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CLINICAL AND MORPHOFUNCTIONAL FEATURES OF THE CARDIOVASCULAR SYSTEM IN CHILDREN WITH REMHELD SYNDROME

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The article is devoted to an urgent problem of pediatrics – Remheld syndrome. The aim of the present work was to study the clinical and morphofunctional features of the cardiovascular system in children with Remkheld's syndrome. 23 children from 10 to 18 years old with Remkheld's syndrome were examined. **Research methods.** Study of blood biochemical parameters (MV-CPK, ASLO titer, C-reactive protein), identification of persistent viral infection markers, ECG, daily monitoring of ECG and blood pressure by Holter, echocardiography, ultrasound of the vessels of the head and neck, ultrasound of the thyroid gland, ultrasound organs of the gastrointestinal tract. In the anamnesis, 78,3% of children had chronic gastroduodenitis, 21,7% had gastroesophageal reflux disease, and 8,7% had a hiatal hernia. All patients complained of cardialgia, interruptions in the work of the heart, a feeling of lack of air, dizziness upon admission. The appearance of noted complaints was associated with eating. **Results.** A study of the state of the cardiovascular system showed the presence of sinus tachycardia in 60,9% of patients, sinus bradycardia in 34,8%, single supraventricular extrasystole in 13,0%, paroxysmal supraventricular tachycardia in 4,3%, and 4,3% – autonomic sinus node dysfunction, in 13,0% – congenital heart disease (patent ductus arteriosus, bicuspid aortic valve), in 8,7% – mitral valve anterior prolapse, in 4,3% – a patent foramen ovale, in 95,7% of children – vegetative-vascular dysfunction. **Conclusion.** Children and adolescents with diseases of the gastrointestinal tract, when cardiac complaints appear, need an in-depth examination of the cardiovascular system.

Keywords: Remheld syndrome; children; cardiovascular system.

КЛИНИЧЕСКИЕ И МОРФОФУНКЦИОНАЛЬНЫЕ ОСОБЕННОСТИ СЕРДЕЧНО-СОСУДИСТОЙ СИСТЕМЫ У ДЕТЕЙ С СИНДРОМОМ РЕМХЕЛЬДА

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Введение. Статья посвящена актуальной проблеме педиатрии — синдрому Ремхельда. Целью представленной работы явилось изучение клинических и морфофункциональных особенностей сердечно-сосудистой системы у детей с синдромом Ремхельда. Обследованы 23 ребенка и подростка от 10 до 18 лет с синдромом Ремхельда. **Методы исследований.** Изучение биохимических показателей крови (МВ-КФК, титра АСЛО, С-реактивного белка), выявление маркеров персистирующих вирусных инфекций, электрокардиография (ЭКГ), суточное мониторирование ЭКГ и артериального давления по Холтеру, эхокардиография, ультразвуковая (УЗ) доплерография сосудов головы и шеи, УЗИ щитовидной железы, УЗИ органов желудочно-кишечного тракта. В анамнезе более чем у $^{3}/_{4}$ обследованных детей наблюдался хронический гастродуоденит, у 21,7 % — гастроэзофагеальная рефлюксная болезнь, у 8,7 % — грыжа пищеводного отверстия диафрагмы. Все больные при поступлении предъявляли жалобы на кардиалгии, перебои в работе сердца, чувство нехватки воздуха, головокружение. Появление отмеченных жалоб было связано с приемом пищи. **Результаты.** Изучение состояния сердечно-сосудистой системы показало наличие у большинства (60,9 %) пациентов синусовой тахикардии, у трети — синусовой брадикардии, у 13,0 % — одиночной наджелудочковой экстрасистолии, у 4,3 % — пароксизмальной наджелудочковой тахикардии. У 1 ребенка диагностирована вегетативная дисфункция синусового узла. У 13,0 % больных выявлялся врожденный порок сердца

(открытый артериальный проток, двухстворчатый аортальный клапан), у каждого десятого пациента – малые аномалии развития сердца. Большинство (95,7 %) детей имели проявления вегетососудистой дисфункции. **Вывод.** Дети и подростки, имеющие заболевания желудочно-кишечного тракта, при появлении кардиальных жалоб нуждаются в углубленном обследовании сердечно-сосудистой системы.

Ключевые слова: синдром Ремхельда; дети; сердечно-сосудистая система.

