



The Features of ECG and Echocg Functional Parameters in Children with Congenital Heart Disease in the Postoperative Period

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Annotation: Congenital heart defects in children rank third among malformations after anomalies of the central nervous system and musculoskeletal system. Our research aims to determine the postoperative clinical and instrumental status of children with congenital heart disease as a result of artificial circulation, to determine the rhythm and conduction of the heart, as well as to prevent postoperative arrhythmias. As a result of our scientific studies, we divided patients into groups according to changes in the conduction system of the heart (sinus node, AV junction) and the degree of difficulty of surgical treatment, as a result of which we can predict the types and frequency of arrhythmias. A relatively common arrhythmia during surgery in the area of the sinus node (correction of interstitial obstruction with semi-abnormal drainage of pulmonary veins) was identified as sinus node dysfunction (59%), which is characterized by subsequent recurrence in all patients. In interventricular septal defect plasticity, complete AV block occurs in 18% of cases, regardless of the condition of the congenital heart defect in changes in the area of the AV node.

Keywords: electrocardiography, electro cardio stimulator, echocardiography, artificial haemorrhage, rhythm, arrhythmia, surgical practice, sinus node dysfunction.

Introduction

Literature data on the incidence of arrhythmias after operations under EC conditions are contradictory. Thus, according to J.W. Delaney [1], arrhythmias were observed in 15% of patients, according to J. Rekawek [2] - in 17.7%, E. Valsangiacomo [3] - in 48%. In the last decade, there has been a change in the structure of postoperative arrhythmias. The achievement of modern cardiac surgery is the reduction in the number of postoperative heart blocks caused by irreversible damage to the conduction system of the heart and requiring constant pacing [4]. According to A. Dodge-Khatami [5], 11% of patients have

ectopic activity in the area of the atrioventricular junction after correction of congenital defects, and mortality among these patients reaches 8%.

Studies of the last decade on heart rhythm disturbances after correction of congenital malformations allow us to state that heterotopic tachyarrhythmias have acquired the greatest relevance in the structure of postoperative arrhythmias, while sinus node dysfunction has retained its significance [4; 6; 7; eight; 9; 10].

Material and methods

All patients underwent traditional clinical-instrumental and laboratory research methods. ECG registration was carried out in 12 conventional leads before surgery, in the first hours after surgery and daily during the entire period of stay in the cardiac intensive care unit. In the absence of rhythm disturbances after the transfer of the patient to the Department of Cardiac Surgery, ECG was recorded 2 times a week until the patient was discharged from the hospital.

When arrhythmias were detected, ECG monitoring was carried out daily until the sinus rhythm was restored; in case of life-threatening tachyarrhythmias, several times a day. The electrocardiogram was recorded on a Cardiofaks electrocardiograph manufactured by Fukuda M-E (Japan). In the operating room and in the cardiac intensive care unit, constant ECG monitoring was performed in standard lead II on a Hewlett Packard model 88S monitor (USA), regardless of the detection of arrhythmias. A control ECG recording was performed 1 month after discharge. For the diagnosis of congenital heart disease and dynamic postoperative control, all patients underwent echocardiography using the Acuson Sequoia and Accustom Cypress (USA) devices with 7 MHz and 3.5 MHz sensors in real-time using the main projections. Tran thoracic echocardiography was performed in all patients in the supine or left lateral position according to the standard technique.

Results and discussion

In the postoperative period, most of the 100 children had various complaints: shortness of breath during exercise and/or at rest - 26 (26%) children, fatigue - 57 (57%), cardialgia - 23 (23%), headache - 14 (14%), frequent acute respiratory viral infections were observed in 30 patients (30%). Significantly more often ($p < 0.001$) there was rapid fatigue, headache less often than frequent colds ($p < 0.01$) and shortness of breath ($p < 0.05$). In general, the group showed a significant decrease in the number of complaints of shortness of breath ($p < 0.001$), fatigue ($p < 0.001$), frequent colds ($p < 0.01$), dyspnea-cyanotic attacks ($p < 0.05$) and an increase in complaints about pain in the region of the heart ($p < 0.01$). The frequent incidence of acute respiratory viral infections significantly decreased ($p < 0.001$) only in patients operated on for tetralogy of Fallot and TMS [12,13]. As a result of the study, we found that 30 out of 100 (30%) children with CHD were operated on late: 4 children with VSD (13.3%) after 10 years, 4 with ASD (13.3%) after 12 years, 2 - with POAVK (6.6%) after 8 years, 6 - with PDA (18.9%) after 5 years, 7 - with TF (23.3%) after 7 years and 7 - with CA (23.3%) after 5 years. The most common late correction occurred in patients with POAVK and PDA, less often in ASD. The late correction of CHD in children was affected by the late diagnosis of the defect - in 16 out of 30 children ($53.3 \pm 9.1\%$), the need to wait for the federal quota for referral to a cardiac surgery centre for surgical treatment, and the shortcomings in the organization of cardiac care for children in the districts - in 6 out of 30 children ($20.0 \pm 7.3\%$), social causes - in 8 out of 30 ($26.7 \pm 8.0\%$) patients.

