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## A CASE OF MULTISYSTEM INFLAMMATORY SYNDROME

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The article presents a clinical case of children multisystem inflammatory syndrome (MSI-Ch) associated with a new coronavirus infection (COVID-19) in a 10-year-old child complicated by pancarditis: endomyopericarditis, unspecified bronchopneumonia, systemic inflammatory response syndrome of infectious origin with an organic disorder: with a lesion heart, kidney, liver, multiple organ failure, secondary antiphospholipid syndrome. The correspondence of the clinical picture, laboratory and instrumental data to the diagnosis of MSI-Ch, and differential diagnosis are discussed.

**Keywords:** multisystem inflammatory syndrome in children (MSI-Ch), Kawasaki disease, Covid-19, children.

**Introduction:** Multisystem inflammatory syndrome in children (MSI-Ch) is a severe condition that occurs after suffering Covid-19, in which internal organs become inflamed - lungs, heart, eyes, kidneys, brain, gastrointestinal tract, skin. This disease has created a diagnostic problem as it shares similarities with Kawasaki disease and Kawasaki syndrome. With MSI-Ch, there is a persistent increase in temperature (100%), a rash on the skin, conjunctivitis, swollen lymph nodes, and edema on the hands and feet. Most also have gastrointestinal symptoms - abdominal pain, vomiting, loose stools. On the part of the respiratory system, signs of damage are observed in less than half of the patients [9,12]. A quarter of children with MSI-Ch have heart disease. There are two types of pathological process in the cardiovascular system. In the first case, this is the

expansion of the coronary arteries, as a rule, without myocarditis. It is detected incidentally on ultrasound of the heart and rarely manifests as an acute coronary syndrome. In the second case, there is a clinic of acute myocarditis, which develops over several days and manifests itself as cardiogenic shock [16].

The main laboratory sign of MSI-Ch is hyperproduction of inflammatory markers - C-reactive protein, ferritin, procalcitonin, fibrinogen, D-dimer, triglycerides [14, 1, 11, 15, 8]. Thrombocytopenia can also be observed, which is not typical for Kawasaki disease and lymphopenia [1, 16]. Almost all children with MSI-Ch will have elevated D-dimer levels, but despite this, thrombosis is rare [17]. Elevated troponin levels indicate cardiac involvement [9,11]. Thus, elevations in inflammatory and cardiac biomarkers not only suggest a diagnosis of MSI-Ch but may reflect disease severity [6,10].

According to recent reports, the Council of State and Territorial Epidemiologists (CSTE) and the US CDC Centers for Disease Control and Prevention have updated the criteria for the diagnosis of MSI-Ch to distinguish this disease from other similar conditions. Thus, MSI-Ch occurs in patients younger than 21 years old, with a coronavirus infection within 60 days before or during hospitalization, a fever of 38°C and above for any duration. The only laboratory sign is now considered to be an increase in CRP levels of 3.0 mg/dl and above. The diagnosis of MSI-Ch requires at least two signs of involvement of organs and systems: damage to the heart, skin and mucous membranes, gastrointestinal tract, changes in hematological parameters and shock [5].

Of the instrumental methods of investigation, echocardiography can be useful for prompt recognition of patients with cardiac dysfunction to adjust therapy or to determine alternative diagnoses [6].

Treatment of MSI-Ch is carried out pri-

marily with immunomodulators, since the disease is caused by dysregulation of the immune system [13]. This is treatment with high doses of intravenous immunoglobulins (IVIG) alone or in combination with a corticosteroid. At the same time, antiplatelet agents and anticoagulants are prescribed [15,8]. In some cases, the appointment of inhibitors of interleukin-6 and antitumor necrosis factor is required [7].

According to many researchers, 50-60% of patients have changes in the cardiovascular system. Most children with MSI-Ch have coronary artery disorders, which is significantly higher than in Kawasaki disease, in which the degree of involvement of the coronary vessels is 10-15% [6,9,10]. Most patients, even with severe cardiovascular disease, recovered without consequences [15,6,10]. Since the development of coronary aneurysms occurs in the recovery stage, it is necessary to conduct control echocardiographic studies even in patients without pathology of the cardiovascular system in the acute stage of the disease [15,8].

