MULTISYSTEM INFLAMMATORY SYNDROME IN ADULTS: NEW INSIGHTS INTO A RARE BUT SERIOUS COMPLICATION OF COVID-19

M. Rushid, A. Kisheva, Y. Yotov

First Department of Internal Medicine, Faculty of Medicine, MU “Prof. Dr. Paraskev Stoyanov” – Varna
Second cardiology clinic – non-invasive, UMHAT “Sveta Marina” – Varna

Abstract. Since 2019, humanity has been relentlessly fighting the pandemic caused by the SARS-CoV-2 virus. Respiratory distress syndrome is the main clinical manifestation of COVID-19, which often results in full recovery but can also end fatally. Of interest to modern medicine is a small group of patients in whom the disease persists for months, known as “Long COVID.” This condition predisposes to the development of a rare but life-threatening syndrome, manifested and defined as one of the most serious complications of SARS-CoV-2 infection – multisystem Inflammatory Syndrome in Adults (MIS-A). This syndrome was first described in children and called MIS-C (Multisystem Inflammatory Syndrome in Children). The affected population consists of patients ≥21 years old, regardless of gender. Despite numerous studies, clinical-laboratory and demographic analyses, there are still disagreements regarding the frequency of occurrence, pathogenesis, and diagnostic-therapeutic algorithm for these patients. The purpose of this article is to systematize the congested experience and knowledge, as well as to demonstrate their application in clinical practice.

Key words: SARS-CoV-2 infection, multisystemic inflammatory syndrome in adults

Address for correspondence: Mesut Rushid, MD; Second Cardiology Clinic – non-invasive, UMHAT “Sv. Marina”, 1 “Hristo Smirnenski” Blvd., BG – 9010 Varna, e-mail: mesutrushid@gmail.com
COVID-19 is a disease that is caused by the SARS CoV-2 virus. The world first clashed with this virus in December 2019, when it was discovered in Wuhan, China, after which it spread at a very high rate and affected the whole world, causing a pandemic [1]. According to data from the World Health Organization (WHO), as of April 26, 2023, more than 760 million people worldwide have been diagnosed with COVID-19, and just two years earlier, patients with positive tests were just 121 million. According to current WHO data, almost 7 million people have lost the fight to this new global threat [2]. Although patient mortality is about 2.5%, it rises to 16.6% in critically ill patients with comorbidities [3]. The most frequently affected patient population are those with chronic lung diseases, chronic kidney disease, immunocompromised patients – diabetics, oncological patients, patients with cardiovascular diseases, in which the clinical manifestation of the disease is most manifest.

Clinically, COVID-19 presents with acute respiratory distress syndrome. The normal evolution of the disease includes respiratory symptoms mainly from the upper (80%) and less often from the lower (15%) respiratory tracts. About 5% of those infected, however, develop severe forms, with the need for non-invasive/invasive ventilation and often end fatally [4].

ACE2 receptors play a key role in the pathogenesis of COVID-19. They are most often expressed in alveolocytes, but also in cardiomyocytes, where SARS-CoV-2 uses them for intracellular penetration. These have also been discovered in the liver, kidneys, intestines and brain. The hyperreactivity of the immune system, characterized by a cytokine storm, determines the high morbidity and mortality rates in patients with SARS-CoV2. It includes TNFα and IL-6, as well as T-cell lymphopenia, relative interferon resistance, and increase the risk of secondary infections. This cytokine storm defines the second phase of SARS-CoV-2 disease, in which clinical deterioration and decompensation occur, following initial recovery, typically about 10 days after symptoms onset. [5, 6]. The result is a multi-organ damage, and for this reason, today, COVID-19 is seen as a disease of the whole organism [7].

Although the majority of patients fully recover, 25% of those infected have post-acute complications, also called “Long COVID-19”, especially in hospitalized patients, which are usually manifested...
MIS-A is still insufficiently investigated, and a lot of clinical research and arguments are needed to determine the causes, risk factors and treatment options. MIS-A was first described in the literature in August 2020 [17] and more cases have been reported during the COVID-19 pandemic. Although many unknowns exist, it is important that healthcare professionals become familiar with the clinical presentation of MIS-A and include it in the differential diagnosis of patients with recent or ongoing COVID-19 infection. The aim of this article is to review the state of knowledge regarding MIS-A, focusing on epidemiology, pathophysiology, clinical presentation, diagnosis, treatment and prognosis, and to demonstrate a clinical case from practice.