INTRODUCTION

Roemheld syndrome (gastrocardiac syndrome) is a complex of gastrointestinal symptoms associated with cardiac manifestations. This syndrome was first described in 1912 by the German therapist Ludwig von Roemheld (1871–1938) as one of the forms of cardiac neurosis. This pathology is based on reflex changes in the functioning of the cardiovascular system, i.e., a decrease in the coronary blood flow that occurs during excitation of the receptors of the esophagus and stomach, which are sensitive to mechanical and chemical influences.

Gastrocardiac syndrome is caused by excitation of the vagus nerve that occurs due to an increase in the susceptibility of mechanoreceptors (sensitive to stretching) and chemoreceptors (sensitive to the action of chemicals) to irritation, which are located in the lower esophagus, stomach, and first segment of the intestine. Typical symptoms occur when the stomach is overfilled with food or in case of aerophagia (swallowing large amounts of air). It can also be caused by increased intra-abdominal pressure due to severe flatulence and irritation of the vagus nerve with a high diaphragm [1, 2].

A number of gastroenterologists associate Roemheld syndrome with atherosclerotic abnormalities in the coronary vessels and explain that symptoms are caused by coronary steal syndrome when the stomach is overfilled with food masses; as a result, blood circulation in the heart decreases due to the redistribution of blood and blood flow to the overloaded stomach [6–8].

Patients with an easily excitable nervous system and obesity are at risk for this pathology. In addition, gastrocardiac syndrome can develop in patients with a hiatal hernia, esophageal tumors, forestomach, gastric ulcer, etc.

Similar disorders can occur with gallbladder pathology, the so-called cholecystocardiac syndrome. Sergei Petrovich Botkin, an outstanding Russian physician, was the first to note the possibility of reflex pain in the heart with cholelithiasis, and paid attention to this syndrome in 1883 [2]. From age 25, he suffered from cholelithiasis, which proceeded with episodes of colic and anginal pains in the region of the heart. Based on his clinical observations, he concluded that "…cholelithiasis is often expressed as phenomena that are concentrated mainly in the region of the heart, especially in those cases when the stone moves in the cystic duct. You will not hear complaints of digestive disorder, pain, and bloating, but the patient will complain mainly of bouts of pain in the side of the heart, occurring with obvious changes in its function, arrhythmia, and dyspnea, in brief, with a clear presentation of angina pectoris."

To rule out cardiovascular diseases, electrocardiography (ECG) is performed in patients suspected with Roemhel syndrome. On onset, bradycardia, tachycardia, extrasystole, degree I atrioventricular nodal block, and signs of myocardial ischemia can occur. The examination plan for these patients also includes a study of blood biochemical parameters (creatine phosphokinase-MB [CPK-MB], lactate dehydrogenase, etc.), daily monitoring of ECG and blood pressure (BP) by Holter, echocardiography (EchoCG), pulmonary function test, tests with functional loads (such as bicycle ergometry and treadmill test), stress echocardiography according to indications, transesophageal electrical cardiac stimulation, cardiac magnetic resonance imaging, and probing of cardiac cavities.

For a long time, in practical gastroenterology, contemporary computer technology has enabled receiving and processing of information about the state of the acid-forming function of the stomach and the nature of motor disorders. Intragastric and intraesophageal pH-metry with computerized data processing has become the main method of functional diagnosis of esophageal and stomach disorders. A new tendency in the use of pH meters is a combination of pH examination and ECG. Simultaneous 24-h pH and ECG monitoring is gaining increasing popularity, as this method increases the ability to interpret cardialgias and their causes and enables differential diagnostics between gastroesophageal reflux and heart diseases, or their combination [1, 5].

Contrast radiography is performed to diagnose hiatal hernia. Ultrasonography (US) of the gastrointestinal tract helps rule out liver and gallbladder

pathologies. The examination schedule may include a urea breath testing to detect *Helicobacter pylori*.

Preoperative endoscopic examination methods, in particular fibro esophagogastroduodenoscopy, is contraindicated in patients suspected with Roemheld syndrome, since psychological stress and irritation of the receptor zones of the esophagus and stomach can lead to excessive excitation of the vagus nerve and ultimately cardiac arrest.

To our knowledge, only a few studies have reported about Roemheld syndrome, and reports of gastrocardiac syndrome in childhood and adolescence are extremely rare.

The work presented aimed to elaborate the clinical and morphofunctional aspects of the cardiovascular system in pediatric patients with Roemheld syndrome.