The pathophysiology of multisystem inflammatory syndrome remains largely unclear. Apparently, it is based on a virus-induced hyperimmune reaction [2,3,4,9]. The most important role in the pathogenesis is played by the activation of T-lymphocytes, hyperproduction of pro-inflammatory cytokines. (TNF- $\alpha$ , interleukins 1, 2, 6, 8, 10, granulocyte-macrophage colony-stimulating factor), deposition of immune complexes in the vascular wall. The mechanism of immune complex deposition in the vascular wall determines the development of a multisystem inflammatory response and explains most of the clinical and laboratory signs of the syndrome, such as fever, hyperferritinemia, coagulopathy, and an increase in inflammation markers [15,16].

**The purpose of the study:** to describe the clinical and laboratory picture

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Table 1

Biochemical parameters of blood serum

| Indicators                             | 4.12.2020 | 15.12.2020 | 11.01.2021 | Reference values |
|----------------------------------------|-----------|------------|------------|------------------|
| ALT (u/l)                              | 19.30     | 17.40      | 34.70      | 0-39             |
| AST (u/l)                              | 49.40     | 17.60      | 13.90      | 0-47             |
| Urea (mmol/l)                          | 6.2       | 7.9        | 6.6        | 1.8-6.4          |
| Bilirubin total (μmol/l)               | 5.2       |            | 6.6        | 3.4-17.1         |
| Creatinine (μmol/l)                    | 55.15     | 45.12      | 47.81      | 27-62            |
| Albumin (g/l)                          | 19.6      | 35.8       | 40.60      | 38-54            |
| Total protein (g/l)                    | 81.4      | 93.90      | 72.20      | 60-80            |
| Glucose (mmol/l)                       | 6.14      | 4.81       | 4.37       | 3.3-5.6          |
| GGT (gamma-glutamyl transferase) (u/l) | 25.5      | 27.2       | 30.50      | 0-17             |
| Phosphorus (mmol/l)                    | 1.11      | 1.35       | 1.59       | 1.45-1.78        |
| Lactate dehydrogenase (u/l)            | 536.7     | 191.6      | 288.0      | 0-295            |
| CPK (u/l)                              | 229.5     |            |            | 0-154            |
| Calcium total (mmol/l)                 | 1.95      |            | 2.47       | 2.2-2.7          |
| Sodium (mmol/l)                        | 130.0     |            | 132.7      | 138-145          |
| Potassium (mmol/l)                     | 4.47      |            | 5.47       | 3.4-4.7          |

Table 2

Complex ultrasound of the heart (M-and B-mode, TsDK, dopplerography)

| Дата       | Conclusion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 03.12.2020 | Decreased systolic function of the myocardium of the left ventricle. Ejection fraction - 47%. A slight expansion of all cavities of the heart, the aorta in the area of the sinuses, the trunk of the pulmonary artery. Sealing of the leaflets of the mitral valve. Insufficiency of the mitral valve of the 1st degree, the valve of the pulmonary artery of the 1st degree. Tricuspid valve insufficiency associated with mild pulmonary hypertension (estimated pressure 36.13 mmHg). Separation of the sheets of the pericardium along the anterior wall of the right ventricle, the posterior wall of the left ventricle. |
| 04.12.2020 | Open oval window 0.35 cm. Insufficiency of the tricuspid valve of the 3rd degree, the mitral valve of the 2nd degree. Additional trabecula in the cavity of the left ventricle. Slight expansion of the cavities of the right atrium and left ventricle. Ejection fraction - 45%.                                                                                                                                                                                                                                                                                                                                               |
| 06.12.2020 | Signs of pulmonary hypertension of the 1st degree. Expansion of the left and right coronary arteries. Separation of the sheets of the pericardium.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 14.12.2020 | Mitral valve insufficiency of the 1st degree, tricuspid valve of the 1st degree. The cavities of the heart are not dilated. Ejection fraction - 67%.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 30.12.2020 | Splitting of the pericardium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

physical development by age, was on mixed feeding.

Past diseases: acute respiratory infections rarely, up to 7 years of age, purulent tonsillitis, chickenpox, in February 2020 - protracted bronchitis.

Vaccinations received according to the calendar. There were no injuries or operations. There is no allergy. Heredity, according to the mother, is not burdened.

Anamnesis morbi: fell ill acutely on November 27, 2020 - fever up to 40°C, weakness, body aches. He was treated on an outpatient basis, took paracetamol, arpeflu, there was no improvement.

