THE PHYSICAL DEVELOPMENT OF CHILDREN WITH CONGENITAL HEART DEFECTS, DEPENDING ON THE METHODS OF THEIR MANAGEMENT

[1]**Abduraxmanova D.F.**, [2]**Akramova Kh.A.**
Tashkent Pediatric Medical Institute, Uzbekistan
https://doi.org/10.5281/zenodo.10279651

Abstract. Congenital heart defects (CHD) are an important problem in pediatrics due to their high prevalence and the need for early surgical correction due to significant health disorders and disability in children (Bokeria L.A., Sarsenbayeva G.I., 2008; Gadaeva A.C., 2011).

About 1.5 million children with CHD are born annually in the world [3,7]. According to the European Registry of Congenital Abnormalities and Twins (EUROCAT), for the period 2010-2014, the prevalence of CHD was 8.1, including severe forms — 2.2 per 1000 newborns [7.9]. CHD remains one of the leading causes of infant mortality, ranking second. In the perinatal period, CHD causes 2.5% of deaths (0.25 cases per 1000 births), 6-11% of deaths in the first year of life and about 50% of deaths associated with congenital malformations.

In Uzbekistan, the birth rate of children with congenital heart defects ranges from 5.5 to 12.7 people per 1000 live births [8]. The frequency of CHD depends on the development of the country's healthcare system or the diagnostic methods available to the doctor. (Epidemiology and risk factors for the development of congenital heart defects in children. 2023.)

Keywords: congenital heart disease, children, physical development, cardiac surgery, anamnesis.

The purpose of the study. To optimize the methodology of preoperative management of young children with congenital heart defects based on an assessment of the state of physical development, and to develop methods of nutrition correction.

Material and methods of research. The study was conducted on the basis of the clinic of the Tashkent Pediatric Institute. A comprehensive examination of 106 children diagnosed with CHD was conducted in the period from 2020 to 2023: 54 girls (46.7%) and 52 boys (53.3%) aged 0 months to 3 years. The average age of patients at the time of the first hospitalization) was 1 year 11 months from month (86 days to 2 years 11 months), the median weight was 8.5 kg (from 6.00 to 13.00 kg). The diagnosis of CHD was confirmed by echocardiographic and X-ray examinations, and in some 9 cases (8.4%) using angiographic examination. Depending on the age (0-12 months and 1 year-3 years), the studied children were divided into 2 study groups.

The main group consisted of 76 children with congenital heart defects who were admitted during the period from March 2020 to March 2023, who underwent the preoperative preparation we proposed. The comparison group consisted of 30 patients with congenital heart defects who were admitted to the cardiac surgery department from 2020 to 2023, who underwent preoperative preparation according to the traditional method before surgery. Depending on the age, all children were divided into 2 study groups.

Table 1. Distribution of the studied children into study groups depending on age.

| Age distribution	Children with CHD	Boys /Girls	Control group	Boys/Girls
0-12 month	32	15\17	17 (50%)	7/10
1-3 year	44	24\20	13 (50%)	6/7
Total	76 (100%)	39\37	30	13/17 (100%)

Thus, in the 1st group of the study, 42.1% were children under 1 year old, and 57.9% of children were children under 1 to 3 years old. In the comparison group of 0-12 months, 56.6% were children aged 1-3 years, and 43.3%, respectively.

The assessment of anthropometric indicators of physical development was carried out according to WHO recommendations.

The results of the study. All children had heart failure during preoperative preparation, of which I degree -9 (16.7%), II A degree – 41 (75.9%), II B degree – 3 (5.5%), III degree – one (1.9%) according to the classification of N.A. Belokon. Signs of pulmonary hypertension were detected in 32 (59.3%) children: grade I in 11 children (20.4%), grade II in 13 (24.1%), grade III in 8 (14.8%) patients. Patients received diuretics, cardiac glycosides and ACE inhibitors.

