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# COVID-19 in Children: Multisystem Inflammatory Syndrome

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Unlike adults, children are less likely to get infected SARS-CoV-2, their disease has a mild form and fatal cases are rather rare. However, a new disease associated with SARS-CoV-2, the multisystem inflammatory syndrome (MIS-C), has been described in children. Most children with MIS-C in the world are blacks or asians.

**Purpose** — to analyze of peculiarities of MIS-C in children of Lviv region.

**Materials and methods.** We have analyzed medical records of 16 children who were treated in Communal Non-Commercial Establishment of Lviv Regional Council «Lviv Regional Children Clinical Hospital «OKHMATDYT» in the period from September 2020 to January 2021 with the diagnosis of MIS-C, associated with SARS-CoV-2.

**Results.** MIS-C was diagnosed in 16 children (average age was 8.2±0.065 years, girls:boys = 1:0.6). None of our patients was the «primary source of SARS-CoV-2» in the household but contracted coronavirus disease after a contact with the sick relatives. The disease occurred in 4 (25%) children against the background of acute coronavirus disease, in 4 (25%) more children during the first month and 8 (50%) children more than a month after acute SARS-CoV-2 infection. All children has febrile fever and general weakness. Besides, in most of the patients clinical progression of MIS-C was characterized by typical skin rashes and conjunctivitis (13 children — 81.5%), facial swelling and edema of distal parts of extremities (11 children — 68.75%). Muscle pain was present in 9 (56%) children, hyperesthesia — in 4 (25%) children, gastrointestinal symptoms — in 8 (50%) our patients. Myocarditis was diagnosed in 4 (25%) children, linear dilatation of coronary arteries (2 children — 12.5%) and small aneurysms (1 child — 6.25%) — in 3 (18.75%) our patients. All these changes returned to normal 1 month after discharge from the hospital.

**Conclusions.** MIS-C response before the 48th day after acute coronavirus disease and is characterized by typical clinical course. Treatment with human immunoglobulin at the dose of 1–2 g/kg, glucocorticosteroids at the dose of 1–2 mg/kg, aspirin 3–5 mg/kg against the background of antibacterial therapy is effective for the prevention of changes in the coronary arteries and for the recovery of all patients.

The research was conducted in accordance with the principles of bioethics set out in the WMA Declaration of Helsinki and Universal Declaration on Bioethics and was approved by the Commission on Ethics of Scientific Research, Experimental Developments and Scientific Works of Danylo Halytsky Lviv National Medical University. The informed consent of the patients was obtained for conducting the studies.

No conflict of interests was declared by the authors.

**Keywords:** COVID-19, pediatric inflammatory multisystem syndrome, pediatric multisystem inflammatory disease, COVID-19 related, MIS-C associated with COVID-19.

## Introduction

In the whole world 2019–2020 will go down in history of medicine, and perhaps of all mankind, as the years of the pandemic caused by the coronavirus SARS-CoV-2 (SARS-CoV-2) [5]. The disease is characterized by acute respiratory symptoms, its being course extremely polymorphic: from asymptomatic or fairly mild to severe with fatal consequences. Compared to adults, children are less likely to contact SARS-CoV-2, the disease is mild and fatalities are rare [13]. However, a new serious disease in the pediatric population, associated with SARS-CoV-2, has been reported in literature as «Pediatric Multisystem Inflammatory Syndrome» or «Multisystem Inflammatory Syndrome in Children» (MIS-C). This disease is characterized by different phenotypes: Kawasaki disease (complete or incomplete form), prolonged fever with signs of inflammation, toxic shock syndrome [9]. The first cases of Kawasaki disease associated with SARS-CoV-2 were described in England, Italy, France, in the regions with the highest number of the infected. This being said, most children with MIS-C were blacks or Asians [15]. This is why it seems challenging to analyze cases of MIS-C in the Ukrainian children.

**Purpose of the research** — to analysis of peculiarities of MIS-C in children of Lviv region.

## Materials and methods of research

We have analyzed in-patient medical records of 16 children age from one to 15 years (average age 8.2±0.065 years) for the period from September 2020 till January 2021, who were treated in Communal Non-Commercial Establishment of Lviv Regional Council «Lviv Regional Children Clinical Hospital «OKHMATDYT» (CNE LRC LRCKH «OHMATDYT») with the diagnosis of MIS-C, associated with SARS-CoV-2. Among them there were10 girls and 6 boys (girls:boys = 1:0.6).