MATERIALS AND METHODS

Twenty-three pediatric patients aged 10–18 years with Roemheld syndrome, who were under monitoring, were treated in the Department of Pediatric Cardiology and Cardiac Surgery of the V.K. Gusak Institute of Emergency and Reconstructive Surgery of Donetsk from September to December 2019. There were 13 (56.5%) boys and 10 (43.5%) girls. Examinations included the study of blood biochemical parameters (such as CPK-MB, anti-streptolysin O titer, and C-reactive protein), identification of markers of persistent viral infections, ECG, daily Holter monitoring of BP, echocardiography, Doppler US of the head and neck vessels, US of the thyroid gland, and US of the gastrointestinal tract.

All patients had a history of gastrointestinal tract pathology, such as hiatus hernia ($n = 2$, 8.7%), gastroesophageal reflux disease ($n = 5$, 21.7%), chronic gastroduodenitis associated with *H. pylori* ($n = 18$, 78.3%), biliary dyskinesia in the presence of gallbladder tortuosity ($n = 10$, 43.5%), and chronic cholecystitis ($n = 5$, 21.7%).

Treatment of patients with Roemheld syndrome included adherence to the diet plan, overeating avoidance, prescription of antispasmodic, sedative, and cardiotrophic drugs, and psychotherapy sessions.

Data obtained were processed by classical mathematical methods of variation statistics using the Statistica for Windows software package version 12.6.

RESULTS

Upon admission, all patients complained of cardialgia, impaired heart functions, air hunger, and dizziness. These complaints were noted by pediatric patients from 1–2 times a day to 2–3 times a week. In all cases, these complaints occurred following food intake. ECG recorded during attacks revealed that 22 (95.7%) children had sinus rhythm, 14 (60.9%) had sinus tachycardia, 8 (34.8%) had sinus bradycardia, 4 (17.4%) had degree I atrioventricular nodal block, 3 (13.0%) had single supraventricular extrasystole, and 1 (4.3%) had paroxysmal supraventricular tachycardia (Fig. 1).

A non-invasive electrophysiological study performed on one child enabled diagnosis of a typical atrioventricular nodal reentrant tachycardia.

Impairment of myocardial repolarization processes was recorded in 8 (34.8%) patients. In 15 (65.2%) patients, an increase in BP was recorded during attacks.

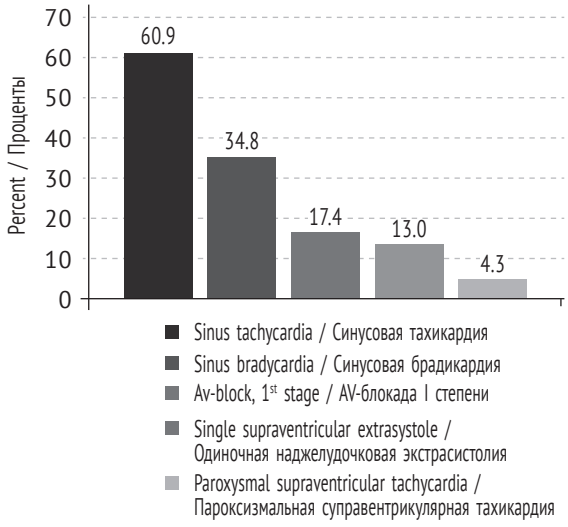

Fig. 1. ECG changes recorded during an attack in patients with Remkheld's syndrome
Рис. 1. Изменения на электрокардиограмме, записанной во время приступа, у пациентов с синдромом Ремхельда

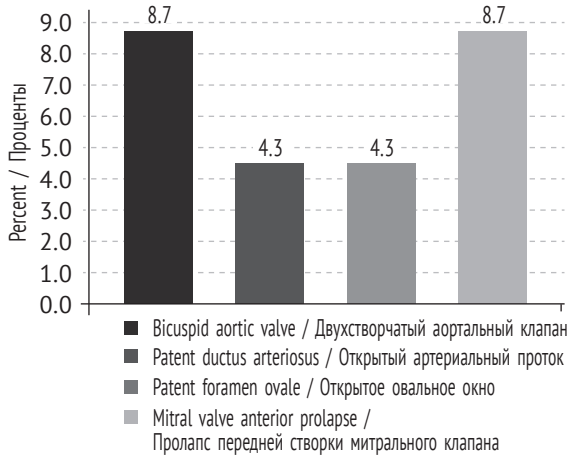

Fig. 2. Morphofunctional state of the cardiovascular system in children with Remkheld's syndrome
Рис. 2. Морфофункциональное состояние сердечно-сосудистой системы у детей с синдромом Ремхельда

The study of the state of the cardiovascular system revealed congenital heart disease (open arterial duct of 0.2 cm) in 1 (4.3%) patient, bicuspid aortic valve in 2 (8.7%) patients, open oval window in 1 (4.3%) patients, and prolapse of the anterior mitral leaflet in 2 (8.7%) patients (Fig. 2).

