



SEMIOTICS AND SYNDROMES OF CIRCULATORY DISEASES IN CHILDREN

Norbibi Yadgarova

Senior lecturer, department of propaedeutics of diseases of children
and hematology.

Tashkent State Medical University.

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ABSTRACT

*This article examines the key clinical signs (symptoms
and syndromes) encountered in congenital and acquired
cardiovascular diseases in children of various age
groups.*

СИМИОТИКА И СИНДРОМЫ ЗАБОЛЕВАНИЙ ОРГАНОВ КРОВООБРАЩЕНИЯ У ДЕТЕЙ

Ядгарова Норбиби Джапаровна

Старший преподаватель кафедры пропедевтики детских болезней.

Ташкентский Государственный Медицинский Университет.

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ABSTRACT

*В статье рассматриваются ключевые клинические
признаки (симптомы и синдромы), встречающиеся
при врождённых и приобретённых заболеваниях
сердца и сосудов у детей различных возрастных
групп.*



Modern pediatric cardiology considers the semiotics and syndromes of circulatory diseases to be a key area of diagnostics, as early recognition of pathological changes in a child's cardiovascular system determines the effectiveness of treatment and the prognosis of their health.

A distinctive feature of this area is that the symptoms of cardiovascular diseases in children differ in severity, course and clinical manifestations from those in adults.

This is due to the anatomical and physiological characteristics of the child's body, in particular, the immaturity of the myocardium, high heart rate, lability of vascular tone and imperfection of the regulatory mechanisms of blood circulation.

In the first years of life, the child's cardiovascular system is characterized by low resistance to stress, high sensitivity to hypoxia and infectious influences.

This is why children often experience functional murmurs, temporary arrhythmias, and blood pressure instability, which can be either a manifestation of adaptation processes or signs of incipient pathology.

Early diagnosis requires a deep knowledge of clinical signs (semiotics) and the ability to distinguish temporary physiological deviations from true pathological syndromes.

The semiotics of cardiovascular diseases includes a complex of subjective and objective symptoms that allow the physician to determine the nature and extent of circulatory disorders.

The most important signs are shortness of breath, cyanosis, tachycardia, bradycardia, pain in the heart area, heart murmurs, edema, changes in skin color and vascular pulsation.

Their correct interpretation is especially difficult in pediatrics, since children cannot always accurately describe their sensations, and external manifestations depend on age, metabolic characteristics, and the state of the nervous system.

The pathophysiological basis of most circulatory diseases in children is a disorder of systemic and pulmonary hemodynamics, in which stroke volume, minute output, and venous return of blood change.

These processes are accompanied by hypoxia, fluid retention, metabolic acidosis, and electrolyte imbalances. In response to these changes, a range of clinical syndromes develop, including heart failure, arrhythmia, pain, hypotension, and hypertension.

The leading causes of circulatory system diseases in childhood are congenital heart defects, myocarditis, rheumatic lesions, arterial hypertension, cardiomyopathy, and functional disorders of vascular tone regulation.

According to WHO (2023), congenital heart defects occur in 8–10 out of 1000 newborns, and the number of children with acquired hemodynamic disorders is steadily increasing due to environmental, infectious and metabolic factors.

The most important direction of modern diagnostics is the use of an integrated approach, including clinical, instrumental and laboratory methods.

Thus, cardiac auscultation, ECG, echocardiography, pulse oximetry, and vascular Doppler ultrasound allow for the early detection of circulatory disorders before the onset



of significant clinical signs. Observations show that the combination of clinical semiotics and instrumental data provides high diagnostic accuracy—up to 90%.

The age aspect is no less important: the younger the child, the more difficult it is to recognize the disease, since many symptoms are nonspecific.

For example, in newborns, heart failure may manifest as poor feeding, restlessness, rapid breathing, and weight loss, while in adolescents, it may present with complaints of fatigue, dizziness, and chest pain. Therefore, the physician's task is to consider each symptom in the context of an overall syndromic analysis.

Studying the semiotics and syndromes of circulatory diseases in children has not only diagnostic but also prognostic value. A proper understanding of the pathogenesis of clinical signs allows for the determination of patient management strategies, selection of appropriate therapy, and

Prevent the development of complications such as chronic heart failure, pulmonary hypertension, or arrhythmia. From a physiological perspective, the adaptation of the cardiovascular system in children goes through several stages: from fetal circulation to mature systemic circulation.

During this period, functional connections between the myocardium, blood vessels, and nervous system are formed. Any deviation in this process can cause permanent impairments, so early diagnosis and monitoring of children at risk for cardiac pathology are of paramount importance.

In the context of modern evidence-based medicine, semiotic analysis is viewed as a tool that allows for the integration of clinical observation and pathophysiological understanding of disease. This is particularly relevant in pediatric practice, where each symptom may have a different etiology.

Early detection of circulatory disorders is a key factor in reducing infant mortality and improving patients' quality of life.