He was hospitalized in the central ulus hospital on November 30, 2020, where he stayed until December 1, 2020 diagnosed with bronchopneumonia. He was transferred to the Children's Infectious Diseases Clinical Hospital (ChIDH) with a risk of covid pneumonia with lung damage up to 8%. On ELISA - elevated Ig G, positive Ig M from 12/01/2020. From 01.12.20 - 03.12.20 was in hospital at the ChIDH. Due to the severity of the condition and the lack of proper treatment in the ChIDH, he was transferred to the pediatric center of the Pediatric Center of the SAI RS (Yakutia) "Republican Hospi-

tal No. 1 - National Center of Medicine". Upon admission, the condition was assessed as very serious, in the mind, the state of health is reduced. Body temperature - 38.8 °C, respiratory rate - 32 per minute, heart rate - 140 beats per minute. Blood pressure - 98/43 mm Hg. Contact, adequate. General hyperesthesia. Lips are bright and dry. The tongue is lined, the tip is "raspberry". Hyperemia of the conjunctiva of both eyes. Nasal breathing is difficult, there is no discharge. Throat is hyperemic. Enlarged cervical lymph node, 3\*3cm, painful. Integuments - abundant maculopapular rash on the

back, back of the thighs, over the elbow and knee joints, hemorrhagic rash on the feet, over the knee joints, not abundant. Feet and hands are moderately edematous, hyperemic. Soreness of large joints - hip, knee, elbow, ankle. Pain in the femoral muscles at rest and on palpation. In the lungs, breathing is carried out in all fields, hard, no wheezing, dry cough, infrequently. The boundaries of the heart are not expanded, the tones are the gallop rhythm, loud, sonorous. The abdomen is soft, swollen, painful on palpation along the intestines, peristalsis is alive. The liver is enlarged by 2.5-3 cm, dense. Stool once, liquid. There are no meningeal symptoms. The peripheral pulse is symmetrical.

The patient was in the Department of Anesthesiology and Intensive Care from 04.12.20 till 08.12.2020, then transferred to the cardio-rheumatology department for further treatment.

**Research results.** In the general blood test at admission: an increase in ESR to 55 mm per hour, neutrophilia (leukocyte formula shift to the left), lymphopenia. Biochemical analysis of blood - cytotoxicity, increased levels of LDH, CPK, uric acid (Table 1). Immunological blood test dated 07.12.20. - an increase in CRP to 72.60 mg / l, ASLO - 424.60 IU / ml. Ferritin from 04.12.20. - 689.71 µg/l (normal - 7-140), troponin - 0.04 ng/l (normal up to 0.03), D-dimer - 1.58 µg/ml (normal - 0-0.5).

On X-ray computed tomography of the chest organs dated 04.12.2020, there were no reliable data for viral pneumonia. Effusion in both pleural cavities with the formation of subsegmental, compression atelectasis. Stagnation in the pulmonary circulation.

Ultrasound examination of the abdominal organs from 12/04/2020: Hepatosplenomegaly. A small accumulation of free fluid in the pelvis. Dopplerographic increase in the linear velocity of blood flow in the superior mesenteric artery.

On the basis of clinical, anamnestic, laboratory and instrumental studies, the main diagnosis was made: Multisystem inflammatory syndrome, COVID-associated. Pancarditis: endomyopericarditis. Complication: Bronchopneumonia, unspecified; Syndrome of a systemic inflammatory response of an infectious origin with an organic disorder: with damage to the heart, kidneys, liver, multiple

organ failure. Secondary antiphospholipid syndrome. Differentiation from Kawasaki disease is indicated by the age of the patient, the severity of the course of the disease, heart damage, involvement of the skin and mucous membranes and the gastrointestinal tract, and a high level of CRP.

Treatment: intravenous immunoglobulin "Privigen", glucocorticoids ("Metipred", "Dexamethasone"), digoxin, aspirin, heparin, veroshpiron, spironalactone. Physiotherapeutic treatment was also carried out - magnetotherapy on the chest.

Discharged on the 40th day with improvement. When discharged, there are no complaints, the condition is satisfactory and stable. It is recommended to observe a pediatrician and an infectious disease specialist at the place of residence, a scheduled examination by a cardiologist, rheumatologist and hematologist in a month with a repeat of the immunogram and coagulogram. Continue exercise therapy. Exemption from physical education for 1 year.

**Conclusion.** This clinical case is a complication of coronavirus infection, when the clinic of multisystem inflammatory syndrome developed.

The severity of the course of the disease is due to the defeat of the cardiovascular system - the expansion of the coronary vessels, the splitting of the sheets of the pericardium. The difficulty in treatment is associated with the lack of effective etiotropic therapy.

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