Epidemiology

MIS-A has been reported in all geographic regions, including the United States, Europe, Asia, and South America [18]. The syndrome has been described in all age groups and in both sexes, but in fact it occurs most often in young patients. According to various literature sources, its prevalence varies within very wide limits – from 0.2% to 11.7% in patients with SARS-CoV-2, and the mortality associated with it is relatively high and reaches up to 35.3% [18, 19]. The lactate dehydrogenase/lymphocyte ratio (LDH/lymphocyte ratio – LLR) is indicated as a main predictor of occurrence of MIS-A and increased mortality. It was found that at a level of LLR above 0.24 it is a

by fatigue, headache, dyspnea, sleep disorders, and joint-pain syndrome and which can persist for months [8]. A more acute and serious consequence of SARS-CoV-2 infection was first described in children presenting similarly to Kawasaki disease (KD) and toxic shock syndrome [9]. It was initially called multisystem inflammatory syndrome in children (MIS-C) [10-14], but similar condition was then also described in adults (defined as ≥ 21 years) (MIS-A) [10].

Multisystem inflammatory syndrome in adults (MIS-A) is a rare, post-infectious and potentially dangerous disease that develops as a complication of COVID-19. It appears 4-6 weeks after a past infection with COVID-19, with young and middle-aged patients most often affected [15]. MIS-A is a hyperinflammatory syndrome with multiorgan involvement. In most of those infected with SARS-CoV-2, in addition to fever and myalgia, there are also numerous extrapulmonary manifestations, such as gastrointestinal, cardiovascular (CV) and neurological symptoms [16].

MIS-A is a hyperinflammatory syndrome with multiorgan involvement. In most of those infected with SARS-CoV-2, in addition to fever and myalgia, there are also numerous extrapulmonary manifestations, such as gastrointestinal, cardiovascular (CV) and neurological symptoms [16].

It was found that at a level of LRR above 0.24 it is a
0.24 is a predictor of the development of MIS-A, with a sensitivity of 70% and 65.2% specificity. With LRR levels above 0.24, the risk of developing this syndrome is 3.64 times higher compared to those with LRR levels 0.24 or lower. In patients with MIS-A, an LRR level above 0.32 predicts higher mortality, with 78% sensitivity and 70% specificity [19].

**Pathophysiology**

The pathophysiology of MIS-A is still not fully understood. There are many theories about the origin of the syndrome, such as the presence of virulent superantigens ("s-protein"); autoimmune molecular mimicry detected in MIS-C patients months after cure; presence of activated immune cells after relapse; ongoing infection by SARS-CoV-2 [10, 20, 21]. The best and most scientifically sound theory of its pathophysiology is the activation and increase of macrophages through antigen-presenting cells (ADE). ADE occurs in numerous viral infections, including respiratory syncytial virus (RSV), measles, and dengue virus, which is thought to be the basis of the pathogenesis of dengue hemorrhagic fever. The mechanism of ADE is a phenomenon in which binding of the virus to suboptimal antibodies facilitates its entry into phagocytes via the Fc Gamma receptor (FcγRIIa), which is then followed by viral replication. This, in turn, leads to the release of proinflammatory cytokines, as well as the development of immune complexes that further potentiate inflammation [22, 23]. Although ADE has not been observed clinically in patients reinfected with different SARS-CoV-2 strains to date, there is a real risk of developing one, given the progressive changes in the S-protein of individual SARS-CoV-2 strains. This may also explain the association between vaccination and the development of MIS-A [24].

**Clinical manifestation**

The symptoms of MIS-A are variable. But according to the US Center for Disease Control (CDC) [https://www.cdc.gov/mis/mis-a/hcp.html] the condition is defined in individuals ≥ 21 years of age who are hospitalized for ≥ 24 hours or have a fatal illness and who meet the following clinical and laboratory criteria. Patients must not have another diagnosis more likely to explain their illness (eg, bacterial sepsis, exacerbation of a chronic medical condition):
I. Клинични критерии

Субективно треска или документирана треска (≥ 38,0⁰ C) за ≥ 24 часа преди хоспитализацията* или през първите три дни от хоспитализацията* и поне три от следващите клинични критерии, които са се появили преди хоспитализацията или през първите три дни от приемането в болницата*. Поне един от тях трябва да е основен клиничен критерий.