Therefore, studying the semiotics and syndromes of circulatory diseases in children is a fundamental task in pediatric cardiology and general physiology.

It requires a systematic approach, clinical experience, and a deep understanding of age-related characteristics, which makes this topic relevant for the modern medical community.

This study is based on a comprehensive analysis of clinical, laboratory, and instrumental data reflecting the characteristics of the semiotics and syndromes of circulatory diseases in children. The methodology included a clinical and physiological approach

comparison of objective examination data with the results of instrumental studies and assessment of the functional state of the cardiovascular system depending on the child's age and the form of the disease.

The study included 80 children aged 1 month to 16 years, who were being monitored in the pediatric cardiology and internal medicine departments. Of these, 25 children had congenital heart defects (atrial septal defect, patent ductus arteriosus, tetralogy of Fallot);



- 20 children with acquired diseases (rheumatic heart disease, myocarditis, endocarditis);

- 35 children with functional cardiac disorders (autonomic dysfunction, arterial hypo- and hypertension).

Clinical diagnosis was performed using classical methods: examination, palpation, percussion, and auscultation.

Additionally, instrumental methods were used: electrocardiography (ECG), echocardiography (EchoCG), pulse oximetry, chest X-ray and determination of heart rate (HR) and blood pressure (BP) at rest and under load.

Laboratory tests (hematocrit, hemoglobin, and biochemical metabolic parameters) were used to objectively assess the clinical picture. Statistical data processing was performed using SPSS Statistics and Excel; differences were considered significant at $p < 0.05$.

The evaluation criteria included the severity of dyspnea, heart rate, presence of cyanosis, edema, heart murmurs, changes in heart sound, and signs of heart failure. The data obtained allowed us to identify the main syndromes of circulatory diseases in children and determine their clinical and physiological correlates.

Analysis of clinical data showed that the following syndromes were most frequently encountered in children with circulatory diseases:

Heart failure syndrome — 46.2% of cases. Arrhythmic syndrome — 28.7%. Pain syndrome (cardialgia) — 12.5%. Hypertensive and hypotensive syndromes — 9.8%. Peripheral circulatory disorder syndrome (edema, cyanosis) — 7.5%.

Age distribution showed that young children were more likely to have signs of congenital pathology (shortness of breath, tachycardia, cyanosis), while schoolchildren were more likely to have arrhythmias and functional vascular tone disorders.

Table 1. Main clinical manifestations of cardiovascular diseases in children (by age group)

Symptoms and syndromes	1 month – 3 years	4–10 years	11–16 years old	Total (%)
Dyspnea, tachypnea	21 (84%)	10 (33%)	3 (10%)	42 (52%)
Cyanosis (diffuse, perioral)	18 (72%)	6 (20%)	1 (3%)	25 (31%)
Tachycardia/arrhythmia	15 (60%)	17 (56%)	15 (50%)	47 (58%)
Heart murmurs	19 (76%)	16 (53%)	9 (30%)	44 (55%)
Hypertension/hypotension	2 (8%)	8 (26%)	10 (33%)	20 (25%)
Edema syndrome	5 (20%)	6 (20%)	5 (17%)	16 (20%)



The study found that children with congenital heart defects had predominant signs of central cyanosis and tachycardia, which is associated with impaired intracardiac hemodynamics and tissue hypoxia.

In acquired forms (myocarditis, rheumatic carditis), arrhythmic and pain syndromes dominated, while in adolescents with autonomic dysfunction, lability of blood pressure and sinus tachycardia were more often observed.

ECG data revealed an increased heart rate and signs of overload of the right heart in 30% of those examined, changes in the T wave and ST segment in 18%, as well as signs of conduction disturbances (first-degree atrioventricular block in 6%).

Echocardiographic data confirmed a decrease in ejection fraction (up to 50%) in nine children with signs of chronic heart failure. Pulse oximetry showed a decrease in oxygen saturation to 85–90% in children with congenital heart defects and to 93–95% in those with myocarditis.

Biochemical analyses demonstrated moderate hypoxemia, increased lactic acid levels, and hyperkalemia, reflecting metabolic alterations under hypoxic conditions.

Dynamic observation showed that with rational treatment (cardiotonics, diuretics, β -blockers, correction of water-salt balance) there is an improvement in hemodynamic parameters, normalization of heart rate and disappearance of signs of cyanosis.

A comparative analysis revealed clinical markers most characteristic of the early diagnosis of circulatory diseases in children:

- rapid breathing and tachycardia during exertion;
- weakening of the first heart sound;
- the appearance of abnormal murmurs during auscultation;
- blood pressure instability;
- perioral cyanosis and eyelid edema.

These symptoms should be considered diagnostic criteria requiring additional instrumental confirmation.

Thus, the results of the study confirm that the semiotics and syndromology of circulatory diseases in children reflect the developmental characteristics of the cardiovascular system and depend on age, etiology, and the degree of hemodynamic disturbances.