When analyzing the anamnestic data, the following results were determined, 12% of families were urban residents. The average age of parents in the group of children with congenital heart defects was higher than in healthy children. In mothers, it was 27.4±0.39 (18-45 years old) years, 28% of women were beyond the limits of reproductive age. The average age of the fathers was 30±0.42 years (18-50 years). 12% of children were raised in single-parent families. The biological history was burdened in 42% of mothers, pregnancy toxicosis was noted, which worsened during pregnancy in half of them. Viral infections during pregnancy were suffered by 41% of mothers.

Fig.2. Analysis of anamnestic data in the study groups.
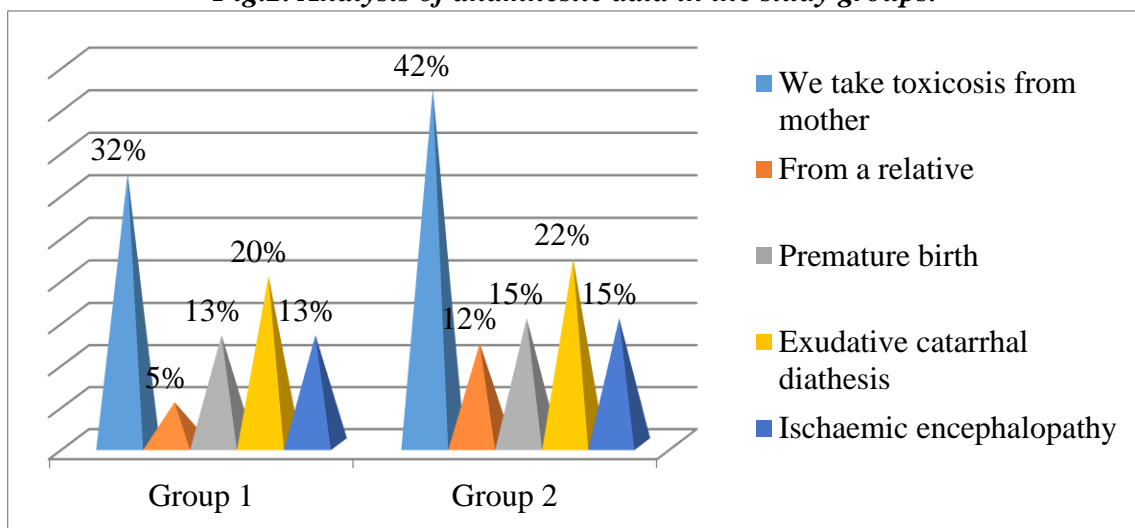
85% of women gave birth to this child first, but only 73% of them had the first pregnancy. The functional state of newborns was assessed with 8-10 points on the Apgar scale in 90% of children and at the 5th minute - in all. All children from the maternity hospital were discharged for home care, under the supervision of a district pediatrician. 90.1% of children were born full-term. Intrauterine growth retardation was found in 15.8% of full-term infants: 1 stage — 9.5%, 2 stage - 2.8% and 3 stage (intrauterine hypotrophy) — 3.5%.

Features of the physical development of children with CHD in the study groups

When analyzing the anthropometric data of children with CHD and the comparison group, the following results were obtained. Anthropometric data of 106 children from 0 to 3 years of age of both sexes, the average values of growth indicators have their own characteristics corresponding to age-sex standards. The children were divided into age categories. There was a slight difference in the growth rates of children in both boys and girls.

In the course of the study, an analysis of the presence of protein-energy deficiency in children with CHD in the study groups was carried out, management tactics and correction of children's nutrition depending on age and degree of protein-energy deficiency were proposed.

Depending on the state of physical development at admission, the children were divided into the following study groups.

Table 2.