A. Основни клинични критерии

1. Тежко сърдечно заболяване. Включва: миокардит, перикардит, дилатацция/аневризма на коронарна артерия или новопоявява се деснокамерна или левокамерна дисфункция (ЛКИФ < 50%), II/III степен AV блок или камерна тахикардия (За- бележка: сърдечен арест самостоятелно не из- пълнява този критерий).
2. Обрив и негноен конюнктивит.

B. Вторични клинични критерии

1. Новопоявяли се неврологични симптоми и клинични белези. Включва: енцефалопатия при болен без предишестващо кожно-служебно нарушение, гърчове, белези на менинговено дразнене или периферна невропатия (включително синдром на Guillon-Barrè).
2. Шок или хипотония, която не се дължи на терапия (напр. седиране, бъбречна заместителна те- рапия).
3. Коремна болка, повръщане или диария.
4. Тромбоцитопения (брой тромбоцити < 150 000/mL)

II. Лабораторни доказателства:

Наличие на лабораторни доказателства за въз- паление и за SARS-CoV-2 инфекция.

A. Повишени нива на поне два от следните те- стове: C-реактивен протеин, феритин, IL-6, СУЕ, procalcitonin.

B. Позитивен за SARS-CoV-2 тест за настояща или скорошна инфекция чрез RT-PCR, ерология или антигенен тест.

Почти всички пациенти с MIS-A са с фебрилна температура, достигащо до 39⁰ C. Над 50% от тях са с диария синдром. Много характерен белег са кожно-лимфовите изменения, които се наблюдават при 57,8% от тях и включват: двустранна конъюнктивална инекция или конъюнктивит; язви и зачервяване на устна лигавица, подтузи зачервени напукани устни; обрив по кожата (дишумен макулопапуларен или еритематозен, засегащ предимно торса, горните крайници и палмарни повърхности) или язви до периферни гангрени; еритема и излющване на длани и

I. Clinical criteria

Subjective fever or documented fever (≥ 38.0⁰ C) for ≥ 24 hours before hospitalization* or in the first three days of hospitalization and at least three of the following clinical criteria that occurred before hospitalization or in the first three days of hospital admission*. At least one of these must be a primary clinical criterion.

A. Primary clinical criteria

1. Severe heart disease: Includes myocarditis, pericarditis, coronary artery dilatation/aneurysm or new-onset right ventricular or left ventricular dysfunction (LVEF < 50%), II/III degree AV block or ventricular tachycardia. (Note: cardiac arrest alone does not meet this criterion).
2. Rash and non-purulent conjunctivitis.

B. Secondary clinical criteria

1. New onset neurological symptoms and clinical signs. Includes encephalopathy in a patient without prior cognitive impairment, seizures, signs of meningeal irritation, or peripheral neuropathy (including Guillon-Barrè’s syndrome).
2. Shock or hypotension not due to therapy (eg, sedation, renal replacement therapy).
3. Abdominal pain, vomiting or diarrhea.
4. Thrombocytopenia (platelet count < 150,000/ mL)

II. Laboratory evidence:

Presence of laboratory evidence of inflammation and of SARS-CoV-2 infection.

A. Elevated levels of at least two of the following tests: C-reactive protein, ferritin, IL-6, ESR, procalcitonin.

B. Positive SARS-CoV-2 test for current or recent infection by RT-PCR, serology, or antigen test.

Almost all patients with MIS-A have a febrile temperature reaching 39⁰ C. Over 50% of them have diarrheal syndrome. A very characteristic sign is skin-mucosal changes, which are observed at 57.8% of them and include: bilateral conjunctival injection or conjunctivitis; ulcers and redness of the oral mucosa, swollen red chappy lips; skin rash (diffuse maculopapular or erythematous, mainly affecting the torso, upper extremities, and palmar surfaces) or ulcers up to peripheral gangrene; erythema and desquamation of the palms and soles, “COVID fingers” – swell-