Autonomic dysfunction of the sinus node was diagnosed in 1 (4.3%) child. Almost all children examined (95.7%) had manifestations of vegetovascular dysfunction.

Concomitant pathology in pediatric patients with gastrocardiac syndrome was represented by overweight in 7 (30.4%) patients, chronic tonsillitis in 4 (17.4%) patients, degree I diffuse non-toxic goiter in 3 (13.0%) patients, juvenile deforming arthrosis of the cervical spine in 2 (8.7%) patients, and persistent Epstein-Barr viral infection in 2 (8.7%) patients. Signs of undifferentiated connective tissue dysplasia (dysplastic tooth growth, hypermobile articular syndrome, chest deformity, scoliosis, platypodia, etc.) were noted in all pediatric patients with Roemheld syndrome.

DISCUSSION

The results of this study indicate that the major complaints of children and adolescents with Roemheld syndrome are associated with impaired cardiovascular function. The characteristic attack usually develops after a meal. Rhythm disturbances (such as tachycardia, bradycardia, and extrasystole) as well as precordialgia often occur. The pain can range from an aching pain to an intense pain, sometimes resembling an angina pectoris, causing fear of death among patients. Pain syndrome can be abrupt or last for several hours. Adolescents usually clearly describe the localization of painful sensations behind the sternum on the left chest, and younger children note painful sensations in the area of the heart. The attack may be accompanied by an increase in BP, dizziness, skin pallor, and cold sweats. A characteristic sign of Roemheld syndrome is the cessation of symptoms after self-provoked vomiting or prolonged belching of air.

Diagnosis of gastrocardiac syndrome is based on history taking, ruling out of heart pathology (rhythm disorders, ischemic disease, etc.), mediastinal diseases (such as mediastinitis and aneurysm of the thoracic aorta), as well as identification of the digestive system pathology, which can be the cause of attacks (hiatal hernia, stomach ulcer, cholecystitis, etc.).

A pediatric cardiologist, a pediatric gastroenterologist, a psychotherapist, and, if necessary, a pediatric surgeon are involved in the treatment of Roemheld syndrome. Regardless of the cause, treatment for gastrocardiac syndrome includes diet therapy, which is based on the prevention of overeating. The child should eat with split meals in small portions. Intake of chemically rough food, as well as gar-forming foods, should be limited or excluded from the diet. In case of obesity, a set of measures should be taken to normalize body weight. To prevent attacks, antispasmodics are taken (papaverine, drotaverine, etc.) half an hour before a meal. Sedatives are also administered. If the gastrocardiac syndrome has no organic cause, psychotherapy is implemented. This treatment is highly effective and improves the quality of life of children and adolescents. Patients with organic pathology of the gastrointestinal tract require treatment of the underlying disease.

The prognosis of Roemheld syndrome is favorable. The disease can be treated quite well, and complete recovery occurs after organic cause is eliminated.

CONCLUSION

Clarification of the clinical and morphofunctional characteristics of the cardiovascular system in pediatric patients with Roemheld syndrome during episodes of cardialgia revealed the presence of sinus tachycardia in most (60.9%) patients, sinus bradycardia in one-third of the patients, single supraventricular extrasystole in 13.0% of the patients, and paroxysmal supraventricular tachycardia in 4.3% of the patients. Autonomic dysfunction of the sinus node was noted in one (4.3%) child. Structural heart abnormalities were found in one-third of the patients, including congenital heart defects (open arterial duct and bicuspid aortic valve) in 13.0% of the patients. Minor structural abnormalities of the heart (prolapse of the anterior mitral leaflet and open oval window) were detected in three patients. Most (95.7%) patients had manifestations of vegetovascular dysfunction.

Children and adolescents with gastrointestinal tract disorders, when cardiac complaints appear, require an in-depth examination of the cardiovascular system using modern diagnostic methods. Similarly, complaints of pain in the heart region and impaired heart rhythm require ruling out of their extracardiac genesis, including digestive pathologies.

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