The percentage of examined children with CHD in the main study group according to body weight and body length/height to WHO standard deviations (n=76)

	The main group (n=76)						
	0-12 months				1-3 years		
	Boys (n=15)		Girls (n=17)		Boys (n=23)		Girls (n=20)	
	No	%	No	%	No	%	No	%
-3SD	3	9,3	4	12,5	6	13,9	5	11,9
-2SD	7	21,8	9	28,1	12	28,5	8	19,1
-1SD	2	6,2	1	3,1	3	7,1	3	7,1
median	2	6,2	2	6,2	2	4,7	3	7,1
+1SD	1	3,1	1	3,1			1	2,3
+2SD								
+3SD	-		-		-	-		

Thus, when analyzing anthropometric indicators, body weight and body length/height, it was determined that at the age of 0-12 months, this indicator was determined at the level of -3CO in 9.3% of cases, and in 18.7% - 2CO in boys and -3CO- 12.5%, respectively -2CO-25% in girls. Also, the signs of BEN were determined in the age group of 1 month-3 years, and respectively in 13.9% of cases it was determined at the level of -3CO, and in 11.9% -2CO in boys and -3CO-28.5%, respectively -2CO-19.1% in girls.

The weight-to-length/height indicator reflects the ratio of the child's weight to the body length/height achieved by him. This indicator is especially important in cases where the age of the child is unknown.

The body mass curve-body length/height allows you to identify those children whose body weight is insufficient, possibly due to protein-energy malnutrition (BENP)/exhaustion or BENP/severe exhaustion.

Assessing physical development, we obtained the following data: body weight and body length/height indicators to standard deviations according to WHO, the indicators in the comparison group were comparable with those of the main study group and were determined as follows, at the age of 0-12 months, this indicator was determined at the level of -3CO in 6.6% of cases, and 2CO in 10% in boys and -3CO- 10%, respectively -2CO-10%.

Detailing the reasons, we found that in the control group, the ratio between children with a deficiency (body weight or height) and the number of children with CHD with low and very low values: by body weight – 17 people (31.5%), height – 16 (29.6%), chest circumference – 19 (35.2%), while in the comparison group there were such children 7 (14%), 6 (8%) and 7 (14%), respectively.

The most reliable indicator in the harmonious development of children is the body mass index (BMI).

Table 4.

Percentage of examined children with CHD in the comparison group in terms of body weight and body length/height to WHO standard deviations (n=30)

	Control group (n=30)							
	0-12 month				1-3 years			
	Boys (n=7)		Girls (n=10)		Boys (n=6)		Girls (n=7)	
	No.	%	No.	%	No.	%	No.	%
-3SD	2	11,7	3	17,6	1	7,6	2	15,3
-2SD	3	17,6	4	13,5	3	23,0	3	23,0
-1SD	1	3,3	3	17,6	2	15,3	1	7,6
median	1	3,3	-	17,6	-	-	1	7,6
+1SD	-		-					
+2SD	-		-		-			
+3SD	-		-		-		-	

Table 5.

The percentage of examined children in the main study group with CHD according to their BMI to age according to WHO standard deviations (n=76)

	0-12 month (n=32)				1-3 years (n=43)			
	Boys (n=15)		Girls (n=17)		Boys (n=23)		Girls (n=20)	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
-3SD	4	12,5	4	12,5	5	11,6	3	6,9
-2SD	6	18,7	5	15,6	8	18,6	11	25,5
-1SD	4	12,5	7	21,8	8	18,6	6	13,9
median	1	3,1	1	3,1	1	2,1	1	2,1
+1SD	-				1	2,1		
+2SD	-							
+3SD	-							

Low BMI values in the range of -3CO and -2CO were determined in 31.2% among boys aged 0-12 months and 28.1% among girls in this age group. Among children with CHD aged 1-3 years, low BMI rates were determined at 30.2% among boys and 30.1% among girls. Thus, the comparison group also identified low BMI in 23.4% of cases aged 0-12 months among boys and in 41.1% of cases among girls, respectively. Among the subjects aged 1-3 years, 30.6% of boys and 38.3% of girls had low BMI. Harmonious growth and weight gain are closely related to the development of functional abilities of organs and systems. Due to hemodynamic disorders, CHD has a direct negative impact on the development of the child.