Clinical study included examination, monitoring of body temperature, respiratory rate, heart rate, monitoring of arterial oxygen percent saturation and diuresis.

SARS-CoV-2 virus RNA was detected on the material sampled from the nose and throat material using an amplifier CFX96 Touch (Bio-Rad, USA) using K653, a set of reagents for detecting SARS-

CoV-2 coronavirus RNA by polymerase chain reaction (PCR) in real time (research and production enterprise «Hema», Ukraine) in the laboratory of State Establishment «Lviv Regional Center for Disease Control and Prevention of the Ministry of Public Health of Ukraine». SARS-CoV-2 specific antibodies of class G (IgG) were determined in venous blood carried out by enzyme-linked immunosorbent assay (ELISA) using a ELx800 *Automated* Microplate Reader (Bio Tek Instruments Inc, USA) and enzyme immunoassay systems for the qualitative and semi-quantitative determination of IgG antibodies for the SARS-CoV-2 coronavirus («Vitrotest Bioreagenta» LLC).

The rest of the generally adopted laboratory tests were conducted in the laboratory of CNE LRC LRCCH «OKHMATDYT»: complete blood count (H18 LIGHT hematology analyzer and reagents, SFRI, France), common urine analysis (urine microscopy method), C-Reactive Protein (CRP) — latex test (C-reactive protein (CRP) — slide, BioSystem S.A., Spain), biochemical blood analysis (DS-161 Auto Biochemistry Analizer, Sinnowa, China) to determine creatinine (Liquick Cor — CREATININE, PZ Cormay, Polska), transaminases (Liquick Cor — ASAT, Liquick Cor — ALAT, PZ Cormay, Polska).

Frontal projection chest X-ray examination was made using Axiom Iconos R 100 apparatus of Siemens Company (Germany).

Transthoracic echocardiography (EchoCG) was made using Esaote My Lab 25 Golg apparatus (Italy) in all standard projections. Left ventricle myocardial dysfunction was diagnosed with the ejection fraction (EF) reduction below 55% or segmental contractility abnormalities. Backflow on the mitral valve into systole indicated mitral insufficiency [12]. To asses dimensions of the coronary arteries and their dilatation or aneurysm we used pediatric internet calculator (Ped(z): https://www.pedz.de/de/pedz/mmode.html). Dilatation of coronary arteries was diagnosed at z-score 2–2.5, and small aneurysms — at z-score 2.5–5 [16].

All results were statistically processed using Excel software of Microsoft Office 2016, PRODUCT ID: 00202-50473-09342-AA974. Quantitative characteristics are shown as M±m (arithmetic mean ± arithmetic mean standard error). 95% confidence intervals were calculated using Wald test, and when frequency of indication approached 0% or 100% — using the φ method (angular phi transformation) known also under the name of Fisher's angular transformation method. The probability of difference between the groups was determined using $\chi^2$ Pearson's method or Fisher method [2].

The research was conducted in accordance with the principles of bioethics set out in the WMA Declaration of Helsinki — «Ethical principles for medical research involving human subjects» and «Universal Declaration on Bioethics and Human Rights» (UNESCO). The research was approved by the Commission on Ethics of Scientific Research, Experimental Developments and Scientific Works of Danylo Halytsky Lviv National Medical University, minutes No. 8 of November 23, 2020. Parents of all the patients gave their consent in writing to examination of their children and publishing results of the studies.

## Results of research and discussion

Patients who were treated at CNE LRC LRCCH «OKHMATDYT» with the diagnosis MIS-C associated with SARS-CoV-2 were divided by age as follows: 4 (25%) children were aged 1–5 years, 7 (43.75%) children aged 6–10 years and 5 (31.25%) children were in the age group from 11 to 15 years. All patients had a cause and effect relationship with coronavirus infection. 4 (25%) children had positive PCR for SARS-CoV-2 at admission to the hospital. In the remaining (12 (75%) children) there was recorded the increased IgG levels to SARS-CoV-2 (3.78±0.727) and the coronavirus infection in past medical history. None of our patients was the «primary source of SARS-CoV-2» in the household but contracted coronavirus disease after a contact with sick relatives. It was established, that MIS-C occurred in 4 (25%) children against the background of acute progression of coronavirus disease, in 4 more children (25%) during the 1st month and in 8 (50%) children one month after coming through contracted SARS-CoV-2 infection. The disease debuted with febrile fever in 16 (100%) patients, and on the 2nd day of the disease 3 (18.75%) children were hospitalized, on the 5–7th day — 12 (75%) and on the 10th day of the disease 1 (6.25%) girl was transferred from the central district hospital. 7 (43.75%) of children received antibacterial therapy at the pre-hospital phase.