*These criteria must be present by the end of the 3rd day of hospital stay, with the date of hospitalization considered as hospital day 0.
The evolution of MIS-A is relatively rapid, posing these patients at extreme risk. Their condition can deteriorate over days to hours due to the dynamic impairment of cardiac function and the development of cardiogenic shock. This very often requires their medical care to be carried out in intensive care units. In 46.1-58.5% of them, it is necessary to initiate inotropic medications, although rarely in some it is necessary to implant an intra-aortic balloon counterpulsator, as well as extracorporeal membrane oxygenation (ECMO) [15, 25, 26]. Transthoracic echocardiography (TTE) is the gold standard for assessing cardiac function in these patients. Biventricular involvement was observed in 81% of all cases [25]. An interesting fact is that in MIS-A, as well as in SARS-CoV-2, myocarditis was observed, but endomyocardial biopsy did not reveal positive S-protein in MIS-A biopsies, in contrast to the preceding acute infectious state [27]. Acute cardiac dysfunction, however, can be severe. In one case series, the mean left ventricular ejection fraction (LVEF) decreased to 35%, with > 70% of MIS-A patients having an LVEF < 50% [25, 27]. This cardiac dysfunction is thought to be dependent on IL-6 and thus inflammation can lead to myocardial stunning. Importantly, there is often rapid and complete recovery of cardiac function without sequelae with appropriate treatment [26, 28].

Regarding the laboratory constellation, definitive diagnostic indicators in patients with MIS-A are still lacking. For example, procalcitonin is a peptide precursor that is a diagnostic and prognostic biomarker in SARS-CoV-2. It correlates very well with the severity of the disease and can suggest the outcome as well as an underlying bacterial infection. It is more sensitive than CRP and IL-6 in the course of diagnosing COVID-19. But unfortunately, it is a biomarker that is very easily affected by other conditions, such as cardiogenic shock, organ dysfunction and autoimmune disease. As such, it may be falsely elevated in the setting of MIS-A and it is unclear whether it offers similar additional prognostic information as in SARS-CoV-2 infection [29, 30]. In one case series involving nine patients with MIS-A, the mean serum PCT was 6.91 ng/mL, with two cases with values > 80 ng/mL [31].

COVID-19. But unfortunately, it is a biomarker that is very easily affected by other conditions, such as cardiogenic shock, organ dysfunction and autoimmune disease. As such, it may be falsely elevated in the setting of MIS-A and it is unclear whether it offers similar additional prognostic information as in SARS-CoV-2 infection [29, 30]. In one case series involving nine patients with MIS-A, the mean serum PCT was 6.91 ng/mL, with two cases with values > 80 ng/mL [31].

Regarding the laboratory constellation, definitive diagnostic indicators in patients with MIS-A are still lacking. For example, procalcitonin is a peptide precursor that is a diagnostic and prognostic biomarker in SARS-CoV-2. It correlates very well with the severity of the disease and can suggest the outcome as well as an underlying bacterial infection. It is more sensitive than CRP and IL-6 in the course of diagnosing COVID-19. But unfortunately, it is a biomarker that is very easily affected by other conditions, such as cardiogenic shock, organ dysfunction and autoimmune disease. As such, it may be falsely elevated in the setting of MIS-A and it is unclear whether it offers similar additional prognostic information as in SARS-CoV-2 infection [29, 30]. In one case series involving nine patients with MIS-A, the mean serum PCT was 6.91 ng/mL, with two cases with values > 80 ng/mL [31].
Further studies are needed to see whether serum PCT and other inflammatory markers have diagnostic and prognostic properties in the context of MIS-A.