Thus, when analyzing the physical development of children with congenital heart defects, it was revealed that only a third of patients (30.4%) had an average degree of physical development, while the majority of children (69.6%) had various abnormalities. Thus, physical development below average is typical for 19.6% of children, low – 37.2%. The indicators of 10.7% of children were rated as above average, and 1.96% – as high. Among children with stage I heart failure, patients with an average level of physical development prevailed, whereas with stage II CHF, children mostly had low physical development indicators.

More than half of the children (71.7%) had a decrease in BMI of varying degrees from moderate and severe exhaustion, the rest (38.3%) had a risk of exhaustion and normal BMI ($p<0.001$), including 16 (21.0%) of them with severe exhaustion.

Low BMI values were due to a lack of body weight and low height. The most frequently detected were: EBD (moderate exhaustion – in 31 patients (40.7%), and mild exhaustion or risk of exhaustion in 27 patients (31.5%), median indicators, these are normal indicators of physical development, were determined in only 5 patients (10.8) children with CHD in the main study group.

The next stage of the study included an assessment of the effectiveness of the proposed management of children in the preoperative period. According to changes in somatometric and biochemical parameters in dynamics in 20 days of life in children with varying degrees of HF and who are on various types of feeding.

At this stage of the study, preoperative preparation of children was carried out, which consisted in nutritional support for children with CHD.

Table 6.
*Types of feeding of children with CHD in the study groups.*

The main research group			Control group
0-12 months	Breast milk +Izikol baby	Breast milk +Mixture(hydrolysis)	Breast milk +Mixture(amino acid)	They received a standard age-related diet and preoperative complex therapy
From 6 months	Complementary food Trimetabol	Complementary food Trimetabol	Trimetabol	
1-3 years	Rational nutrition	Rational nutrition +Balanced mixture (2 months)	Rational nutrition +Balanced mixture (4 months)	

When comparing the studied indicators in children with CHD, depending on the type of preoperative preparation (the main group – up to a year exclusively breast milk and adapted milk formula as supplementary food, timely introduction of complementary foods, from 1-3 years of age, rational nutrition and adapted milk formula as supplementary food.

The control group consisted of children on a standard age-appropriate diet. Considering that the protein level in the diet at 20 days in the compared groups did not significantly differ, we can talk about the lack of energy potential for protein utilization in newborns with CHD who receive exclusively breast milk or adapted formula as food. It is known that children with CHD with HF have higher calorie needs than healthy children. And these needs cannot be met by using only mother's milk or an adapted milk formula, it is necessary to use special fortifiers for mother's

milk. At 20 days of life, children with CHD who received breast milk and supplementary feeding as their main food managed to achieve a higher protein and carbohydrate content in their diet. When analyzing the indicators of physical development after preoperative preparation (after 20 days), the following results were obtained.

