [2,7]. In recent years, despite significant improvements in the outcomes of cardiac surgical treatment, the study of long-term neuropsychological consequences in children with CHD has become increasingly relevant [3,4]. Early childhood is a critical period for the formation of the central nervous system, during which any adverse factors, including chronic hypoxia and disturbances of systemic hemodynamics, may lead to delays in cognitive, speech, and motor development [5,6]. It has been established that children with CHD already exhibit deviations in the development of higher mental functions before the age of 2 years, including reduced cognitive performance, impaired speech development, and delayed motor skills [5,8].

Neurophysiological research methods are of particular importance, as they allow the identification of early signs of functional immaturity and dysfunction of the central nervous system. According to electroencephalography data, children with CHD often demonstrate diffuse changes in bioelectrical activity, delayed formation of cortical rhythms, and signs of dysfunction of midline brain structures, reflecting a slowing of neuronal maturation processes [6,9]. As shown in the present study, young children with congenital heart defects exhibit significant impairments in cogni-

tive, speech, and motor development, as well as pronounced changes in neurophysiological parameters.

Despite the available data, a comprehensive assessment of cognitive and neurophysiological indicators in young children with CHD remains insufficiently developed, which determines the need for further research in this area [1,5].

Thus, the study of cognitive, psychomotor, and neurophysiological development in children with congenital heart defects is a relevant task in modern pediatrics and neurology and is of great importance for the early diagnosis and prevention of developmental disorders.

The aim of the present study is to assess the indicators of cognitive, speech, and psychomotor development in young children with congenital heart defects, as well as to investigate neurophysiological changes in the central nervous system based on electroencephalography data.

Materials and methods. The study was conducted at Samarkand State Medical University and specialized medical institutions of the Samarkand region. The work had a comparative clinical-neurophysiological design and was aimed at assessing cognitive, speech, and psychomotor development, as well as the functional state of the central nervous system in young children with congenital heart defects.

The study included children aged 12–23 months. The main group consisted of 93 children with congenital heart defects, while the control group included 32 clinically healthy children matched for age and sex. Group formation was performed according to inclusion and exclusion criteria, ensuring homogeneity and comparability.

Neuropsychological development was assessed using the standardized Bayley Scales of Infant and Toddler Development (Bayley-III), which allow quantitative evaluation of cognitive, speech, and motor components of development. The analysis included cognitive, language, and motor indices.

The functional state of the central nervous system was evaluated using electroencephalography (EEG), with analysis of the brain's bioelectrical activity, including assessment of diffuse changes, cortical rhythm maturation, presence of paroxysmal activity, and signs of midline structure dysfunction.

Statistical analysis was performed using IBM SPSS Statistics software. Quantitative variables are presented as mean $\pm$ standard deviation ($M \pm \sigma$). Differences between groups were assessed using Student's t-test, while categorical variables were analyzed using the chisquare (χ^2) test. A p-value of $<0,05$ was considered statistically significant.

Results and Discussion. The assessment of cognitive, speech, and motor development in young children was carried out using the Bayley Scales of Infant and Toddler Development (Bayley-III), which allow for quantitative evaluation of the main domains of neuropsychological development.

The analysis of cognitive and psychomotor development indicators in Group I children (Table 1) demonstrated statistically significant differences between the main and control groups across all studied parameters. Thus, the cognitive index in children with congenital heart defects was $86,2 \pm 9,8$ points, which was significantly lower compared to the control group ($98,4 \pm 7,6$ points; $p < 0,001$). This reduction indicates early impairments in cognitive functioning, including processes of perception, attention, and basic thinking.

Speech development in the main group was also characterized by a significant delay: the mean language index was $83,5 \pm 10,6$ points versus $96,2 \pm 8,3$ points in the control group ($p < 0,001$).

This indicates a delay in the development of both receptive and expressive language, which is an important marker of impaired neuropsychological development. Motor development indicators in children with CHD were also reduced ($88,1 \pm 9,2$ points) compared to the control group ($99,1 \pm 6,9$ points; $p < 0,001$), reflecting delayed formation of both gross and fine motor skills.

1 table.

Indicators of cognitive and psychomotor development in young children depending on the presence of congenital heart defects (CHD), ($M \pm \sigma$).

Indicator	MG (n=93)	CG (n=32)	p
Cognitive index	$86,2 \pm 9,8$	$98,4 \pm 7,6$	$<0,001$
Language index	$83,5 \pm 10,6$	$96,2 \pm 8,3$	$<0,001$
Motor index	$88,1 \pm 9,2$	$99,1 \pm 6,9$	$<0,001$

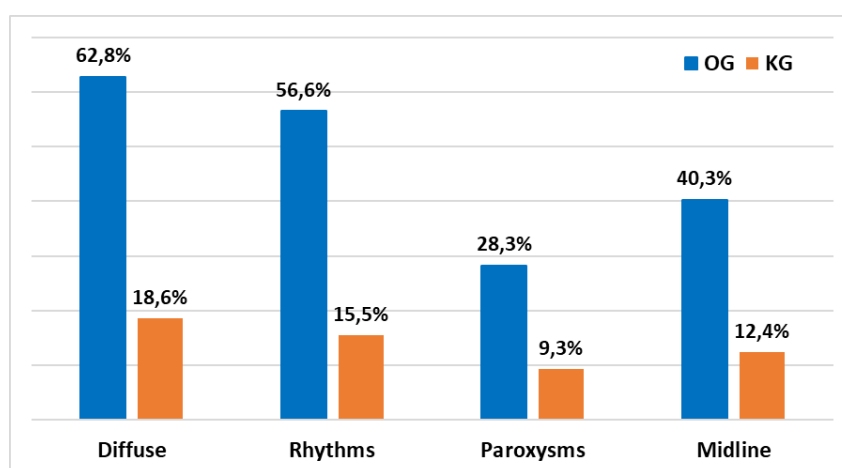


Fig. 1. EEG indicators in young children depending on the presence of congenital heart defects (CHD).

Analysis of electroencephalography and neurosonography data (Fig. 1) revealed significant differences between children with congenital heart defects and clinically healthy children, reflecting pronounced functional and structural changes in the central nervous system. According to EEG data, diffuse changes in the brain's bioelectrical activity were significantly more frequently recorded in the main group (62,8% vs 18,6%; $p < 0,001$), indicating functional

immaturity and cortical dysfunction. Delayed formation of age-appropriate cortical rhythms was observed in 56.6% of children with CHD, which was significantly higher than in the control group (15,5%; $p < 0,001$).

This reflects a delay in the maturation processes of the central nervous system under conditions of chronic hypoxia. Paroxysmal activity was observed in 28.3% of patients in the main group compared to 9.3% in the control group ($p < 0,01$), indicating increased cortical excitability. Signs of dysfunction of midline structures were also significantly more frequently detected in children with CHD (40,3% vs 12,4%; $p < 0,001$).

Conclusions:

1. In young children with congenital heart defects, a significant reduction in cognitive, speech, and motor scores was revealed according to the Bayley-III scales compared to healthy peers.

2. Cognitive impairments in children with CHD are manifested by reduced cognitive performance, delayed speech development, and impaired motor skills, indicating a delay in the formation of higher mental functions.

3. According to electroencephalography data, children with CHD show significantly more frequent diffuse changes in bioelectrical brain activity and delayed formation of cortical rhythms, reflecting functional immaturity of the central nervous system.

4. Patients with congenital heart defects demonstrate a higher frequency of paroxysmal activity and signs of midline structure dysfunction, indicating increased excitability and impaired regulatory brain mechanisms.

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