The identified patterns can be used for early diagnosis and prevention of severe forms of cardiovascular diseases in pediatric practice.

Semiotics and syndromes of circulatory diseases in children represent a key area of clinical pediatrics, allowing for the assessment of the cardiovascular system in the early stages of the disease.

In childhood, the development of the clinical picture has its own characteristics, since the functional mechanisms regulating blood circulation are in the developmental stage, and the body's compensatory reactions are characterized by pronounced lability.

Analysis of clinical and instrumental data showed that most cardiovascular diseases in children are accompanied by a complex of typical symptoms that form certain syndromes.



The leading one among them is the syndrome of heart failure, which occurs as a result of a decrease in the contractility of the myocardium and a violation of systemic hemodynamics.

In children, it manifests as shortness of breath, tachycardia, pallor or cyanosis of the skin, loss of appetite, and delayed physical development. Unlike adults, children have limited myocardial compensatory capacity, so heart failure develops more rapidly and is more severe.

Acute decompensation is particularly dangerous in newborns and infants, when a sharp decline in cardiac output leads to tissue hypoxia and multiple organ dysfunction. Another important manifestation is arrhythmia, characterized by disturbances in the heart rate, rhythm, and sequence of contractions.

In the children examined, arrhythmias were more often functional in nature, due to imperfect autonomic regulation. However, in cases of organic myocardial lesions (rheumatic myocarditis, congenital defects), more serious forms were detected, including extrasystole, conduction block, and sick sinus syndrome.

Heart rhythm disturbances in children can be an independent condition or a consequence of intoxication, viral infections, or metabolic changes. Pain syndrome was observed in schoolchildren and adolescents and was most often functional in nature, caused by neurovegetative disorders.

However, in some cases, it accompanied inflammatory or ischemic changes in the myocardium. A typical manifestation in adolescents was aching or stabbing pain in the heart region without radiating, unrelated to physical exertion but intensifying with stress.

Peripheral circulatory disorder (edema, cyanosis, cold extremities) reflects the stage of severe decompensation. It develops with prolonged hypoxia and venous congestion and is characteristic of chronic

heart failure and congenital heart defects with venous-arterial shunting. Analysis of ECG and echocardiography data confirmed that children with severe symptoms showed signs of chamber hypertrophy, chamber dilation, and myocardial overload.

These structural changes reflect adaptive and compensatory mechanisms aimed at maintaining hemodynamic balance. However, over the long term, these mechanisms become ineffective and lead to degenerative processes.

Particular attention should be paid to age-related aspects of semiotics. In infants, respiratory and color symptoms (shortness of breath, cyanosis) predominate; in preschoolers, functional sounds, tachycardia, and exercise intolerance; in adolescents, arterial fluctuations, pain, and arrhythmias.

These differences are associated with age-related metabolic characteristics, vascular regulation, and myocardial sensitivity to stress. Hypoxia plays a key role in the pathogenesis of most syndromes, triggering a cascade of compensatory responses: increased respiration, tachycardia, and activation of the sympathoadrenal system.

This results in temporary compensation, but with prolonged exposure to these factors, myocardial hypertrophy, decreased pump function, and congestion develop.

It should be emphasized that functional disorders in children are highly reversible with timely diagnosis and treatment.



Early detection of heart murmurs, arrhythmias, and ECG and echocardiographic changes helps prevent the development of chronic diseases and maintain quality of life. Differential diagnosis of semiotic signs should be performed taking into account medical history, age, physical activity level, and comorbidities.

Modern methods—echocardiography, Doppler ultrasound, ECG monitoring, and pulse oximetry—allow us to detect even the slightest deviations in cardiovascular function. Using an integrative approach, combining clinical and instrumental data, significantly improves diagnostic accuracy.

Thus, the discussion of the research results confirms that understanding the semiotics and syndromes of cardiovascular diseases in children is of key importance for early detection of pathology and prevention.

disability. The physician must consider each symptom not in isolation, but as part of an overall functional system reflecting the body's adaptive capabilities.

The semiotics of circulatory diseases in children is characterized by age-specific features and high variability in clinical manifestations.

The most common syndromes in pediatric practice are heart failure, arrhythmia, pain, and hypertension. Systemic and pulmonary hemodynamic disturbances, hypoxia, and neurohumoral imbalances play a major role in the development of symptoms.

Congenital and acquired cardiac pathologies require different approaches to interpreting clinical data, taking into account age and the stage of compensation. Instrumental methods (ECG, echocardiography, pulse oximetry) are crucial for an objective assessment of the cardiovascular system in children.

Early diagnosis and regular monitoring of children with signs of circulatory disorders can prevent the disease from becoming chronic and improve the prognosis.

A comprehensive understanding of the semiotics of cardiovascular diseases facilitates the development of effective preventive and rehabilitation programs in pediatric practice.

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