Ways to correct comorbid states during surgical interventions in children with congenital heart disease

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Abstract: In surgical practice, the presence of comorbid pathology has a significant impact on the course of the postoperative period, the development of complications, and also affects the prognosis. Current standards and approaches in surgery should include an analysis of comorbid diseases when choosing methods of anesthesia, intensive care and tactics of surgical intervention. In surgical interventions in children for congenital heart disease, it is necessary to carry out intensive therapy, including the correction of disorders of all vital organs. In our study, we focused on the correction of some disorders, in particular physical development, hormonal and immune status disorders, neurocognitive disorders. We studied several domestic and foreign literary data on the correction of these disorders.

Keywords: congenital heart defect, correction, comorbid conditions, surgery, nootropic drugs

Children with CHD often have low birth weight. This is due, on the one hand, to hemodynamic impairment, and on the other hand, to hormonal imbalance. The child's weight at the time of cardiac surgery is an important predictor of morbidity and mortality, especially in children under 1 year of age. Although many studies, including those by Chowdhury D. at al (2022), have found higher mortality in patients with low birth weight (<2.5 kg), it has been found that delaying surgery to achieve adequate weight has a more detrimental effect on cardiac hemodynamics than benefit. Thus, early surgical intervention can be performed even in patients weighing <2.5 kg. However, other factors that may affect prognosis should be assessed and addressed before surgery. [101, 415-450]. To correct the nutritional status of children with CHD under 1 year of age, it is recommended to use breast milk and, if necessary, use fortifiers that help increase its caloric content to 80–90 kcal/kg; use semi-elemental mixtures enriched with medium-chain triglycerides (0.67 kcal/ml, 1–1.5 kcal/ml); increase the frequency of feeding or feed through a tube or increase the concentration of the mixture; introduce complementary foods early (from 4 months of life); in

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children with clinical manifestations of heart failure, use mixtures with a low sodium content.

Limitation of fluid and salt is an important therapeutic factor, especially during the preoperative period. Recommendations for the management of children with CHD often note that a high-salt diet can have a negative effect on the course of the disease due to fluid overload and increase/provoke decompensation. Reducing salt intake, in addition to preventing exacerbations of heart failure, reduces the doses of necessary diuretic therapy. It is obvious that most children with CHD lag behind in physical development. Growth retardation secondary to heart failure in childhood is well documented but poorly studied. Le Roy C. at all (2019) analyzed 640 children from Chile requiring cardiac surgery for congenital heart defects and showed low growth in 24.1%. The highest percentage of short stature is associated with heart failure caused by atrioventricular valve insufficiency (66.7%), VSD (33%) and left heart hyperplasia syndrome after Norwood 1 surgery (33.3%). Low serum IGF-1 levels indicate heart failure in children with left-to-right shunt due to CHD, which increases after corrective surgeries.

McElhinney D.B. et al. (2014) proposed recombinant growth hormone treatment in children with short stature due to heart failure caused by dilated cardiomyopathy, published in PEDIATRICS in 2014. Two of the eight patients developed progressive heart failure and underwent heart transplantation. However, the authors conclude that "the benefits of growth hormone treatment were not associated with significant associated side effects." Growth hormone therapy was associated with significant acceleration of somatic growth. Reiner Buchhorn (2019) reports on a boy who suffered from heart failure for most of his childhood before a heart transplant at age 12 after 6 heart surgeries at an early age. He received growth hormone treatment at the age of 10 years after pediatric endocrinologists suggested a final height of 130 cm. He clearly demonstrated that his final cardiac decompensation was caused by growth hormone treatment.

Despite many suggestions about the benefits of using thyroid hormones in the treatment of CHD, their role is still not completely clear. According to D.V. Borisov (2020), the most pressing issue is the selection of the dose and timing of hormone administration in patients with subclinical hypothyroidism and CHD. Moreover, there is still no consensus on which of the thyroid hormones (T3 or T4) is most preferable in children with CHD. The available data from experimental and clinical studies suggest that therapy with growth hormones and thyroid hormones can improve the clinical status of children with CHD and hemodynamic parameters with a minimal risk of complications, primarily arrhythmias. It should also be taken into account that the vast majority of studies devoted to the use of these hormones were conducted on biological models. Despite the encouraging results of experimental studies, large intervention

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studies on the use of hormones in children with CHD have not been conducted. Further clinical studies are required for a more in-depth assessment of the effect of these agents on the cardiovascular system. One explanation for this situation may be the caution of doctors regarding the risk of developing proarrhythmogenic effects and the possibility of inducing ischemia/myocardial damage. Drug therapy using nootropic drugs traditionally occupies a significant place in the restoration and correction of cognitive impairment [40, 77-84; 55, 44; 32, 36-41; 54, 12-16]. According to Platonov T. N. and Platonov T. N. (2013), a group of "true nootropics" is distinguished, for which the ability to improve cognitive functions is the main effect, as well as a group of nootropic drugs of mixed action (the so-called neuroprotectors), in which the nootropic effect is supplemented by other actions. A drug that combines these properties and has found wide application in neuropediatrics is Cortexin, a high-tech product, a complex polypeptide drug of biological origin.

It has pronounced metabolic activity: normalizes the metabolism of neurotransmitters; regulates the balance of inhibitory/activating amino acids and the levels of serotonin and dopamine; has a GABAergic effect, antioxidant effect; normalizes the bioelectrical activity of the brain. As numerous studies have shown, having a pronounced tissue-specific effect on the cells of the cerebral cortex, this neuropeptide drug has a cerebroprotective, nootropic, neurotrophic, neurometabolic, stimulating, anti-stress, antioxidant effect. Unlike most nootropics, the neuroprotector can be prescribed in the afternoon due to the fact that this drug is balanced in the composition of stimulating and inhibitory amino acids. In the works of Isanov V. A. (2018), a positive effect of Cortexin in combination with kinesitherapy on impaired motor and cognitive functions was demonstrated when it was prescribed to 118 patients with congenital heart disease aged from 1 year to 18 years. L. A. Pak et al. during the observation of 25 children with neurocognitive impairments under 6 years of age found that against the background of the use of Cortexin (5 courses of 10 injections at intervals of 3 months), the volume of motor activity and the set of motor skills significantly increased, visual-motor coordination improved, the sleep-wake cycle normalized, the emotional background improved, and disorders of the articulatory apparatus decreased. A cumulative effect of the drug was revealed: with repeated courses of therapy, its positive effect persisted for 6 to 18 months. N. V. Ivannikova et al., when examining 22 patients with neurocognitive disorders aged 1–6 years during complex rehabilitation with 20-day use of a neuroprotective agent (course dose of 200 mg), noted a significant improvement in well-being, behavior, sociability, and integrative functions in 62.1% of those examined, and a moderate improvement in the form of a decrease in the severity of subjective manifestations in 33.3%.

The data of V. I. Guzev (2015) indicate that after taking pantogam, children experience an improvement in their abilities that correspond to age norms: gross motor

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skills, fine motor skills, speech, and social adaptation. After taking pantogam for 2 months, Age-related normalization of electroencephalography (EEG) was noted: a decrease in diffuse changes and delayed maturation of the basic rhythm in 7.5% of children, and in another 7.5% of children the EEG began to correspond to the age norm.

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