Fig. 2. Analysis of indicators of physical development of children with CHD in the main study group before and after the integrated approach.
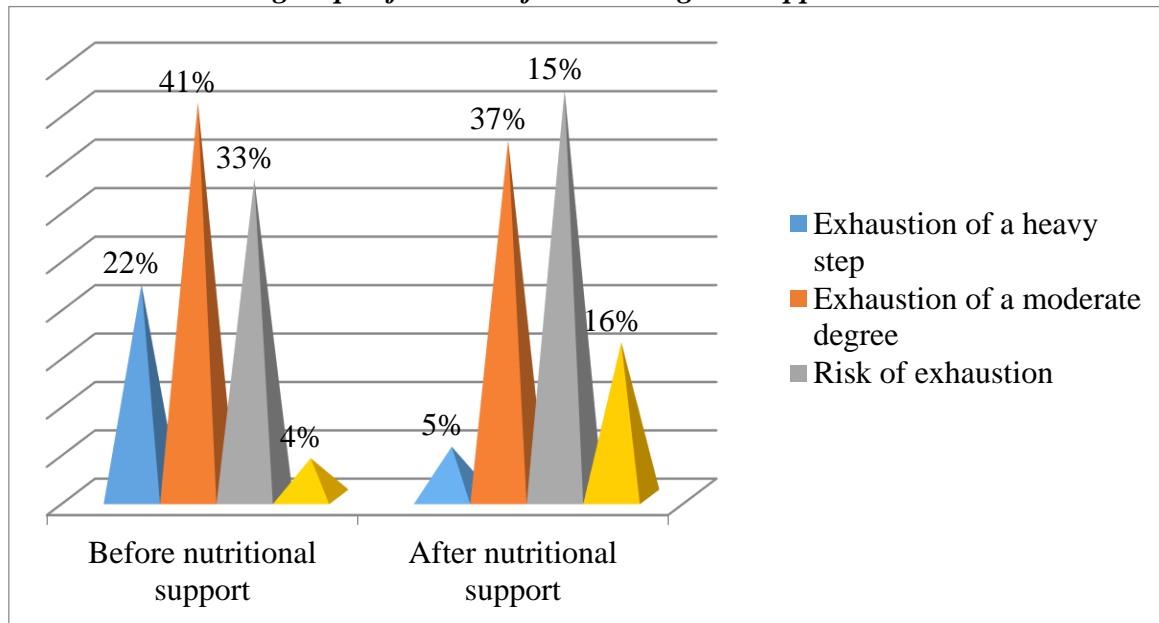

Thus, after an integrated approach, physical development improved in children of the main group, which was manifested in a decrease in the percentage of children with severe EDD from 22% to 5% (>0.05), as well as an increase in the median percentage from 4% to 16% (>0.01)

When conducting a comparative analysis in children of the control group, the following results were obtained.

The physical development of children in this study group also improved, but the indicators were lower than in the main study group, so children with severe EDD decreased from 23% to 20%, and an increase in the median percentage was noted from 6% to 8%.

Fig. 3. Analysis of indicators of physical development of children with CHD in the control group of the study before and after the integrated approach.
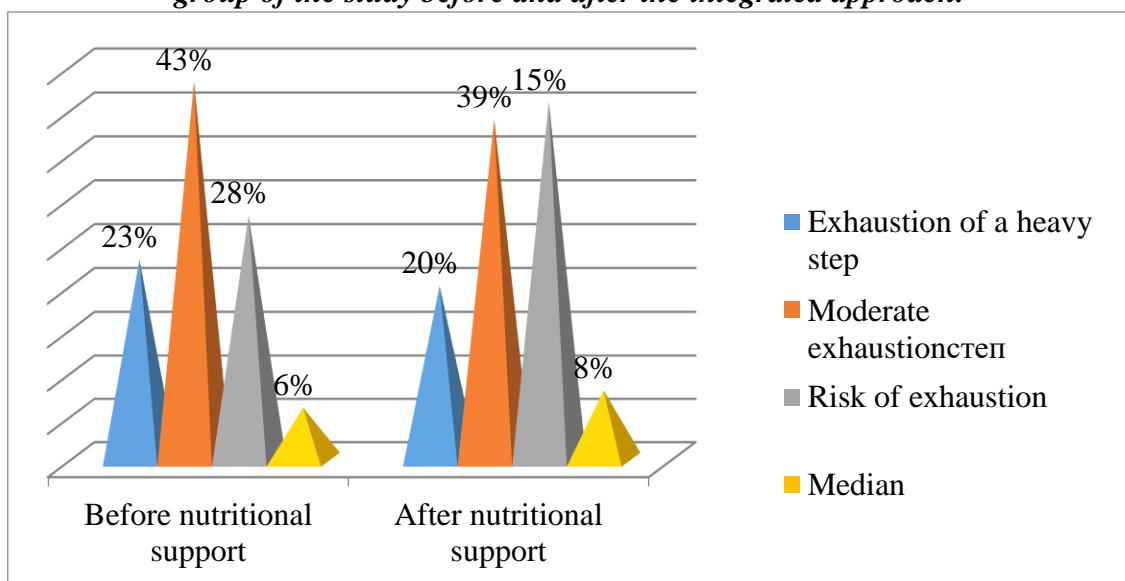
The improvement in physical development indicators in the control group of the study was comparably lower compared to the main group. Severe EBD in the main group decreased from 21% to 16.6%, compared with the control group from 23% to 20%, and the median values (BMI is normal) were determined in the main study group increased from 4% to 16% compared with the control group from 6% to 8%.

