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Congenital Cardiac Abnormalities in Children: Prevalence and Risk Factors

Raupov Abdurahmon Ortiq o'g'li
Bukhara State Medical Institute named after Abu Ali ibn Sina, Uzbekistan, Bukhara, st. A. Navoi.,
raupov.abdurahmon@bsmi.uz

Resume: The high prevalence of congenital cardiac abnormalities and the necessity of early surgical treatment due to serious health issues and incapacity in children make them a significant challenge in pediatrics. 0.7–1.7% of newborns have congenital cardiac disease, according to the WHO. The composition of childhood cardiovascular disease has evolved dramatically in the last few decades. Rheumatic diseases and infectious myocardial lesions became less common as the number of cases of CHD, cardiac arrhythmias, conduction abnormalities, and cardiomyopathies increased. At number two, CHD continues to be one of the top causes of infant death. Congenital cardiac illnesses account for 2.5% of deaths during the perinatal period (0.25 instances per 1000 births), 6–11% of deaths during the first year of life, and roughly 50% of deaths linked to congenital abnormalities. In this sense, the problem of examining the epidemiology and risk factors for the early onset of congenital cardiac abnormalities is still pertinent and calls for further scientific investigation.

Keywords: congenital heart disease, risk factors, epidemiology, intrauterine infection

In Uzbekistan, the birth rate of children with congenital heart defects is from 5.5 people to 15.7 people per 1000 live births [8]. The frequency of congenital heart defects depends on the development of the health care system in the country or the diagnostic methods available to the doctor. Congenital heart disease occupies a key place among a wide range of diseases that require the involvement of a pediatric cardiologist. The generally accepted minimum calculated indicator of the frequency of congenital heart defects is 8 cases per 1 thousand live births [6,7].Congenital heart defects are the most common congenital anomaly, which occurs in almost 1% of live births [11]. Among congenital defects, congenital heart defects is the leading cause of infant mortality. Quite often in their practice, a doctor is faced with the presence of several nosological forms in the patient's diagnosis. The combination of pathologies of different organs and systems in one diagnosis is quite understandable, since many diseases have a common etiopathogenetic basis. Pediatric cardiology has always been the basis of pediatrics, simultaneously constituting its integration and having a significant impact on the reduction of perinatal mortality; which is the basis for the development of the assessment of medicine in the country.

Congenital heart defects (CHD) consist of a wide range of anomalies and malformations affecting the heart and great vessels that develop in utero, are present at birth, and present in infancy, adolescence, or adulthood. Cardiovascular anomalies typically result from defective morphogenesis during embryologic development. Malformations may be limited to the cardiovascular system (nonsyndromic) or occur in combination with anomalies of other systems as part of specific syndromes (syndromic). The most common CHDs diagnosed in infancy are muscular and perimembranous ventricular septal defects followed by secundum atrial septal defects, with a combined prevalence of 48.4 cases per 10,000 live births [15]. Approximately 85% of children have a multifactorial etiology of CHD in children, which usually is the only malformation in the child

and is the result of the interaction of many individually undefined genes and a number of other causes. The risk of recurrence of CHD in a family varies depending on the cause. The risk is negligible for de novo mutations, 2-5% for nonsyndromic multifactorial CHD, and 50% for cases where the cause is an autosomal dominant mutation [110, 1171-1178]. It is important to determine the genetic factors, since most patients with CHD survive to adulthood and, potentially, start families.