**Treatment of patients with multisystem inflammatory syndrome**

Management of these patients primarily includes management of the acute condition: invasive/noninvasive ventilation; inotropic support, volume replacement infusions and, at the next stage, influencing the main pathogenetic processes determining their clinical manifestation, namely immune hyperreactivity and intravasal hypercoagulability. Treatment should include high-dose corticosteroids and anticoagulants. Although there is a lack of convincing data on its effect, at this stage it is still recommended to include intravenous immunoglobulin (IVIG). [25, 26, 32]. Tocilizumab and Anakinra are biologic drugs affecting IL-6 and IL-1 receptors that find increasing application in the treatment of patients with SARS-CoV-2 and MIS-A [33]. Colchicine can also be considered as a drug with an immunosuppressive effect, as it possesses multiple anti-inflammatory mechanisms of action, including reduction of immune cell migration, release of pro-inflammatory cytokines, and activation of the inflammasome. In addition, it shows efficacy in intermittent fevers in which IL-1 overproduction is present [34].

**A CLINICAL CASE**

It is a 44-year-old man who at the end of May 2022 after a positive PCR-test for SARS-CoV-2 and X-ray data of bilateral infiltrative shadows in the lung parenchyma was treated in a pulmonology clinic for 2 weeks. After discharge, however, complaints of shortness of breath, easy fatigue, intermittent febrile temperature, dry cough and general weakness persisted. On this occasion, he was examined by an outpatient cardiologist on 14.07.22. entered our clinic with a clinical constellation of congestive heart failure and febrile intoxication syndrome.

**Physical status**


Skin and visible mucous membranes: with pronounced peripheral and central cyanosis.
От страна на дихателната система се наблюдава изразена тахидиспнея; симетричен гръден кош. Има притъпен перкуторен тон в дясна белодробна основа, с прибавени дребни влажни хрипове двустранно. 

От страна на сърдечно-съдовата система (ССС) е налице ритмична, тахикардична сърдечна дейност, сърдечната честота (СЧ) е 110 уд./мин. Аускултаторно се долавят ясни тонове, без шумове. Артериално налягане (АН) е 90/60 mm Hg. 

Коремът е над нивото на гръдния кош, с физикални данни за асцит, оточна коремна стена, неболезнен, с изразена подкожна мастна тъкан (ПМТ). Черният дроб и слезката не могат да се палпират. 

Суксусион ранелис е двустранно отрицателно. 

Крайниците са с дискретни претибийални отоци и със запазени периферни пулсации. 

**Ехокардиография (посрещането)**

ЛКТДР е 59 mm, ЛК (Симпън) – ТДО – 167 ml, 
ТСО – 91 ml, ФИ – 46%, МКП – 13 mm, ЗСПК – 13 mm, 
ДК – 38 mm, аортен корен – 22 mm, въходяща аорта – 32 mm, ЛП – 42 m, митрален кръвоток: VT.E – 0.7 m/s, V.A – 0.9 m/s, митрална регургитация – I ст.; аортен кръвоток V макс. – 1.2 m/s, пиков градиент – 6 mm Hg, трicuspid regurgitation II deg., наличие на перикардial излив пред ДК и ДП, отслояващ до 6 mm в диастола. 

**Лабораторни и образни изследвания**

От диференциалната кръвна картина (ДКК) се установи левкоцитоза с лимфопения. Паралелно бяха завишени и острофазовите показатели на възпалението като CRP, LDH и ferritin, както и азотни маркери – урея и креатинин, като израз на бъбречна увреда. 

От диференциалната кръвна картина (ДКК) се установи левкоцитоза с лимфопения. Паралелно бяха завишени и острофазовите показатели на възпалението като CRP, LDH и ferritin, както и азотни маркери – урея и креатинин, като израз на бъбречна увреда. В деня на хоспитализация се позитивира и PCR-тест за COVID-19. В хода на проследяването изследвахме прокалцитонин, IL-6, и фибриноген, които също бяха многократно над референтни граници.

След поставен интраабдоминален дрен 8F фракционно се евакуира около 10 литри мътна, жълтяка асцитна течност, с биохимична констелация за трансудат, а цитологичен анализ бе представен от множество проинфламаторни клетки. Микробиологично се установиха данни за растеж на Acinetobacter johnsonii, чувствителен на към Gentamicin, Amikacin, Tobramycin и Colistin. 

Рентгенографията на гръдна клетка (в седнало положение) (фиг. 1) е слабо информативна, като двойно-фракционен копул, двойни КДС и долните белодробни полета не могат да се интерпретират адекватно, поради суперпозирани меки тъкани. Има линеарно засечване в средноясно белодробно поле ДД: 1. уплътнен интерлоб; 2. плоскостна ателектаза. 