Thus, the use of semi-elemental mixtures based on high-grade protein hydrolysis for a complex approach in patients with CHD makes it possible to improve nutritional tolerance and, after 30 days, improve protein synthesis indicators, reduce the activity of systemic inflammation, and get a tendency to increase somatometric indicators.

Conclusion

Young children with CHD in this study are characterized by a lag in physical development and feeding disorders that occur in unfavorable conditions of the medical and social status of families. The analysis of the physical development of children with CHD was determined by the progressive development, respectively, of the effects of hemodynamic disorders. Severe EBD was detected only in every fifth child (21.0%), the risk of mild EBD (exhaustion was determined) in (31.5%); 1/3 of the children were diagnosed with moderate EBD in 40.7% and normal BMI indicators were determined. - 5,2%.

When comparing the results obtained with the control group, it was statistically significant ($p<0.05$) that the children of the main group had higher (1.6 times) physical development indicators than the children who did not receive the proposed recommendations.

REFERENCES

1. Мутафьян, О.А. Пороки сердца у детей и подростков: руководство для врачей /О.А. Мутафьян. – М.: ГЭОТЭРМедиа, 2009. – 560 с.

2. Бокерия, Л.А. Сердечнососудистая хирургия2008. Болезни и врождённые аномалии системы кровообращения /Л.А. Бокерия, Р.Г. Гудкова. – М.: Издво НЦССХ им. А. Н. Бакулева РАМН, 2009. – 129 с.

3. Игишева, Л.Н. Современная организация медицинской помощи новорожденным с критическими врождёнными пороками сердца на дооперационном этапе /Л.Н. Игишева, Е.Г. Цой, О.В. Куренкова, Г.В. Артамонова //Комплексные проблемы сердечнососудистых заболеваний. – 2013. – № 4. – С. 5661.

4. Бокерия, Л.А. Педиатрические аспекты в неонатальной кардиохирургии /Л.А. Бокерия, М.Р.Туманян, О.В.Филаретова, И.И. Труни на с соавт. //Детские болезни сердца и сосудов. – 2012. – № 1. – С. 3546.

5. Joosten, K.F. Prevalence of malnutrition in pediatric hospital patients /K.F. Joosten, J.M. Hulst //Curr. Opin. Pediatr. – 2008. – V. 20, N 5. – P. 590596.

6. Da Silva, V.M. Growth and nutritional status of children with congenital disease /V.M. da Silva, M.V. de Oliveira Lopes, T.L. de Araujo //J. Cardiovasc. Nurs. – 2007. – V. 22, N 5. – P. 390396.

7. Хроническая сердечная недостаточность: федеральные клинические рекомендации /Союз педиатров России, Ассоциация детских кардиологов России. – М., 2015. – 40 с.

8. Маянский, Н.А. Натрийуретические пептиды в практике детского кардиолога /Н.А. Маянский, Е.Н. Басаргина //Вопросы диагности ки в педиатрии. – 2009. – Т. 1, № 2. – С. 1216.