Among our patients, 3 (18.75%) were obese with 1 (6,25%) girl diagnosed simultaneously with ascariasis; 1 (6.25%) boy was behind in physical growth and development and at the age of 10 weighed 20 kg (-3.96 z-score); 1 (6.25%) girl had been treated for epilepsy during the last 3 years and another 1 (6.25%) girl had a visual pathology — astigmatism. Clinical manifestations in

our patients, aside from fever, included symptoms on the part of practically all organ systems. General weakness was noted in all (100%) children. Muscle pain was observed in 9 (56.25%) children of our patients. Hyperaesthesia was established in one quarter (25%) of our patients. As to the gastrointestinal symptoms, 8 (50%) children had abdominal pain, 8 (50%) — complained of nausea and vomiting, and 6 (37.5%) children had diarrhea. What is more, 1 (6.25%) boy was referred for the consultation to a surgeon with suspected acute surgical pathology with subsequent differential diagnosis of ulcerative necrotic colitis. Changes in the skin and mucous membranes were characterized by polymorphic rashes and conjunctivitis (that appeared on the $4^{th}$ – $6^{th}$ day of the disease) in 13 (81.25%) children, hyperemia of lips and tongue in 4 (25%) children. In 11 (68.75%) patients facial swelling of face and edemas of hands and feet were observed against the background of rashes. Only in 6 (37.5%) children minimally enlarged cervical lymph nodes could be palpated. The 4 (25%) children had shortness of breath and cough. Symptoms on the part of the nervous system were manifested as headache in 4 (25%) of our patients and 9 (56.25%) children were pathologically drowsy (Table 1). The 1 (6.25%) girl had a critically severe progression of the disease with toxic shock syndrome.

The first publications on the system analysis of clinical, laboratory particularities and treatment of MIS-C appeared in October 2020 [1,3,7]. The studies cover the period of time from January to July 2020 and quite large groups of patients. This gave us the opportunity to compare our results with the world results (Table 1). In 2020 we had a 15-fold increase in the number of cases of Kawasaki disease in the children population of Lviv region. It is known that a typical Kawasaki disease is usually diagnosed in children under 5 years of age. In contrast, in our study, children of this age accounted for only 25%.

Of course, our cohort is several-fold smaller and, perhaps, in the future, having a larger study

*Table 1*

**Clinical manifestations of MIS-C in children treated at the «Lviv Regional Children Clinical Hospital «OKHMATDYT» in comparison with the data of literature system reviews**

| Indicator | CNE LRC LRCKH «OHMATDYT» | M. Ahmed (syst. rev.) [1] | S.C. Aronoff (syst. rev.) [3] | S. Godfred–Cato [7] |
|---|---|---|---|---|
| Total, n (%) | 16 (100%) | 662 (52.3%) | 505 | 570 (55.4%) |
| Age, years | 8.2±0.065 | 9.3 | 8 | 8 |
| Comorbidities, % | 37.50% (13.78-61.22) | 48% (44.23–51.84) | | 34% (29.9–38.17) |
| Muscle pain / weakness, % | 100% (94.12–100.00) | 13.4% (10.85–16.04)* | | |
| Gastrointestinal symptoms, % | 50% (25.5–74.5) | | 79.1% (75.46–82.56)* | 90.9% (88.37–93.39)* |
| Abdominal pain, % | 50% (25.5–74.5) | 73.7% (70.36–77.07)* | | 61.9% (57.69–66.16) |
| Diarrhea, % | 37.5% (13.78–61.22) | | | 53.2% (48.81–57.51) |
| Nausea and vomiting, % | 50% (25.5–74.5) | 68% (64.42–71.53) | | 61.8% (57.52–65.99) |
| Skin and mucous membranes, % | 93.75% (77.21–100.00) | | | 70.9% (66.91–74.84)* |
| Rash, % | 81.25% (59.2–95.94) | 56.2% (52.41–59.97)* | 60.2% (55.93–64.47) | 55.3% (50.93–59.6)* |
| Conjuctivitis, % | 81.25% (59.2–95.94) | 51.8% (48.01–55.62)* | 52.2% (47.92–56.63)* | 48.4% (44.06–52.78)* |
| Lips and tongue hyperemia, % | 25% (3.78–46.22) | 32.6% (29.06–36.2) | 43.5% (39.24–47.89) | |
| Edema of the limbs, % | 68.75% (46.04–91.46) | 19.3% (16.33–22.34)* | 47.5% (43.17–51.88) | |
| Lympha-denopathy, % | 37.5% (13.78–61.22) | | 30.4% (26.48–34.51) | 13.3% (10.37–16.3)* |
| Difficulties breathing, % | 25% (3.78–46.22) | 18.3% (15.33–21.22) | | 26.1% (22.31–29.97) |
| Pathological drowsiness, % | 56.25% (31.94–80.56) | 19.5% (16.47–22.5)* | | 32.6% (28.54–36.72 |
| Shock syndrome, hypotension, % | 37.5% (13.78–61.22) | 60.1% (56.39–63.85) | 72.7% (68.79–76.56)* | 49.5% (45.11–53.83) |