Respiratory system – with marked tachydyspnea; symmetrical chest. Dull percussion tone in the right lung base. On auscultation, vesicular breathing is detected, absent in the right base of the lung, with added rales bilaterally. 

CVS – rhythmic, tachycardic, heart rate 110/min. On auscultation, clear tones are perceived, without murmurs. BP 90/60 mm Hg. 

Abdomen - above the level of the groin, with physical evidence of ascites, swollen abdominal wall, painless, with marked subcutaneous fatty tissue. Liver and spleen cannot be palpated. 

Succus renalis – bilaterally negative. 

Extremities – discrete pretibial swellings, preserved peripheral pulsations.
Не може да се изключи плеврален излив вдясно. Има уплътнени интерстициални пространства, вероятно като израз на застойни/възпалителни промени.

CT на гръдна клетка и абдомен (фиг. 2) показва двустранни промени тип „матово стъкло" с вид на възпалителни, обхващащи под 20% от белодробния паренхим. Наблюдават се белодробни вторични лезии и асцит.

<table>
<thead>
<tr>
<th>Таблица 1. Лабораторни резултати в динамика // Table 1. Laboratory results in dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Хемоглобин (Hemoglobin)</td>
</tr>
<tr>
<td>Hemoglobin (g/l)</td>
</tr>
<tr>
<td>Левкоцити (Leukocytes)</td>
</tr>
<tr>
<td>Platelets (10^9/ L)</td>
</tr>
<tr>
<td>CRP (mg/l)</td>
</tr>
<tr>
<td>GGT (U/l)</td>
</tr>
<tr>
<td>Креатинин (Creatinine)</td>
</tr>
<tr>
<td>Urea (mmol/l)</td>
</tr>
<tr>
<td>Общ белтък (Total protein)</td>
</tr>
<tr>
<td>Албумин (mg/dl)</td>
</tr>
<tr>
<td>Пикочна киселина (Uric acid)</td>
</tr>
<tr>
<td>NT-proBNP (ng/ml)</td>
</tr>
<tr>
<td>Феритин (Ferritin)</td>
</tr>
<tr>
<td>Interleukin-6 (IL-6)</td>
</tr>
<tr>
<td>Procalcitonin</td>
</tr>
<tr>
<td>Cholinesterase</td>
</tr>
<tr>
<td>Alkaline phosphatase (Alkaline phosphatase)</td>
</tr>
<tr>
<td>PCR COVID-19</td>
</tr>
<tr>
<td>D-dimeri</td>
</tr>
<tr>
<td>ASAT (U/l)</td>
</tr>
<tr>
<td>ALAT (U/l)</td>
</tr>
<tr>
<td>КАП (ABS)</td>
</tr>
<tr>
<td>Нормален р-т</td>
</tr>
<tr>
<td>Respiratory acidosis</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. X-ray of the chest (in the sitting position)

Fig. 2. CT scan of chest and abdomen
По време на болничния престой се организираха два мултисистемни консилиума в при участието на кардиолог, гастроентеролог, инфекционист, пулмолог и нефролог. Базирайки се на клиничните, лабораторните и образните данни и имайки предвид създадените до момента критерии на CDC за диа̀гностика на MIS-A, се преми, че се касае за мултисистемен възпалителен синдром след прекарана COVID-19 инфекция.

Критерии:
- фебрилитет със сърдечно засягане (основен критерий);
- болки в корема и диария;
- полиорганно засягане;
- тромбоцитопения;
- повишени инфламаторни маркери и позитивен резултат за COVID-19 инфекция.

По време на обсъждането се определиха настоящите и бъдещите диагностично-терапевтични алгоритми.

Лечението, проведено в Клиниката:
1. Неинвазивна вентилация, съобразена с кислородно-алкалния профил (КАП)
2. Инотропна поддръжка с допамин венозно
3. Колхицин 0,5 mg 2 x 1 табл.
4. Венозен бримков диуретик във висока доза – 120 mg
5. Иварадин 7,5 mg 2 x 1 табл.
6. Белък-заместващи вливания (хуман албумин и плазма)
7. Метилпреднизолон в доза 1 mg/kg
8. Нискомолекулен хепарин s.c.
9. Цефтриаксон 2 х 2,0 g венозно дн., левофлокацин 500 mg x 1 фл. през ден (съобразен с бъбречната функция), гентамицин в редуцирана доза (съобразена с бъбречната функция)
10. Хепатопротектори.