Surgical treatment of children with CHD contributed to the normalization of physical development. In the late period after surgical correction, the lag was recorded in 32 children ($20.9 \pm 3.0\%$), against 98 ($64.0 \pm 3.8\%$) before surgery ($p < 0.001$). A decrease in the Cole index < 90 was noted in 25 children ($16.3 \pm 3.0\%$) versus 70 ($45.7 \pm 4.02\%$) before surgical correction ($p < 0.001$). After the surgical correction of CHD, there was a significant improvement in the indicators of physical development in children ($p < 0.001$), regardless of the type of CHD [14, 15]. Hypertrophic changes in the myocardium, identified

according to ECG data, in children in the postoperative period, significantly decreased ($p < 0.001$) only in CHD with MCC enrichment. When we studied cardiac conduction disorders in the postoperative period of various congenital heart diseases, it was found that complete blockade of the right bundle branch of His was a frequent consequence of surgical correction of congenital heart disease and was registered in 36 children ($23.5 \pm 3.4\%$). This type of cardiac conduction disorder is a consequence of damage to the middle or distal part of the right bundle of His during flap suturing [11,12].

It should be noted that significantly more often ($p < 0.001$) complete blockade of the right bundle branch block occurred in CHD with ICC depletion, which corresponds to the data of other authors [16, 17, 18]. The atrioventricular blockade was diagnosed in 6 children ($3.9 \pm 1.5\%$) in the postoperative period with the correction of various CHD, which is significantly less than other cardiac conduction disorders ($p < 0.001$). After correction of any CHD, there was a decrease in the size of the heart, which is confirmed by a significant decrease in the cardiothoracic index. Our examination of children with CHD with MCC enrichment in the long-term period after surgical treatment revealed a significant decrease in systolic pressure in the right ventricle and pulmonary artery ($p < 0.001$), but only 69 ($71.8 \pm 4.6\%$) children had normal values. After surgical treatment in patients with high pulmonary hypertension, 6 out of 23 patients ($26.0 \pm 9.1\%$) had a decrease in pressure in the pulmonary artery to normal, in 16 ($69.6 \pm 9.6\%$) - it decreased to mild pulmonary hypertension, in 1 patient ($4.4 \pm 4.2\%$) - there was no hemodynamic effect of the operation. In 17 of 26 ($65.4 \pm 9.3\%$) patients with mild pulmonary hypertension, the systolic pressure in the pulmonary artery decreased to normal levels. In children with mild pulmonary hypertension, complete normalization of pressure in the pulmonary artery occurs significantly more often ($p < 0.01$). Prolonged bradysystole is possible when using unreasonably large dosages of drugs. These observations indicate that any antiarrhythmic drugs (even those with ultra short action) are potentially dangerous, therefore, when stopping arrhythmias, one should always be ready for resuscitation [7]. The critical condition of the child, often occurring with tachycardia, requires careful administration of Apothem use of amiodarone in the practice of the cardiac intensive care unit for stopping AVUET revealed the property of the drug to contribute to the visualization of AV dissociation on the ECG already in the first hours of using the drug, most likely due to inhibition of atrioventricular and ventriculoatrial conduction. A significant side effect of intravenous amiodarone is hypotension due to peripheral vasodilation. This effect is most pronounced when using the drug in higher doses and with its rapid introduction, especially in patients with severe left ventricular dysfunction, who are at high risk of developing hypotension. The decrease in systemic A/D correlates with the rate of administration or the administration of high doses of the drug. With the aggravation of hypotension, it is necessary to reduce the rate of amiodarone infusion (saturation with amiodarone is carried out in 2-3 hours). Thus, the algorithm for detecting AV dissociation on the ECG using medications allows for prompt and reliable diagnosis for the timely and effective treatment of atrioventricular nodal ectopic tachycardia in children after CHD surgical treatment.

Conclusion

The distribution of patients into groups according to the principle of conflict between the conduction system of the heart (sinus node and AV junction) and the area of operation, taking into account the complexity of the surgical intervention, makes it possible to predict the variant of arrhythmias and the frequency of their occurrence after CHD correction. With intervention in the area of the sinus node (correction of PALV with ASD, isolated PALV in the SVC), the most common arrhythmia is sinus node dysfunction (59%), which is reversible in all patients. In the absence of a conflict with the conduction system of the heart (radical correction of TMS and pathology of the aortic arch), DSU often detected in the postoperative period (40%) is associated with postoperative oedema of the sinus node region as a result of mechanical trauma during SVC annulations in newborns and the high complexity of the surgical intervention. DSU in these patients is also reversible. VSD patency that

conflicts with the area of the AV connection, regardless of the complexity of the CHD, is accompanied by the occurrence of a complete AV block in 18% of cases, but only in 2.6% of cases is the implantation of a permanent pacemaker required. Radical correction of complex CHD with VSD, conflicting with the AV junction, is accompanied by a high risk (20.5%) of the development of AV nodal ectopic tachycardia. The predictors of AVUET occurrence are longer CPB and AO clamping time, early age and low weight of patients, higher Aristotle Scores for the complexity of the operation, and aggressive inotropic support compared to patients without AVUET. The occurrence of AVUET after complex surgical interventions accompanied by VSD palsy leads to an increase in the length of stay in the cardiac intensive care unit, the time of mechanical ventilation and the time of cardio tonic support, and is also an independent predictor of postoperative mortality. The use of the algorithm for diagnosing atrioventricular nodal ectopic tachycardia using drug tests to detect atrioventricular dissociation provides a timely diagnosis of this life-threatening tachyarrhythmia and its adequate treatment.

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