*Note:* * — significant difference ($p<0.05$) in comparison with Non-Commercial Establishment of Lviv Regional Council «Lviv Regional Children Clinical Hospital «OKHMATDYT».

*Table 2*

**Clinical and biochemical laboratory parameters in children with MIS-C treated at the «Lviv Regional Children Clinical Hospital «OKHMATDYT»**

| Indicator | | M±m | N | % |
|---|---|---|---|---|
| WBC | normal (5.5–12.0×10⁹/l) | 9.07±0.71 | 4 | 25 |
| | leukocytosis (>12.0×10⁹/l) | 25.49±2.41* | 12 | 75 |
| Lymphopenia (<1.5×10⁹/l) | | 0.82±0.18* | 7 | 43.75 |
| Hb (<100 g/l) | | 93.71±1.16* | 7 | 43.75 |
| Platelet (<150×10⁹/l) | | 102.8±13.07 | 10 | 62.5 |
| Creatinine (>120 umol/l) | | 145.8±8.93* | 6 | 37.5 |
| ALAT (>30 U/l) | | 49.96±8.64 | 5 | 31.25 |
| ASAT (>30 U/l) | | 61.43±9.71* | 9 | 56.25 |
| CRP (mg/l) | | 151.63±10.083* | 14 | 87.5 |

*Note:* M±m — arithmetic mean ± standard arithmetic mean error; n — absolute number of patients; % — percentage value; * — significant difference ($p<0.05$) in comparison with the reference value of the analysis.

group our results will change. However, our patients, compared with the data published by M. Ahmedet al [1], more often ($p<0.05$) complained of muscle pain, especially of cervical and occipital muscles, that in several cases was interpreted as stiffness. Changes in the skin and mucous membranes ($p<0.05$) were recorded in a considerably larger number of children [7]. It is characteristic, that conjunctivitis and polymorphic rashes were more common in our group [1,3,7]. The number of patients with edema of the hands and feet was definitely larger than in the study of M. Ahmed et al and did not differ significantly from the data presented by S.C. Aronoff et al [1,3]. Significantly fewer of our patients had symptoms of gastrointestinal tract lesions [1,3,7]. We assume, that this can be connected with uniformity of patients in our group in whom the clinical course of the disease is similar to the complete or incomplete form of Kawasaki disease. On the other hand, the systemic analyses could include children not only with phenotype of the Kawasaki disease, but also with persistent fever, myocarditis, and toxic shock syndrome. Another proof in favor of this hypothesis is a definitely lower percentage of children with shock in our study in compared with the data of M. Ahmed et al. [1].

At laboratory examination (Table 2) in 12 (75%) children showed leukocytosis, the average number of neutrophils attained 18.63±2.21×10⁹/l and lymphocytes — 2.31±0.49×10⁹/l. This being said, in 7 (43.75%) patients their number was lower than 1.5×10⁹/l, in 4 (25%) of which this number was less than 1.0×10⁹/l (0.29–0,62×10⁹/l). CRP, as an inflammation biomarker, was increased in 14 (87.5%) children (mean value 151.63±10.083 mg/l). A lower than normal level of hemoglobin (Hb) was observed in 7 (43.75%) patients (mean value 93.71±1.16 g/l). In 10 (62.5%) children the platelet count was below 150×10⁹/l (148.27±22.522×10⁹/l). Increased level serum creatinine level (over 120 μmol/l) was found in 6 (37.5%) children, alanine aminotransferase (ALAT) was slightly increased in 5 (31.25%), but the increased aspartate aminotransferase (ASAT) level was observed in 9 (56.25%) patients.