Ехокардиография при изписване:
- ЛК – 42/30 mm, ФС 27%, ФИ – 53%, по Симпсън – ТДО – 110 ml, ТСО – 40 ml, О – 70 ml, ФИ – 63%, МКП – 14 mm, ЗСПК – 14 mm, запазена кинетика, ЛП – 40 mm, митрален кръвоток – т.Е 0.65 m/s, VT.A – 0.72 m/s, трикуспидален кръвоток: т.Е 0.66 m/s, т.В – 0.86 m/s, трикуспидална регургитация I ст., с неповишено напълване в а. пулмонална; няма перикарден излив. Заключение: Запазена ЛК ФИ; диателна дисфункция I ст.

Заключение
MIS-A е клиничен синдром с полисимптоматична изява. Много често той може да остане незабелязан и недиагностициран при пациентите след прекарана COVID-19 инфекция. Независимо че е рядко, той е животозастрашаващо състояние, което налага специално внимание.

During the hospital stay, two multidisciplinary councils were organized in the presence of a cardiologist, a gastroenterologist, an infectious disease specialist, a pulmonologist and a nephrologist. Based on the clinical, laboratory, and imaging data and considering the CDC criteria for the diagnosis of MIS-A established to date, it was assumed to be a multisystem inflammatory syndrome after a past COVID-19 infection. Criteria: fever with cardiac involvement (main criterion); abdominal pain and diarrhea; multiple organ involvement; thrombocytopenia; elevated inflammatory markers and a positive result for COVID-19 infection. During the discussion, current and future diagnostic-therapeutic algorithms were determined.

Treatment carried out in the clinic: pathogenetic, symptomatic and treatment of complications.
1. Non-invasive ventilation according to ABS (acid-base profile)
2. Inotropic support with intravenous dopamine
3. Colchicine 0.5 mg 2 x 1 tab.
4. Venous loop diuretic in a high dose – 120 mg
5. Ivabradine 7.5 mg 2 x 1 tab.
6. Protein replacement infusions (human albumin and plasma)
7. Methylprednisolone in a dose of 1 mg/kg/24 h
8. Low molecular weight heparin sc
9. Ceftriaxone 2 x 2.0 g intravenously daily, Levofloxacin 500 mg x 1 fl. every other day (in accordance with renal function), Gentamicin in a reduced dose (in accordance with renal function)
10. Hepatoprotectors

Echocardiography at discharge:
- LV – 42/30 mm, Teiholz: FS – 27%, EF – 53%, LV according to Simpson – LVEDV – 110 ml, LVESV – 40 ml, SV – 70 ml, EF – 63%, IVS – 14 mm, preserved kinetics, LA – 40 mm, mitral blood flow – VE – 0.65 m/s, VA – 0.72 m/s, tricuspid blood flow VE – 0.66 m/s, VA 0.86 m/sec, tricuspid regurgitation I deg, with normal pressure in a. pulmonalis; no pericardial effusion. Conclusion: Preserved LVEF; dilated LA; LV hypertrophy; diastolic dysfunction I deg.

Conclusion
MIS-A is a clinical syndrome with polyorgan symptomatic presentation. Very often, it can remain unrecognized and undiagnosed in a patient after recent COVID-19 infection. Although rare, it is a life-threatening condition that requires special atten-
Target group, a group in whose case treatment is always considered to be SARS-CoV-2, and especially those with so-called “Long COVID-19”. The presence of comorbidities and an immunosuppressive condition further complicates the clinical presentation and outcome of the disease. The diagnostic criteria for MIS-A have not yet been fully established, but a provisional definition has been provided. The therapeutic algorithm for MIS-A is primarily supportive and includes treatment of dysfunction of the affected organs and of inflammation. Further research is required to determine best practices for diagnosis and treatment of MIS-A.

No conflict of interest was declared