Anomalies in the anatomical development of the heart and large vessels usually form in the 2nd to 8th week of intrauterine development as a result of impaired embryonic morphogenesis and can be caused by both hereditary (gene, chromosomal, genomic, zygotic mutations) and environmental factors affecting the developing embryo. The specific causes of the occurrence of congenital heart disease are unknown. Most often, congenital heart disease is sporadic, not associated with a syndrome and of unclear etiology [75, 121-127]. The genetic etiology is not identified in approximately 72% of patients with congenital heart disease [138, 690-706; 146, 2241-2247]. They are often associated with chromosomal abnormalities detected by karyotyping in more than 1/3 of patients with congenital heart disease. Most often, it is trisomy on chromosomes 21, 18 and 13. In addition to Down's syndrome, there are about 20 hereditary syndromes, in most cases, accompanied by CHD. In total, syndromic pathology is found in 6-36% of patients. However, some of these anomalies account for only about 5-6% of patients with congenital heart disease. The monogenic nature of CHD has been proven in 8% of cases; about 90% are inherited multifactorially, i.e. are the result of a combination of genetic predisposition and the impact of environmental factors. The latter act as provoking factors, revealing hereditary predisposition when the "threshold" of their combined action is exceeded. The risk of CHD recurrence in a family varies depending on the cause. The risk is insignificant for newly emerged mutations, 2-5% for non-syndromic multifactorial congenital heart defects, and 50% when the cause is an autosomal dominant mutation. [11]. Defects in the genetic code and embryogenesis disorders can also be acquired - exposure of the fetus and the mother's body to certain unfavorable factors (radiation, alcoholism, drug addiction), endocrine diseases (diabetes mellitus, rubella, systemic lupus erythematosus, thyrotoxicosis), viral and other infections suffered in the first trimester of pregnancy (rubella, influenza, hepatitis B), taking medications (lithium preparations, warfarin, thalidomide, antimetabolites, anticonvulsants, lithium, isotretinoin, anticonvulsants). Mixed viral and enterovirus infections suffered by the fetus in utero are of great importance in the development of heart and vascular pathology. In addition to etiological factors, risk factors for the birth of a child with CHD are identified. These include: maternal age; toxicosis and threat of termination of the first trimester of pregnancy; stillbirths in the anamnesis; the presence of children with congenital malformations in close relatives [4,9,10]. It is unclear whether maternal age is an independent risk factor for the development of CHD. The age of the father may also be a risk factor [13].

The impact of unfavorable factors on a woman can disrupt the differentiation of the heart and lead to the formation of congenital heart disease. Such factors are considered to be:

- Infectious agents (cytomegalovirus, herpes simplex virus, influenza virus, enterovirus, Coxsackie B virus, etc.);
- hereditary factors - in 57% of cases, congenital heart disease is caused by genetic disorders, which can occur both in isolation and as part of multiple congenital malformations; the most well-known causes of congenital heart disease are point gene changes or chromosomal mutations in the form of deletion or duplication of DNA segments;
- somatic diseases of the mother, and first of all - diabetes mellitus lead to the development of hypertrophic cardiomyopathy and congenital heart disease;
- Occupational hazards and bad habits of the mother (chronic alcoholism, computer radiation, mercury and lead intoxication, exposure to ionizing radiation, etc.) [14].

The most common defects are: ventricular septal defect - VSD (28.3%); atrial septal defect - ASD (10.3%); pulmonary artery stenosis (9.8%); tetralogy of Fallot - TF (9.7%); aortic stenosis (7.1%);

coarctation of the aorta - CAA (5.1%); transposition of the great vessels (4.9%); hypoplastic tricuspid valve syndrome, patent ductus arteriosus (PDA), and complete anomalous venous return are also encountered [14].

Intrauterine infectious pathology of the fetus and newborn is one of the most pressing and complex problems in pediatrics. The share of infectious and inflammatory processes in the structure of perinatal mortality is about 10-18%, second only to intrauterine asphyxia, respiratory disorders and congenital anomalies. The relevance of the problem of intrauterine infection is due not only to significant peri- and postnatal losses, but also to the fact that children who have suffered a severe form of congenital infection very often develop serious health problems, leading to disability and a decrease in the quality of life in general [6,7]

Among the pathogens, a special position is occupied by infections of the TORCH complex - Toxoplasma (toxoplasmosis), Rubella (rubella), Cytomegalovirus (cytomegalovirus), Herpes (herpes). Includes such infections as hepatitis B and C, syphilis, chlamydia, gonococcal infection, HIV infection, listeriosis, enterovirus infection and others affecting the fetus [6,7].

In the absence of adequate therapy during pregnancy, up to 50% of newborns with at least one TORCH infection in the mother are born with various injuries: intrauterine infections (IUI), intrauterine growth retardation (IUGR), hypotrophy, pregnant malformation (PM), including congenital heart disease, cerebrovascular accidents. With a mixed infection, the incidence of neonatal morbidity reaches 50-100% [2].

In the studies of Lobzova A.V. (2014), immunological markers for a particular infection or association of infectious agents were diagnosed in newborns with and without congenital malformations. In this case, antibodies of class G to viral-viral associations (CMV + herpes simplex virus (HSV)) were often determined both in the main and control groups (56.33 and 65.38%, respectively). In this case, in the main group, immunoglobulins of class G to HSV were detected in 98.6% of the examined newborns and in 80.7% of the children in the control group, to CMV - in 95.8 and 96.1%, respectively, which is consistent with the literature data on the ever-increasing infection of the population with these pathogens [2, 7].

Due to the fact that the frequency of intrauterine infections does not tend to decrease and, accordingly, there are no adverse consequences, further study in this area is required to develop measures to prevent them.

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