Compared with the data of the American and European meta-analyses, in contrast to the indices given by M. Ahmed et al., there was a significantly higher leukocytosis and a significantly lower level of platelets ($p\leqslant0.05$) was observed in our group of children [1]. In contrast, compared to the values shown by S.C Aronoff et al., against the background of significantly higher numbers of leukocytes and CRP the absolute number of lymphocytes was three times higher ($p\leqslant0.05$) in children of our group [3]. Perhaps in this situation it is important on which day of the disease and on which day of fever these indices have been determined. In the first 5 days we often did not observe any increase in the number of granulocytes and registered absence of CRP. However, starting from the 5th day of the fever period, especially with the appearance of rashes, conjunctivitis and edema of the hands and feet, leukocytosis with neutrophilia, CRP increased sharply, and platelets count decreased.

Arterial blood oxygen saturation ($SpO_2$) in 6 (37.5%) patients at admission to the hospital was below 93%, and the mean value in children of the study group was 87.38%±1.23. The 4 (25%) of our patients had radiologically confirmed pneumonia. At that time half of them had a positive PCR to SARS-CoV-2, that is an acute progression of coronavirus disease.

EchoCG revealed 4 (25%) cases of reduced (26–55%) left ventricular ejection fraction (EF) and mitral valve insufficiency (MI). Myocarditis

*Table 3*

**Changes in echocardiographic parameters in children with MIS-C treated at the «Lviv Regional Children Clinical Hospital «OKHMATDYT» compared with J. Bordet and co-authors**

| Indicator | CNE LRC LRCCH «OHMADYT» (n=16) | Jeanne Bordet et al. (n=32) |
|---|---|---|
| Left ventricular ejection fraction, % | 60.8 (26–74)* | 54.8 |
| Left ventricular dysfunction | 6 (37.5%) | 13 (41.9%) |
| Mitral valve regurgitation | 4 (25%) | 16 (51.5%) |
| Dilatation / aneurysms of coronary arteries | 3 (18.75%) | 5 (16.1%) |

*Note:* * — the difference is insignificant (p>0.05) compared to the data of J. Bordet et al. [4].

was diagnosed in 4 (25%) children. Linear dilatation of coronary arteries (2–12.5%) and small aneurysms (1–6.25%) were identified in 3 (18.75%) of our patients (Table 3). All these changes returned back to normal one month after discharge of the patients from hospital. EchoCG changes found in our patients did not differ significantly from the data of J. Bordet et al. [4]. The limitation of EchoCG is visualization of only initial segments of the coronary arteries, and this is why we plan to conduct the study using a computerized tomography 6 months after recovery, despite the absence of EchoCG changes in the follow-up examination of children a month after discharge from the hospital.

The first cases of coronavirus infection were registered in Ukraine in the end of March 2020. Since that time their number has been steadily growing and the first peak incidence of SARS-CoV-2 in both, Ukraine and Lviv region, was registered in the end of November 2020. The first patient diagnosed with MIS-C was admitted to our hospital on September 1, 2020. This is why we cannot attribute occurrence of MIS-C in time only to the pandemic and the peak incidence of SARS-CoV-2. Bearing in mind that we had no opportunity to conduct a virological study, we can assume that the occurrence of MIS-C in Lviv region can be associated with a certain serotype of SARS-CoV-2 virus, which actually provokes an «inadequate» immune response, which ultimately causes inflammation and systemic vasculitis [10]. On the other hand, MIS-C, like Kawasaki disease (whose etiology as of today has not been established), leads to widespread vasculitis in the result of damage to endothelium, which can also be caused by a certain type of virus or super antigen [14]. Besides that, there is no denying influence on the formation of exactly such type of immune response of the combined viral load in each specific population. After all, other viruses circulating in this environment can also cross-react with SARS-CoV-2, which will cause MIS-C symptoms [4].

Standard Ig (IVIG) intravenous therapy at the dose of 2 g/kg was performed on 7 (43.75%) patients, 8 (50%) children received IVIG at the dose of 1 g/kg and one (6.25%) girl was not treated with IVIG because her mother did not give her consent. All our patients were administered aspirin: 10 (62.5%) children at the dose of 30–50 mg/kg with subsequent reduction of the dose to 3–5 mg/kg, the remaining children (6 children — 37.5%) began treatment immediately with aspirin at the dose 3–5 mg/kg. Parenteral administration of glucocorticosteroids (GCS) and antibiotics was prescribed to all children. The 1 (6.25%) girl in a very grave condition, with EF reduced to 26%, required mechanical lung ventilation, extracorporeal oxygenation and inotropic support and was administered low molecular weight heparin (Table 4).

Prescribing treatment to our group of patients, we followed recommendations of the American

*Table 4*

**Therapeutic tactics of patients with MIS-C: «Lviv Regional Children Clinical Hospital «OKHMATDYT» and data published by J. Bordet et al.**

| Indicator | CNE LRC LRCCH «OHMADYT» (n=16) | Jeanne Bordet et al. (n=32) |
|---|---|---|
| Mechanical lung ventilation | 1 (6.25%)* | 5 (15.6%) |
| Extracorporeal oxygenation | 1 (6.25%) | |
| Inotropic support | 1 (6.25%)* | 9 (28.1%) |
| Immunoglobulins | 15 (93.75%) | 24 (75%) |
| Glucocorticosteroids | 16 (100%) | 14 (43.8%) |
| Aspirin | 16 (100%) | 23 (71.9%) |
| Antibiotics | 16 (100%) | 26 (81.3%) |
| Heparin | 1 (6.25%) | 11 (34.4%) |

*Note:* * — significant difference (p<0.05) compared with J. Bordet et al. [4].

Heart Association on treatment of Kawasaki disease. This is why initially half of our patients received standard IVIG therapy at the dose of 2 g/kg and aspirin at the dose of 30–50 mg/kg with subsequent reduction of the dose to 3–5 mg/kg in order to prevent changes in the coronary arteries. Taking into account the large volume of infusion and changes in the heart, the full IVIG dose was administered in 24 to 48 hours. However, guided by the clinical and laboratory indices and absence at the time of the studies pertaining to treatment of MIS-C associated with SARS-CoV-2, we decided to administer IVIG at the dose of 1 g/kg during 24 hours with satisfactory changes in the laboratory and EchoCG indices. That is, abatement of fever and other symptoms and the tendency towards reduction of inflammation markers in children in the absence of any EchoCG changes the IVIG dose was determined at 1 g/kg/24 h. At the same time, even in the absence of EchoCG changes, the continued fever or MIS-C symptoms were indications for the continued IVIG treatment (2 g/kg/48 h). Following recommendations of the American Heart Association treatment of Kawasaki disease by IVIG injection was carried out from the 5$^{th}$ to the 10$^{th}$ days of fever. None of our patients required repeated IVIG injection.

Following subsequently recommendations elaborated by the American and British colleagues for treatment of MIS-C [4], half of our patients received aspirin immediately at the dose of 3–5 mg/kg. Similarly to the British recommendations, all children underwent antibiotic therapy. Low-molecular-weight heparin was prescribed to our only girl in the gravest condition whose EF dropped to 26%, and her condition required extracorporeal oxygenation.

One last thing. The use of GCS remains to be controversial. In 2014 there were published results of the meta-analysis and recent studies that demonstrated a positive effect of GCS in combination with IVIG preventing formation of coronary artery aneurysms in severe cases of Kawasaki disease with a high risk of resistance of the organism to IVIG [6]. However, another group of researchers, having analyzed 80 case histories of patients with coronary artery aneurysms arrived at the conclusion that the use of GCS in the acute period of Kawasaki disease has an adverse effect on reconstruction of coronary arteries [11]. In 2016, 2331 case histories of children with Kawasaki disease were analyzed in China. GCS therapy is recognized as an independent factor of the risk of occurrence of aneurysms and large coronary artery aneurysms [12]. Therefore, relying on the results of these studies and bearing in mind absence of resistance to IVIG in our group, we decided to use standard doses of GCS instead of pulse therapy.

Comparing treatment with the data published by Jeanne Bordet et al. [4], it should be noted that our patients significantly less often ($p < 0.05$) required mechanical ventilation and inotropic support against the background of treatment with IVIG, aspirin, antibiotics and standard doses of GCS.

## Conclusions

The MIS-C response according to the results of our study appeared before the 48$^{th}$ day after acute coronavirus disease and in 12 (75%) of children treated as inpatients was observed against the background of increased concentrations of antibodies to SARS-CoV-2 of Ig G class and 4 (25%) children against the background of acute course of coronavirus disease. Clinical course of the disease in most children is characterized by febrile fever and general weakness, typical skin rashes, conjunctivitis, swollen and edema of distal parts of the arms and legs. Differentiated approach to treatment with human immunoglobulin at the dose of 1–2 g/kg, glucocorticosteroids at the dose of 1–2 mg/kg, aspirin 3–5 mg/kg against the background of antibacterial therapy appeared to be effective for the prevention of changes in the coronary arteries and for recovery of patients.

*No conflict of interests was declared by the authors.*

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